Mt Gilead Stage 2 Preliminary Documentation EPBC 2019/8587

Prepared for Lendlease Communities (Figtree Hill) Pty Limited

For Public Exhibition

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Abbreviations

Abbreviation	Description
ABL	Australian Bat Lyssavirus
APZ	Asset Protection Zone
BA	Biobanking Agreement (under the now repealed TSC Act)
BBAM	BioBanking Assessment Methodology
BCAM	Biodiversity Certification Assessment Methodology
BCAR	Biodiversity Certification Assessment Report
BCF	Biodiversity Conservation Fund
BCS	Biodiversity Certification Strategy
BC Act	NSW *Biodiversity Conservation Act 2016*
BSA	Biodiversity Stewardship Site Agreement (under the BC Act)
CCC	Campbelltown City Council
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CLEP	Campbelltown Local Environment Plan 2011
CPW	Cumberland Plain Woodland
CS&E	NSW Chief Scientist & Engineers
DAWE	former Commonwealth Department of Agriculture, Water and Environment (now DCCEEW)
DGR	Director General Requirements
DNG	Derived Native Grassland
DotEE	former Commonwealth Department of the Environment and Energy (now part of DCCEEW)
DPE	NSW Department of Planning and Environment
DP&I	former NSW Department of Planning and Infrastructure (now part of DPE)
DPIE	former NSW Department of Planning, Industry and Environment (now Part of DPE)
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP&A Act	*NSW Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
FMP	Fauna Management Plan
HBT	Hollow Bearing Tree
KMP	Koala Management Plan
LEP	Local Environment Plan
LGA	Local Government Area
MDP Lands	Mt Gilead Stage 1
MGS2	Mt Gilead Stage 2

Abbreviation	Description
MNES	Matters of National Environmental Significance
OEH	former NSW Office of Environment and Heritage (now part of DPIE)
PD Report	EPB Act Preliminary Documentation Assessment Report
PBFD	Psittacine Beak and Feather Disease
PMST	Protection Matters Search Tool
PoM	Plan of Management
RFEF	River-flat Eucalypt Forest
RMS	NSW Roads and Maritime Services
SCKHCS	South Campbelltown Koala Habitat Connectivity Study
SEPP	NSW State Environmental Planning Policy
SSTF	Shale Sandstone Transition Forest
TEC	Threatened Ecological Community
TSC Act	now repealed NSW *Threatened Species Conservation Act 1995 (replaced by BC Act)*
WSUD	Water Sensitive Urban Design

Executive Summary

Purpose and scope of this report

On 27 November 2019, the proposed Mt Gilead Stage 2 residential development (MGS2) was referred to the then Australian Government Department of the Environment and Energy (DotEE) (now Department of Agriculture, Water and the Environment (DAWE)) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 24 February 2020, the DAWE determined that the proposed action is a '*controlled action'* and that it will be assessed by preliminary documentation. This document is the EPBC Act Preliminary Documentation Assessment Report for the proposed development and has been provided to DAWE to enable further assessment and approval under the EPBC Act (EPBC Ref: 2019/8587).

Project proponent

The designated proponent for the Mt Gilead residential development is Lendlease Communities (Figtree Hill) Pty Limited.

Site context

Mt Gilead Stage 2 is located off Appin Road, approximately 7 km south of the Campbelltown city centre within the Campbelltown Local Government Area (LGA). The study area is comprised of the following lots which have a total area of 644.27 ha:

- Lots 1 and 2 DP1218887
- Part Lot 5 DP1240836
- Lot 2 DP603674
- Lot 1 DP603675
- Lot 2 DP 249393.

The direct and indirect impact or 'action area' comprises 259.02 ha of the total study area and directly and indirectly affects 46.23 ha of native vegetation in various condition states from highly modified to intact remnant vegetation.

Matters of National Environmental Significance

The following Matters of National Environmental Significance (MNES) were assessed as part of the referral:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) – a Critically Endangered Ecological Community
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion (SSTF) – a Critically Endangered Ecological Community; and

- River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of southern NSW and eastern Victoria (RFEF) – a Critically Endangered Ecological Community (but not considered in accordance with section 158A(1)(j) of the EPBC Act as listed after the Controlled Action decision was made)
- *Phascolarctos cinereus* (Koala) – and endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) - Vulnerable
- Chalinolobus dwyeri (large-eared Pied-bat) - Vulnerable
- *Lathamus discolor* (Swift Parrot) – Critically Endangered
- *Pomaderris brunnea* (Rufous Pomaderris) Vulnerable

The PD requirements have requested further information on the MNES listed above, and the following MNES:

Flora:

- *Syzygium paniculatum* (Magenta Lilly Pilly) – Vulnerable.

Fauna:

- *Dasyurus maculatus* (Spot-tailed Quoll) – Endangered
- *Hoplocephalus bungaroides* (Broad-headed Snake) – Vulnerable
- *Litoria littlejohni* (Littlejohn's Tree Frog) – and endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petauroides volans* (Greater Glider) – and endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petrogale penicillata* (Brush-tailed Rock-wallaby) – Vulnerable
- *Pseudomys novaehollandiae* (New Holland Mouse) – Vulnerable
- *Synemon plana* (Golden Sun Moth) – Vulnerable.

All MNES listed above have been assessed in this report, consistent with the requirements outlined by DAWE (Table 1).

Description of the proposed action

The Mt Gilead Stage 2 action area is 644.27 ha of which 259.02 ha (the action area) is proposed for urban development and associated infrastructure (roads, detention basins, open space), 149.28 ha of retained rural land, open space and existing power, gas and water easements and 235.96 ha of dedicated conservation lands (which includes 33.54 ha of environmental buffers). The Mt Gilead Stage 2 development will deliver approximately 3,300 new houses with a range of lot sizes consistent with the natural features of the site to accommodate 10,000 new residents. Development is likely to commence in 2025 and take up to 10 years to complete in eight indicative stages, depending on demand for housing.

Avoidance and mitigation of MNES

Measures to avoid and/or reduce impacts to biodiversity values have been included at all stages of the project, including identification and avoidance of high or higher conservation value areas during the rezoning process (intact remnant vegetation and habitat for threatened plants and animals). Feedback during consultation with stakeholders and relevant authorities was also used to update the proposed development footprint and reduce impacts to threatened ecological values. The November 2019 referral proposed to impact 332 ha of land, comprising 76.88 ha of native vegetation of which 55.47 ha meets the condition thresholds of EPBC Act listed threatened ecological communities (10.10 ha of Cumberland Plain Woodland in condition categories A and C and 45.37 ha of Shale Sandstone Transition Forest in condition categories D, B and A. The referred development footprint proposed to impact 23 individuals of the endangered plant *Pomaderris brunnea* and up to 72.22 ha of Koala habitat.

As part of preparing this PD Report, and revisions to the Master Concept Plan these impacts have been reduced to 46.23 ha of direct and indirect impacts to native vegetation in various condition states, of which 35.86 ha meets EPBC Act condition thresholds of listed communities, and 17.54 ha of indirect/ partial impacts to native vegetation, of which 14.42 ha meets EPBC Act condition thresholds in 30m TEC buffers that will be managed for conservation and improve in condition over time.

As a result of the avoidance and impact minimisation measures incorporated into the planning of the action, the final areas of impact to MNES are as follows:-

- 7.59 ha of direct impact to EPBC Act listed CPW within the action, no partial impacts in asset protection zones (APZs) and up to 0.98 ha of indirect impacts in 30 m buffer areas around proposed conservation areas (Stewardship Agreement sites) within the action area.
- 26.29 ha of direct impacts to EPBC Act listed SSTF within the action area, partial impacts to 1.63 ha in asset protection zones (APZs) and up to a further 13.33 ha of indirect impacts in 30 m EEC buffer areas around proposed conservation areas.
- Impacts to two *Pomaderris brunnea* across the action area (down from 23).
- up to 47.87 ha of impacts to Koala habitat comprising 30.71 ha of permanent impacts (20.63 ha of low condition, non-browse species scattered paddock trees), up to 11.50 ha of partial impacts in APZ's and open space areas (where some Koala feed trees can be retained), 3.85 ha of temporary impacts (detention basins and creek crossings that will be revegetated to Koala habitat after construction and 1.81 ha of excluded access to existing habitat (as a result of Koala exclusion fencing to prevent Koalas entering urban areas and the associated risks of vehicles and domestic dog attack)
- Up to 44.52 ha of impacts to Spot-tail Quoll habitat (mainly loss of 41.91 ha of thinned/pasture improved woodland, scattered paddock trees and derived grassland/shrubland across action area), 1.71 ha of partial impacts (managed bushfire APZs) and exclusion from 1.81 ha of habitat as a result of koala exclusion fencing.
- Up to 44.35 ha of impacts to potential Grey-headed Flying-fox and Large-eared Pied-bat habitat (mainly loss of 41.76 ha of thinned/pasture improved woodland, scattered paddock trees and derived grassland/shrubland across action area) and 1.71 ha of partial impacts (managed bushfire APZs where some trees will be retained).
- Up to 44.13 ha of impacts to potential Swift Parrot foraging habitat (mainly loss of 37.76 ha thinned/pasture improved woodland, scattered paddock trees across action area) and 1.63 ha

of partial impacts (managed bushfire APZs where some trees will be retained and the establishment of a walking track that will not impact any trees).

The Department considered that the proposed action was 'likely to have significant impacts on CPW, SSTF, Rufous Pomaderris, Koala, Spot-tailed Quoll, Grey-headed Flying-fox, Large-eared Pied-bat and Swift Parrot, however, this preliminary documentation report has concluded, after a more detailed assessment and further measures to avoid and minimise impacts that that residual significant impacts, in the context of the EPBC Act, will only be likely for SSTF and CPW. i.e. it has been determined that residual significant impacts would not occur to the Rufous Pomaderris, Koala, Spot-tailed Quoll, Grey-headed Flying-fox, Large-eared Pied-bat, Swift Parrot or the Greater Glider. However, the 224.75 ha of permanently protected and managed habitat to be dedicated as biodiversity offsets for CPW and SSTF will also deliver offsets for these species.

Conservation outcomes for MNES

As a result of the conservation measures proposed in the biocertification assessment and this preliminary documentation report, 209.08 ha of land comprising 162.54 ha of existing vegetation, 45.57 ha of restored native vegetation and 0.97 ha of existing tracks and water bodies will be permanently protected and managed for conservation in two proposed offset areas within the action area. The offset areas will be registered as Biodiversity Stewardship Agreement sites (BSAs) under the NSW BC Act within 12 months of action approval. A third BSA will also be registered over 26.89 ha of land at Browns Bush on the eastern side of Appin Road to provide protection for Koalas (although this area is not required or proposed to meet the offset requirements for Koala or any other MNES as part of the proposed action). These areas will be signed and fenced with koala exclusion fencing to prevent domestic dogs and stock entering the offset areas and other inappropriate access. The conservation areas will be subject to in perpetuity weed and feral animal control programs, supplementary tree, shrub and ground cover plantings in degraded areas to restore vegetation to EPBC Act condition criteria for SSTF, CPW and RFEF.

In addition to this proposed conservation measures, 149.28 ha of land in the action area will be 'retained' as either rural land, public open space and existing easements which includes 25.81 ha of native vegetation, and some landscape tree plantings to further enhance habitat for the Koala. Collectively, these Stewardship Agreement sites, rehabilitated detention basins, retained open space and easements will form an over 300 ha, fully fenced (koala exclusion fencing), dog and vehicle prohibited, Gilead Koala Conservation Reserve. The Gilead Koala Conservation Reserve provides connected corridors linking the Georges and Nepean River catchments as recommended by the NSW Chief Scientist. The Gilead Koala Conservation Reserve will be subject to a Koala Conservation and Management Plan including on-going management and mitigation of threats, community education and involvement and ongoing research and monitoring. Lendlease will also provide Koala underpasses and exclusion fencing between Beulah and Noorumba Biobank sites on both sides of Appin Road to retain connectivity between the Georges and Nepean River corridors and reduce an existing Koala road kill hotspot as described in RMS (2023). This will be a permanent underpass at Noorumba Reserve and an interim underpass as Browns Bush as part of the initial phase of the Appin Road upgrade works. Detailed designs for these underpasses have been submitted to the NSW Government for approval. These underpasses have been incorporated into an amended Koala Management Plan prepared under EPBC 2015/7599, which was approved on 30 May 2023. Lendlease have also made an irrevocable Letter of

Offer to the NSW Government to modify the Mt Gilead Voluntary Planning Agreement to provide a permanent Koala underpass at Beulah).

In summary the three conservation areas are :-

- The 189.09 ha Gilead Stewardship Agreement site with
- The 19.99 ha Mt Gilead-Homestead Stewardship Agreement site; and
- The 26.89 ha Browns Bush Stewardship Agreement site (although this site is not required to meet the offset requirements for the project).

The total offset area proposed for the Action (not including the Browns Bush BSA site) is 209.08 ha which includes 162.54 ha of existing vegetation, 45.57 ha of vegetation to be restored as Koala habitat (commencing in Year 1) and 0.97 ha of existing management trails and water bodies. There are a further 1.25 ha of proposed bush walking tracks within the offset area that will not impact any trees (and that are included in the impact assessment). The rehabilitation of 24.15 ha of detention basins and a further 25.81 ha of vegetation within the 149.28 ha of retained land, easements and open space, will provide, additional, accessible Koala habitat, that is protected from vehicles and dogs by Koala exclusion fencing. These areas are not required to meet the offset targets, and whilst providing a positive benefit for Koalas and other MNES, they have not been included in the offset calculations.

Collectively the proposed Gilead and Mt Gilead Homestead Biodiversity Stewardship sites will permanently protect and manage:-

- 11.47 ha of EPBC Act condition A and C CPW within the offset areas and a further 9.89 ha to be restored to EPBC condition CPW outside of the buffer zones, and an additional 0.98 ha of EPBC CPW and 3.68 ha of non- EPBC CPW in the buffer zones to be managed and enhanced within the offset area (Total CPW in offset area of 25.04 ha and 26.02 ha of CPW being managed)
- 96.83 ha of EPBC Act condition SSTF within offset areas and 24.42 ha to be restored to EPBC condition SSTF outside of the buffer zones, and an additional 13.33 ha of EPBC SSTF and 13.39 ha of non-EPBC SSTF in the buffer zones to be managed and enhanced area within the offset area (Total offset area of 134.63 ha with 147.97 ha of SSTF managed)
- 21.60 ha of EPBC Act condition RFEF within offset areas and 4.17 ha to be restored to EPBC condition, and an additional 0.28 ha of EPBC RFEF in the buffer zones to be managed and enhanced within the offset area (Total area of managed RFEF being 26.05 ha)
- 249 *Pomaderris brunnea* recorded plants
- 151.58 ha of existing and 56.54 ha of restored (derived grassland/shrublands and cleared areas) Koala habitat
- 155.18 ha of existing and 53.90 ha of restored (derived grassland/shrublands and cleared areas) Grey-headed Flying-fox and Large-eared Pied-bat foraging habitat
- 162.54 ha of existing and 45.57 ha of restored (derived grassland/shrublands and cleared areas) Spot-tailed Quoll habitat, and
- 143.80 ha of existing and 48.70 ha of restored Swift Parrot foraging habitat.

These offsets will be legally 'secured' by the registration of in perpetuity, fully funded, Biodiversity Stewardship Agreements with the area of offset required for each impacted MNES calculated using the

EPBC Act Offset Calculator and secured via the retirement of Biodiversity credits of an equivalent area from the registered BSAs.

Although no offsets are required for impacts to potential habitat for Grey-headed Flying-fox, Large-eared Pied Bat, Spot-tailed Quoll, Swift Parrot, or Greater Glider, as the impacts to the habitat for these species has been assessed as not being significant, the conservation areas above will protect and manage 155.18 ha, 162.54 ha, and 143.80 ha of existing suitable habitat respectively for these species on-site and a further 53.90 ha, 45.57 ha and 48.70 ha of restored habitat respectively as part of the Stewardship Agreement sites.

Similarly, 21.90 ha of EPBC Act condition RFEF and 4.17 ha of restored RFEF within the proposed offset areas and outside buffer zones will be used to offset the impacts for the 0.35 ha of direct impacts to RFEF, although in accordance with section 158(1)(j) of the EPBC Act an offset for this community is not required as it was not listed as threatened at the time of the Controlled Action decision.

The management of these conservation areas will improve the condition of the vegetation, so that existing degraded areas of SSTF and CPW will meet the EBPC Act condition criteria in the short to medium term (5-10 years).

Construction and Environment Management Plan (CEMP) and Koala Management Plan

To further manage the potential direct and indirect impacts associated with the proposed action, the proponent has prepared a draft Construction Environment Management Plan (CEMP) and a Koala Management Plan (KMP).

The CEMP and KMP have been prepared for vegetation clearing within the action area to guide the development outlined in this assessment and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off etc) are contained within the development footprint and ensure that appropriate mitigation measures are put in place to minimise indirect impacts to threatened fauna during and post construction in the proposed conservation area. Specifically, these plans address the protection of the land proposed for conservation measures and its buffers such that surrounding roads will be fully curbed and guttered with no stormwater being discharged into the conservation areas other than that treated within the bio-detention basins. In addition, the CEMP will include, but not be limited to:

- temporary and permanent protective fencing will be erected around all areas identified for conservation prior to clearing activities to minimise any inadvertent damage
- a fauna pre-clearance protocol
- where trees are removed in the development area, these will be salvaged for fauna habitat values in the proposed Stewardship Agreement sites (i.e. meeting the additional management requirement of importing logs and hollows into the conservation area)
- a de-watering plan for any farm dams that are removed, including a provision for pre-dewatering monitoring and clearance protocols, and
- monitoring of performance measures and non-compliance.

Recommendations of the Chief Scientist and Engineer and Campbelltown City Council on protection of the Campbelltown Koala population

Whilst not NSW Government policy, the proposal has considered the recommendations of the NSW Chief Scientist & Engineer (CS&E) in regards to the protection of the Campbelltown Koala population and aligns with Campbelltown City Council's (CCC) Koala Plan of Management.

Collectively, the two BSA sites and retained open space, not including the retained rural land around the Gilead Homestead will form an over 300 ha of fully fenced, dog and vehicle prohibited, Gilead Koala Conservation Reserve. The Gilead Koala Conservation Reserve is consistent with the recommendations of the NSW Office of the Chief Scientist and Engineer's recommendations for the Protection of the Campbelltown Koala population and the Department of Planning and Environment's 24 planning principles for the Greater Macarthur Growth Area. The Gilead Koala Conservation Reserve will be subject to a Koala Conservation Plan including on-going management and mitigation of threats, community education and involvement and ongoing monitoring.

Mt Gilead Koala Conservation Plan

The proponent has prepared a Gilead Koala Conservation Plan (Lendlease 2022) to serve as a comprehensive conservation management framework to guide the design, planning, construction, habitation, monitoring and adaptive management of Koalas in the study area.

Social and economic factors

The Campbelltown LGA has a forecast population increase projection of over 100,000 people between 2019 and 2036 (Campbelltown Local Strategic Planning Statement to 2040 (CCC 2020). An additional 26,700 homes will be required in the Campbelltown LGA by 2036 to meet this population growth. The Greater Macarthur Growth Area (GMGA), which includes the proposed Mt Gilead Stage 2 development, was first identified by the NSW State Government for planned growth in 2013 as part of the Draft Metropolitan City Strategy for 2031 (DP&I 2013) with the Precinct formally declared a Growth Area in 2019. The Mt Gilead Stage 2 development will deliver approximately 3,300 new houses to accommodate 10,000 new residents.

In terms of negative social and economic impacts, the Site is buffered from land uses to the north by Menangle Creek (Figure 5). The State Heritage Item Mount Gilead Homestead is buffered from the Site by significant vegetation along the common boundary and will be retained as an agricultural enterprise (Figure 6). All other adjoining land holdings are agricultural enterprises or Mount Gilead Stage 1 which is currently being developed with approvals in place for a total 1,700 lots.

The action will have very low impacts on the local community as existing residential areas are located some distance from the action area, impacts from increased traffic generated from the development will be minimised through upgrades to existing roads and the provision of public transport.

When completed the action will support over 2,200 full time equivalent jobs (1,018 onsite and 1,244 offsite) during the planned construction period. Create nearly 3,400 permanent jobs by the completion of the development through the planned centres, supporting non-residential development and supporting industries; and represents civil construction works value in excess of $1.16 billion that will contribute to construction employment over the life of the project.

1. Scope of this report

On 27 November 2019, the proposed Mt Gilead Stage 2 residential development was referred to the then Australian Government Department of the Environment and Energy (DotEE) (now Department of Climate Change, Energy, the Environment and Water (DCCEEW)) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Appendix A**).

On 24 February 2020, the then Department of Agriculture, Water and the Environment (DAWE) determined that the proposed action is a '*controlled action*' and that it will be assessed by preliminary documentation (PD Report). **Appendix B** includes a copy of this determination and the additional assessment requirements that this assessment report is required to address are provided as **Appendix C**.

A copy of the referral documentation and controlled action decision notice can be found at http://epbcpublicportal.awe.gov.au/all-referrals/ and enter the referral number 2019/8587.

This document is the EPBC Act Preliminary Documentation Assessment Report for the proposed development and will be provided to DCCEEW to enable further assessment under the EPBC Act (EPBC Ref: 2019/8587).

The names, qualifications, experience and roles of the ecologists who prepared the report are provided in **Appendix D**.

From the information provided in the referral, the then DotEE (now DCCEEW) considered that the following Matters of National Environmental Significance (MNES) were 'likely' to be significantly affected by the proposed action:

Threatened ecological communities:

- Shale Sandstone Transition Forest in the Sydney Basin Bioregion (SSTF); and
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW)

Fauna:

- *Phascolarctos cinereus* (Koala)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- Chalinolobus dwyeri (large-eared Pied-bat)
- *Lathamus discolor* (Swift Parrot)

Flora:

- *Pomaderris brunnea* (Rufous Pomaderris)

From the information provided in the referral, the DotEE (now DCCEEW) considered that the following MNES have the 'potential' to be significantly affected by the proposed action:

Flora:

- *Syzygium paniculatum* (Magenta Lilly Pilly)

Fauna:

- *Dasyurus maculatus* (Spot-tailed Quoll) – Endangered
- *Hoplocephalus bungaroides* (Broad-headed Snake) – Vulnerable
- *Litoria littlejohni* (Littlejohn's Tree Frog) – and endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petauroides volans* (Greater Glider) – and endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petrogale penicillata* (Brush-tailed Rock-wallaby) – Vulnerable
- *Pseudomys novaehollandiae* (New Holland Mouse) – Vulnerable
- *Synemon plana* (Golden Sun Moth) – vulnerable.

The purpose of this Preliminary Documentation is to address the further information requested by the then DotEE (**Appendix C**). This document includes the information contained in the referral document, where still relevant, and other relevant background studies, to provide all the relevant information in one report. The additional information requested by the then DotEE (now DCCEEW) has been addressed in this report and is summarised in Table 1.

Table 1: Additional information requested by DAWE

Information requested by DotEE	Section
Description of the action, including • Location of works • Timing and duration • Feasible alternatives • State legislation assessment requirements • How the action relates to any other action • Consultation • Relation to other actions	Section 2 and Section 3
Species / communities for which further information is required The Department considers the following species and communities are likely to be significantly affected by the proposed action. Detailed information is required on the relevant impacts, proposed management and mitigation measures, and proposed offsetting measures for each of these species and communities: • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – Critically Endangered • Shale Sandstone Transition Forest of the Sydney Basin Bioregion – Critically Endangered • Rufous Pomaderris (*Pomaderris brunnea*) – Vulnerable • Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) – listed as endangered in February 2022 but as Vulnerable at the time of the Controlled Action decision • Swift Parrot (*Lathamus discolor*) – Critically Endangered • Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable • Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable	MNES Sections 4 TECs Section 5 Th Flora Section 6 Th Fauna Section 7
Additional species / communities to be addressed The Department considers that the following species are potentially significantly affected by the proposed action, but a determination could not be made based on the referral information. Further	Sections 4.3.2 and 4.3.3

Information requested by DotEE	Section
information is required on the likelihood of occurrence, assessment of relevant impacts against the significant impact criteria, proposed avoidance and mitigation measures, and if applicable, proposed offset measures: • Broad-headed Snake (*Hoplocephalus bungaroides*) – Vulnerable • Brush-tailed Rock-wallaby (*Petrogale penicillate*) – Vulnerable • Golden Sun Moth (*Synemon plana*) – Vulnerable • Greater Glider (*Petauroides volans*) – Endangered (however was listed as Vulnerable at the time of the Controlled Action decision • Littlejohn's Tree Frog (*Litoria littlejohni*) – Endangered (however was listed as Vulnerable at the time of the Controlled Action decision • Magenta Lilly Pilly (*Syzygium paniculatum*) – Vulnerable • New Holland Mouse (Pseudomys novaehollandiae) – Vulnerable • Spot-tailed Quoll (*Dasyurus maculatus*) – Endangered	
Avoidance and mitigation measures The PD must include a description of all proposed avoidance, mitigation and management measures to address each of the identified impacts for the above mentioned listed threatened species and communities.	Section 8
Koala Management Plan Your preliminary documentation must provide details of the proposed Koala Management Plan, as part of a Construction Environmental Management Plan, for the proposed action.	Section 8 and **Appendix M**
Offsets Significant residual impacts (i.e. after any avoidance and mitigation measures have been considered) on any listed threatened species or community must be offset in accordance with the Department's EPBC Environmental Offsets Policy 2012 and offset assessment guide, or other endorsed offset framework (see separate heading below)	Section 9
Fires Consider the recent bushfire impacts when assessing the impacts of your proposal. The PD should provide detailed information on the following: • Identify the fire affected threatened species and ecological communities (or their habitats) occurring within the proposed action area. Note that the Department has published information on fire-affected species at http://www.environment.gov.au/biodiversity/bushfirerecovery/research-and-resources • Location of the proposed action area in relation to fire-affected areas, any fire damage to the environment directly surrounding the proposed action area. • The likely importance of the habitat within the proposed action area for fire-affected threatened species and communities, for example in terms of post-fire refuge, survival and recovery. • As required, re-assess the impacts of the proposed action based on the above information.	Section 7
Social and economic matters Consider the following: • consideration of both costs (e.g. disruption to existing community infrastructure or environmental features) and benefits (e.g. increased housing or employment) • consideration of different scales of impact where relevant (e.g. local, regional, and national) • estimated capital value and ongoing economic value, using specific dollar or other numerical values where relevant.	Section 2.6

Information requested by DotEE	Section
Environmental history of the person proposing to take the action Your preliminary documentation must provide details of any proceedings under a Commonwealth, state or territory law for the protection of the environment, or the conservation and sustainable use of natural resources, against the person proposing to take the action (or if the person is a corporation, its executive officers, and if the person is a subsidiary of another corporation, the history of the parent body and its executive officers).	Section 2.7
Cumberland Plain Conservation Plan and the Western Sydney Strategic Assessment In making a decision about the proposed action under Part 9 of the EPBC Act, the Department is required to consider any relevant information in a Strategic Assessment Report given to the Minister under an agreement under Part 10. Your preliminary documentation must include discussion of the relationship of the proposed action to the Cumberland Plain Conservation Plan (CPCP) and consider whether the proposed action is consistent with the outcomes and objectives of the CPCP.	Section 3
Lendlease Communities (Figtree Hill) Pty Ltd Environmental Polices and Planning Framework	**Appendices E, F & G**

2. Introduction

2.1 Proponent

The designated proponent for the Mt Gilead residential development was Lendlease Communities (Figtree Hill No 3) Pty Limited.

In May 2022, Lendlease Communities (Figtree Hill No 3) Pty Ltd submitted a request to DAWE to 'change the person proposing to take the Action' from Lendlease Communities(Figtree Hill No 3) Pty Ltd to Lendlease Communities(Figtree Hill) Pty Ltd. This request was approved in June 2022 and a copy of the decision was published on the Department's website at http://epbcpublicportal.awe.gov.au/all-referrals/.

The contact for the Commonwealth assessment of the proposed action is:

Mr Mark Anderson, Senior Development Manager

Lendlease Communities (Figtree Hill) Pty. Limited

Level 14, Tower Three, International Towers Sydney

Exchange Place, 300 Barangaroo Avenue, Barangaroo NSW 2000

2.2 Variation to proposal to take an action

In May 2022, Lendlease Communities divested the isolated Lot in the north-west of the study area to an unrelated entity.

Following advice provided by the Department, in September 2022, Lendlease Communities(Figtree Hill) Pty Ltd submitted a s156A variation to referred action request to remove Lot 1 DP 622362 of approximately 27 ha from the action area, thereby reducing the action area from 672.12 ha to 644.83 ha. The remainder of the action i.e. a residential development and associated infrastructure, retail and educational facilities, public open spaces, active and passive open spaces and conservation lands, remained unchanged. This request was approved on 28 October 2022 and a copy of the decision was published on the Department's website at http://epbcpublicportal.awe.gov.au/all-referrals/.

In February 2023, Lendlease Communities (Figtree Hill) Pty Ltd submitted a second s156A variation to referred action request to remove approximately 0.57 ha from the referral area reducing the Action area to 644.27 ha to facilitate the delivery of the Koala underpasses, proposed to be a conservation commitment as a variation to the Koala Management Plan for Mt Gilead Stage 1 (EPBC 2015/7599). This request was approved on 30 May 2023 and a copy of the decision notice was published on the Department's website at http://epbcpublicportal.awe.gov.au/all-referrals/.

2.3 Location of works and site description

The site is located at Appin Road Gilead, in the southwest of the Sydney metropolitan area, approximately 7 km south of the Campbelltown city centre (Figure 1, Figure 4).

The site history and its condition has informed the planning and location of urban development areas to ensure its many natural assets and heritage values are preserved. Continuous and progressive

agricultural activities have occurred on the development site since the 1800's, which has led to the progressive clearing of native vegetation across the majority of the site other than along creek lines which provide a contiguous corridor of native vegetation linking Noorumba Reserve and the Beulah Biobank sites adjacent to Appin Road to the Nepean River.

The predominant landform (approximately 62 per cent or 397.51 ha of the 644.27 ha action area) is currently large open grazing paddocks with scattered shade trees transected by natural creek lines containing remnant native vegetation communities (265.28 ha); Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest (Cumberland Plain Woodland), Shale Sandstone Transition Forest and River-flat Eucalypt Forest (266.48 ha).

2.4 Background Planning to urban development in the area

The Greater Macarthur Growth Area (GMGA), which includes the proposed Mt Gilead Stage 2 development, was first identified by the NSW State Government for planned growth in 2013 as part of the Draft Metropolitan Strategy for Sydney to 2031 (DP&I 2013) with the Precinct formally declared a Growth Area in 2019.

The Mt Gilead Stage 2 action area was identified in the *Metropolitan Plan for Sydney 2036* as a key location to provide housing for the predicted growth of Campbelltown – Macarthur as a Major Centre (DP&I 2013). The Plan anticipates the South West Sydney region will need to provide an additional 155,000 dwellings and 141,000 new jobs by 2036, with the Campbelltown – Macarthur Strategic Centre contributing 11,000 of these jobs. The following are the key issues in relation to the supply of housing and jobs of relevance to the proposed action:

- the Campbelltown LGA currently has a much higher proportion of public housing, and much lower private rental housing than the Sydney average;
- unemployment in the LGA is above Sydney's average (at it's peak in 2021 at 6.3% in comparison to 5.1% for Sydney as a whole in 2001), albeit unemployment levels in the LGA are continuing to have a decline to March 2023;
- Campbelltown has a much lower proportion of people in the 'white collar' occupational categories (managers, administrators, professions) and higher proportion in other skilled categories.

In line with the priorities of the Draft Metropolitan Strategy for Sydney 2031, the DPIE continued investigations to confirm the viability of Greater Macarthur to contribute to housing supply in Sydney's South West. This resulted in the release of the Greater Macarthur Land Release Investigation Area Preliminary Strategy and Action Plan in 2015 that identified urban capable land, including the action area and established the preliminary structure plan for the broader release area.

Since this time, the State Government has confirmed Greater Macarthur, including the action area, as a Land Release Area in the Greater Sydney Region Plan - Metropolis of Three Cities (Greater Sydney Commission 2018) and resulted in Greater Macarthur being formally declared as a Growth Area in 2019.

In support of the declaration of Greater Macarthur as a formal Growth Area, DPIE prepared the Greater Macarthur 2040 Interim Plan. This plan establishes the revised structure plan for development,

indicative transport corridors, indicative Koala corridors and environmental conservation lands subject to the Cumberland Plain Conservation Plan (DPIE 2020) (Figure 2). Specific to the Greater Macarthur Growth Area, this plan identifies the capacity to deliver 39,000 new homes to meet the demand of projected population growth in Sydney's South West and it was 'intended' that the Gilead 2 development (i.e. action area) will make a considerable contribution of 4,500 new homes to supply in the region. As a result of changes to the referred Masterplan, and significant widening of Koala corridors, the number of lots to be created is now expected to be approximately 3,300.

The land within the action area has been identified as developable land by the NSW Department of Planning, Industry and Environment (DPIE). For further details, please see the full document at http://www.planning.nsw.gov.au/~/media/ABA7AB6177DF4D638F0529A906A9BB52.ashx.

A limitation in housing choice has been identified as a limiting factor to the attractiveness of the Campbelltown area as a place to live for professional and business people. The proposed development and average lot size at Mt Gilead will strategically address this issue, so contributing to the required growth of Campbelltown – Macarthur as a Major Centre.

2.5 Proposed action

Mt Gilead Stage 2 is west of Appin Road and the approved Stage 1 development (EPBC 2015/7599) as shown in Figure 1.

The amended Mt Gilead Stage 2 action area is 644.27 ha of which 230.97 ha is proposed for urban development (primarily containing low and medium residential development, retail & educational facilities) and associated infrastructure (detention basins, Bushfire Asset Protection Zones), 26.80 ha of active open space, 1.25 ha of bushland walking paths 1.2m wide, 10.00 ha of passive open spaces areas (heritage curtilage and retained bushland, 139.28 ha of retained rural land and existing power, gas and water easements and 235.96 ha of dedicated conservation lands.

The Stage 2 development will deliver approximately 3,300 lots with a range of lot sizes consistent with the natural features of the site. Development is likely to commence in 2025 and take up to 10 years to complete in seven indicative stages, depending on demand for housing.

An indicative Masterplan for the proposed development is shown at Figure 3. The spatial boundaries of the study area are shown in Figure 4. The Lot/DP boundaries, together with riparian areas (creek lines), existing easements and surrounding conservation areas are shown in Figure 5.

2.6 Development footprint

The action area is 644.27 ha of which is comprised of:

- 259.02 ha of the action area will be directly (urban development and associated infrastructure) or indirectly impacted (bushfire asset protection zones, active open space)
  - 212.79 ha of which is cropping and/or pasture land, farm roads or dams
  - 46.23 ha of which is existing native vegetation
- 235.96 ha of the action area to be conserved in three Biodiversity Stewardship Agreement sites (BSAs)
  - 186.65 ha of which is existing native vegetation

  - 48.03 ha of which is pasture to be restored to native woodland vegetation
  - 1.29 ha of which are existing management tracks and dams that will be retained
- 30.27 ha will be retained as existing easements (powerline, water and gas), passive open space and heritage curtilage.
  - 13.07 ha of which is existing native vegetation
- 119.01 ha will be retained as rural land
  - 12.74 ha of which is existing native vegetation

A breakdown of the study and action area and proposed land use is shown in Figure 6 and Table 2. It is noted that there are minor differences between the action area and the extent of native vegetation documented in this report compared to the NSW Biocertification Assessment (ELA 2023a) which are due to the differences in the way that vegetation patches are defined at the State and National level and rounding to two decimal places multiple layers of data.

Table 2: Proposed land uses and associated area in the action area

Land use	Area (ha)	% of action area	Area of Vegetation	% of Action Area
Land proposed for development (urban development and associated infrastructure - roads, bio-detention basins, active open space, APZs)	259.02	40.20%	46.23	17.87%
Land proposed for conservation (to be registered as 3 Biodiversity Stewardship Agreement sites)***	235.96	36.23%	186.65	72.15%
Retained lands (land excluded from this assessment) includes Mt Gilead Homestead lands, Local Open Space and existing easements.	149.28	23.17%	25.81	9.98
Total	**644.27**	**100%**	**258.68**	**100%**

*** Only two of these BSA sites, comprising 209.08 ha are required be used to fulfil all of the offset requirements of the project.

2.7 Feasible alternatives considered

The location of Mt Gilead has been previously identified as a key location to provide needed housing into the future for the predicted growth of Campbelltown – Macarthur as a major centre in accordance with strategic directions outlined in the Greater Sydney Regional Plan – A Metropolis of Three Cities (GSC 2018). The Plan anticipates the South West Sydney region will need to provide an additional 155,000 dwellings and 141,000 new jobs by 2036.

Mt Gilead Stage 2 has been identified as a priority precinct in the Greater Macarthur Land Release Investigation and draft Structure Plan (DPE 2015; 2018) and the December 2021 update (DPE 2021). The ecological assessments conducted in the action area by ELA between 2013 and 2020 have been used to inform avoidance and minimisation of direct and indirect impacts to biodiversity values throughout the Master planning stage. These principles include:

- the layout design selection process must include consideration and analysis of the biodiversity constraints of the proposed action
- the project should be located in areas where the native vegetation and threatened species habitat is in the poorest condition

- the project should be in areas which avoid EECs or CEECs
- the project should aim to minimise the amount of clearing or habitat loss
- the project should be located in areas that do not have native vegetation or require the least amount of clearing.

The final proposed action is the result of a series of redesigns taking into account the above and is shown in Figure 3. Whilst all impacts to matters of NES have not been completely avoided, impacts have been minimised as far as practicable. The proposed action has been designed to retain larger, more viable patches of habitat for these matters of NES in moderate to good quality, with development concentrated in poorer condition areas of the communities.

As a result of the revisions to the proposed Master Plan, and options to avoid and minimise impacts, impacts have been reduce from 332 ha of land, comprising 76.88 ha of native vegetation of which 55.47 ha met the condition thresholds of EPBC Act listed threatened ecological communities in the referred action (**Appendix A**) to 259.02 ha of land, with 46.23 ha of direct impacts to native vegetation in various condition states, of which 35.86 ha meets EPBC Act condition thresholds of listed communities. The referred development footprint proposed to impact 23 individuals of the endangered plant *Pomaderris brunnea* and up to 72.22 ha of Koala habitat, the final development footprint will impact two plants of P. brunnea plants and 47.87 ha of Koala habitat, 33.39 ha or 70% of which is in low condition (scattered paddock trees of non-preferred browse species).

2.8 Relation to other actions

The proposed action is related to Mt Gilead Stage 1 (EPBC 2015/7599) which was approved in December 2018 but is not reliant on Stage 1. All offsets for Stage 1 have already been secured and active management has commenced and is ongoing. Access to the proposed Stage 2 action area will be via Stage 1.

2.9 Social and Economic

The Mt Gilead Stage 2 development will deliver approximately 3,300 new houses to accommodate 10,000 new residents.

In terms of negative social and economic impacts, the Site is buffered from land uses to the north by Menangle Creek (Figure 5). The State Heritage Item Mount Gilead Homestead is buffered from the Site by significant vegetation along the common boundary and will be retained as an agricultural enterprise (Figure 6). All other adjoining land holdings are agricultural enterprises or Mount Gilead Stage 1 which is currently being developed with approvals in place for a total 1,700 lots.

The action will have very low impacts on the local community as existing residential areas are located some distance from the action area, impacts from increased traffic generated from the development will be minimised through upgrades to existing roads and the provision of public transport.

When completed the action will support over 2,200 full time equivalent jobs (1,018 onsite and 1,244 offsite) during the planned construction period. Create nearly 3,400 permanent jobs by the completion of the development through the planned centres, supporting non-residential development and supporting industries; and represents civil construction works value in excess of $1.16 billion that will contribute to construction employment over the life of the project.

2.10 Environmental record of the proponent

Lendlease Communities (Figtree Hill) Pty Ltd is a subsidiary of the Lendlease Corporation. Lendlease Corporation has an exemplary record of environmental management and sustainability at state, national and international levels.

Lendlease has worked closely with community as well as local and state authorities to ensure site-responsive outcomes on its projects. Examples of this include returned effluent treatment and reuse systems, seed collection and propagation programmes with both Landcare and Greening Australia, undertaking HIA Green Smart Programmes across a number of projects, provision of site-based management plans across all communities, generation of site based urban design outcomes (in consultation with local authorities), water recycling programmes at a number of communities, waterway and corridor management plans ensuring no impact into downstream wetlands and builders water recycling programs.

Additional to this, Lendlease undertakes community education and interaction programmes across its communities to create a high level of social capital. Lendlease also uses local Supply Nation certified first nations business to undertake ecological restoration work.

Lendlease has won numerous state and national awards for master planned communities. These awards are recognition for the comprehensive planning and implementation of site-specific outcomes in working with all constraints including the provision of environmental and sustainability initiatives.

Lendlease Communities (Figtree Hill) Pty Ltd has not had any proceedings under Commonwealth, state or territory law for the protection of the environment.

2.11 Proponents environmental policies and planning frameworks

Copies of Lendlease Communities environmental policies and planning frameworks are provided at **Appendix E, F** and **G**.

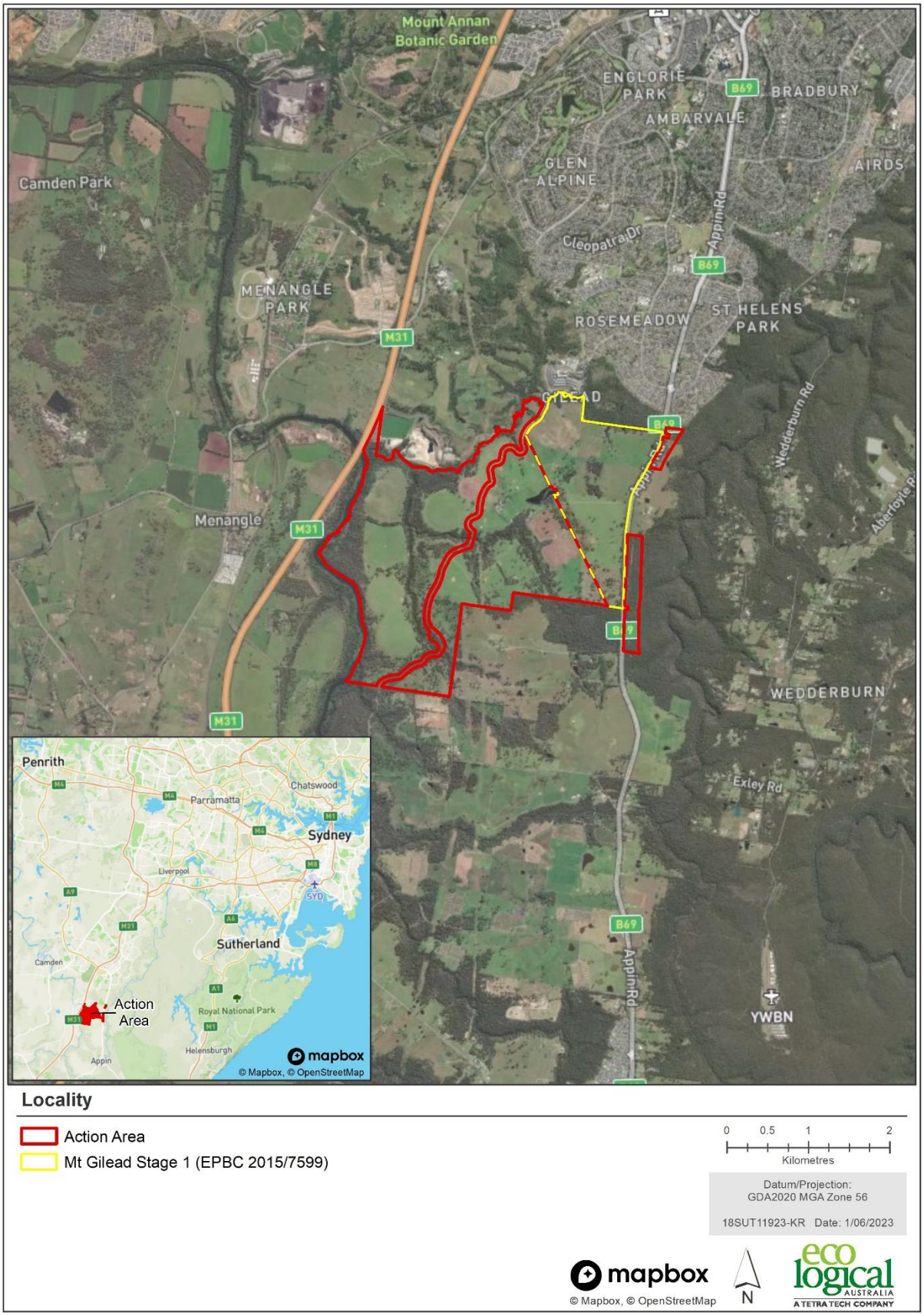


Figure 1: Location of the action area

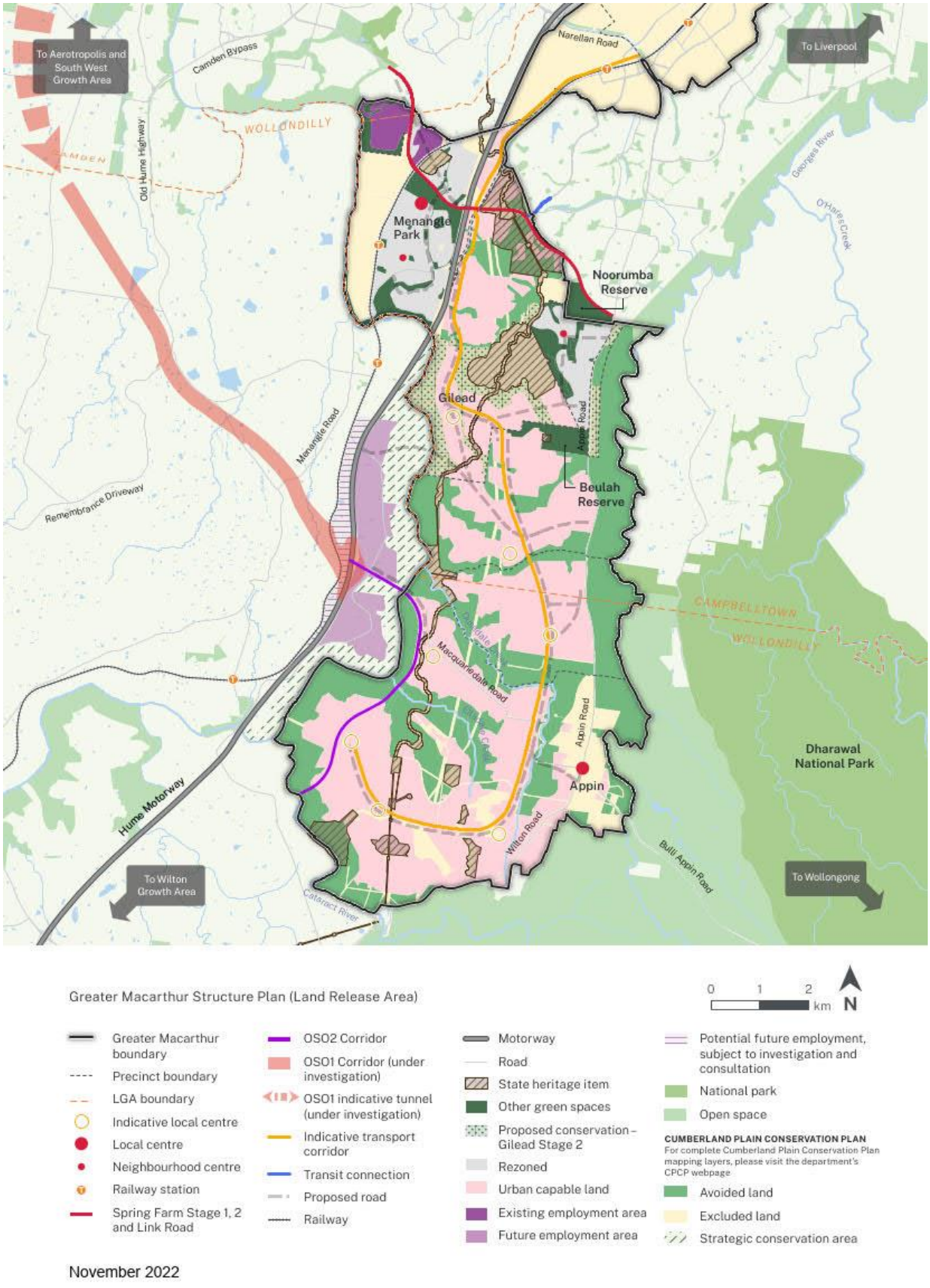


Figure 2: Department of Planning Macarthur Structure Plan (Source DPE 2022)

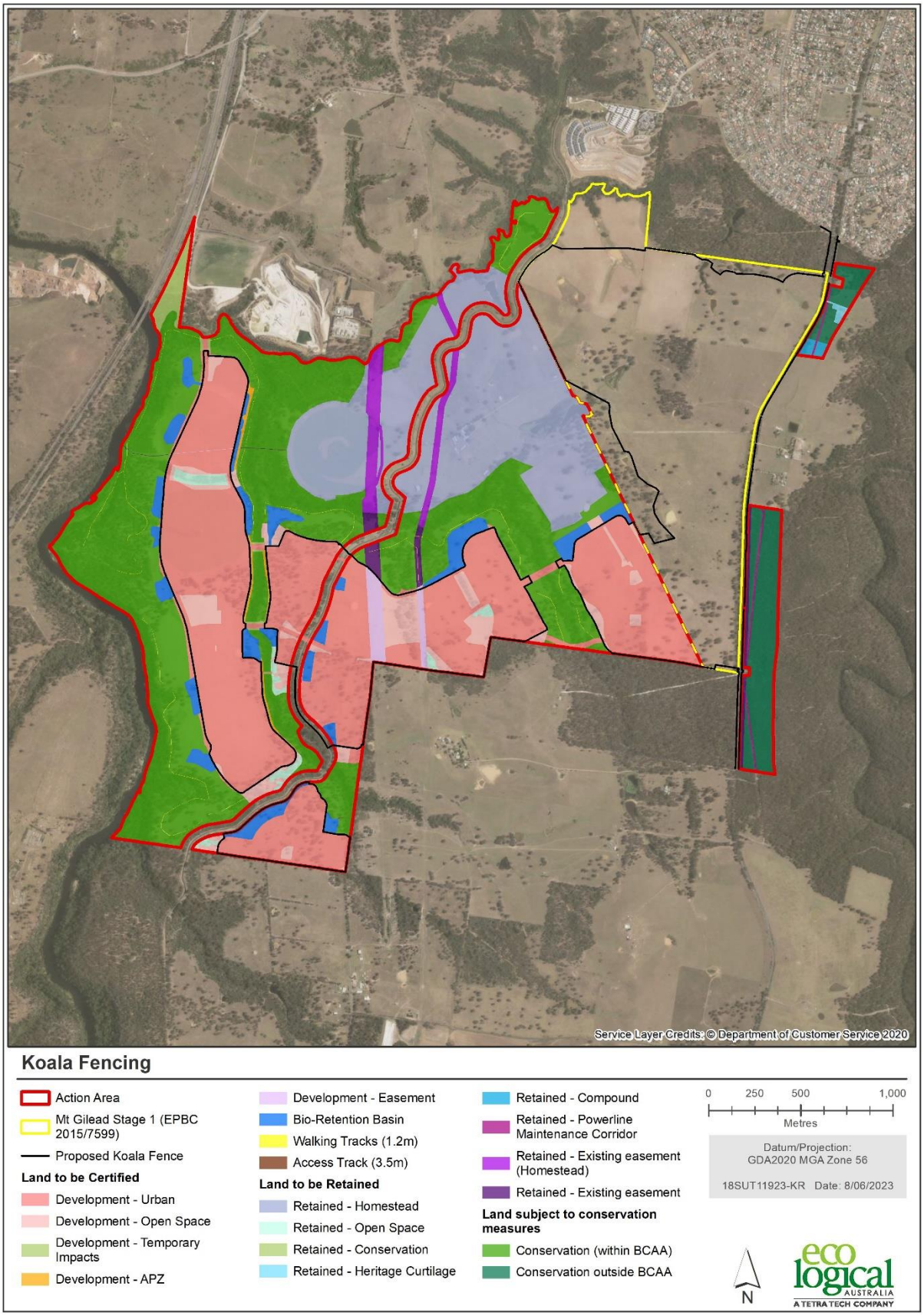


Figure 3: Mt Gilead Stage 2 Masterplan

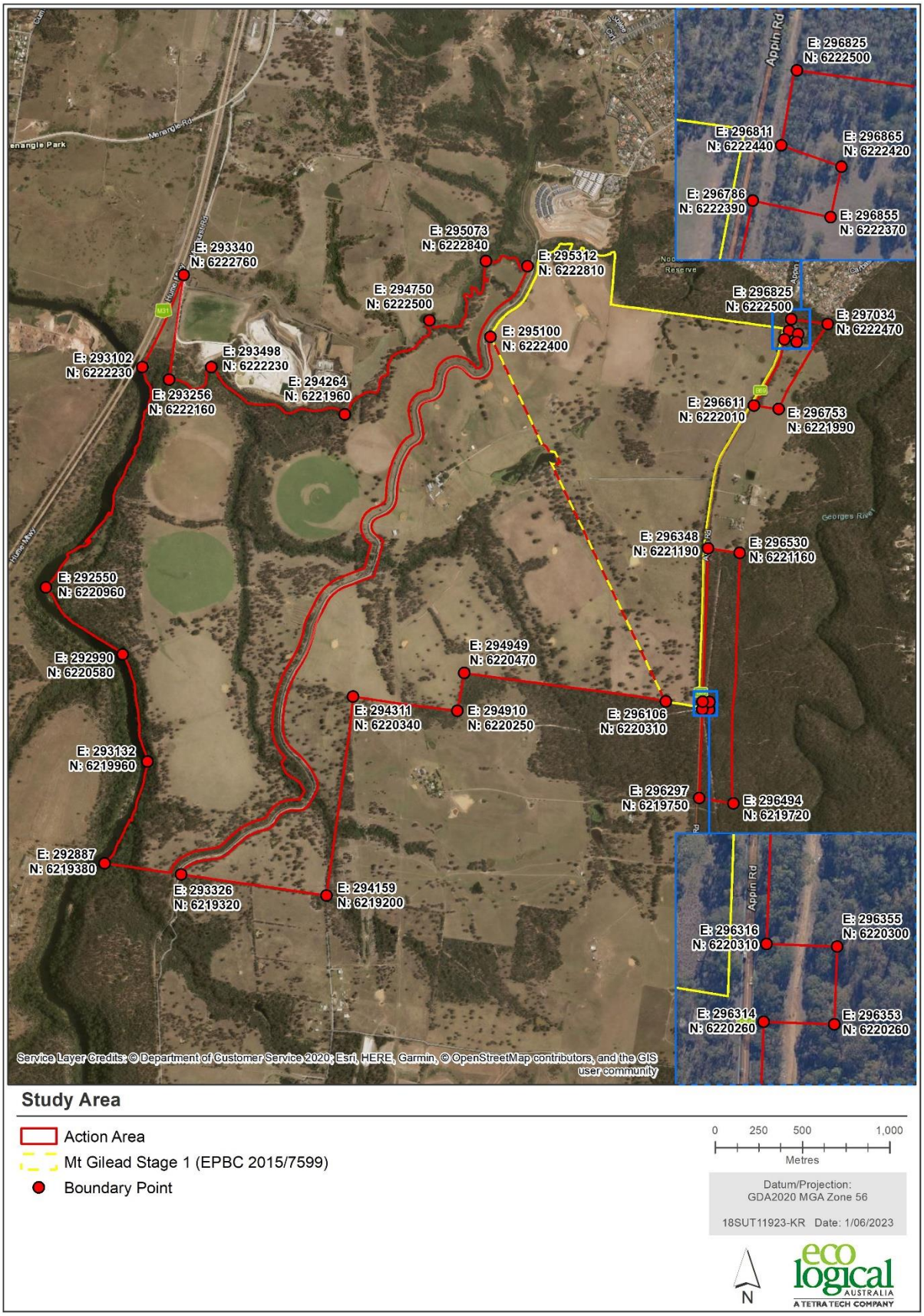


Figure 4: Spatial boundaries of the action area

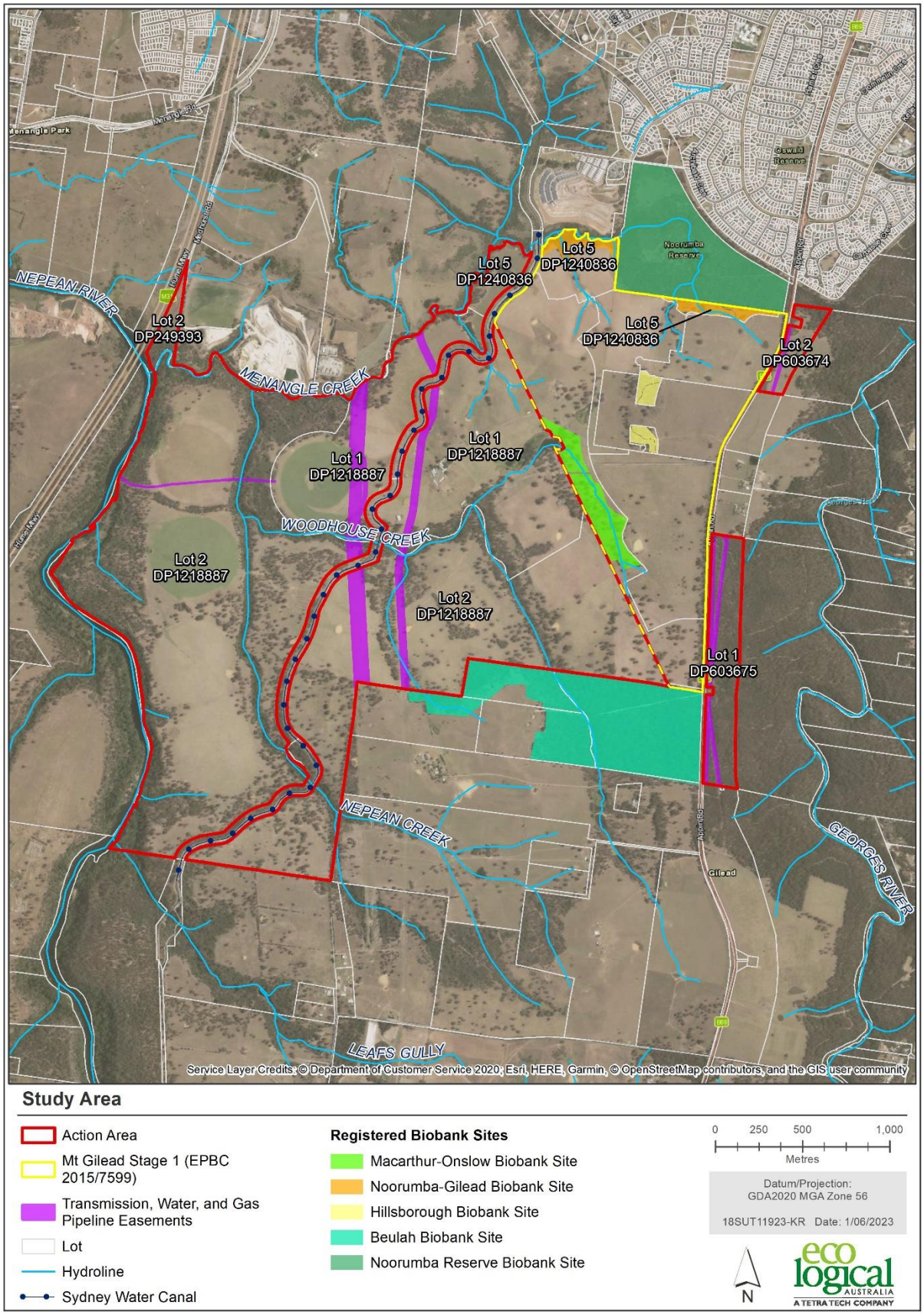


Figure 5: Features in and adjacent to the action area

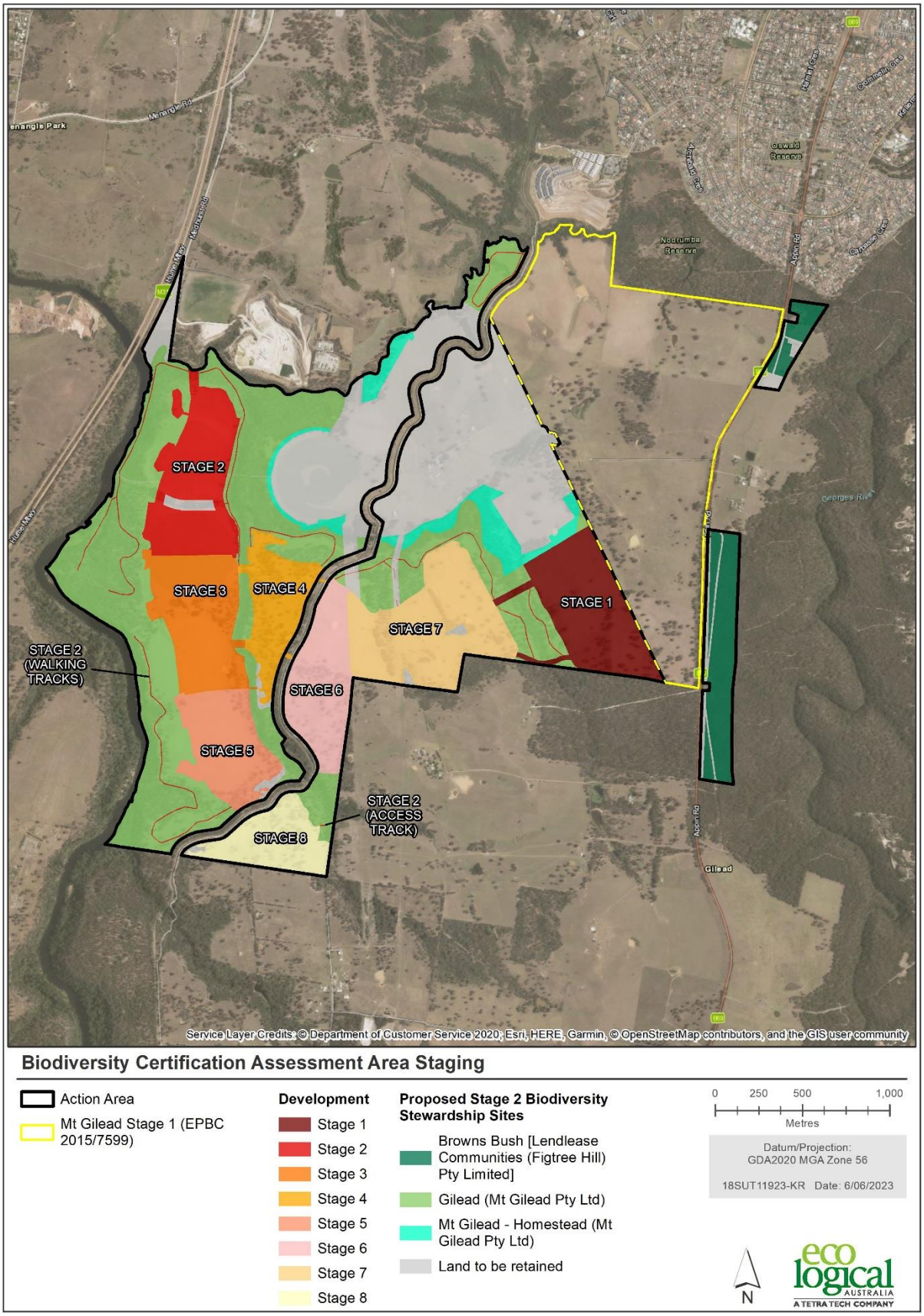


Figure 6: Proposed development footprint, staging and Biodiversity Stewardship Agreement sites

3. Legislative context and other assessments

3.1 Environmental impact assessments under Commonwealth or State legislation

The proposed action seeking approval includes subdivision, early site establishment works and subsequent urban development and associated infrastructure (power, water, sewerage and other utilities. This action has been written to consider the overall (total) impact on the site's environmental values for all stages of work and is based on the preferred indicative layout plan for the action area. The proposed development will be staged over an indicative ten-year timeframe (subject to demand for housing lots).

3.1.1 Commonwealth legislation

On 27 November 2019, the proposed Mt Gilead Stage 2 residential development was referred to the then Australian Government Department of the Environment and Energy ((DotEE) now Department of Agriculture, Water and the Environment (DAWE)) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Appendix A.

On 24 February 2020, the DAWE decided that the proposed action is a '*controlled action'* and that it will be assessed by preliminary documentation (Appendix B). This document is the EPBC Act Preliminary Documentation Assessment Report (PD Report) for the proposed development, has been prepared to address the assessment requirements outlined in **Appendix C** and has been provided to DAWE to enable further assessment and approval under the EPBC Act (EPBC Ref: 2019/8587).

At the time of the controlled action decision (i.e. 24 February 2020), the Koala was listed as a vulnerable species under the EPBC Act. The Commonwealth Minister for the Environment supported a recommendation from the Commonwealth Scientific Committee in February 2022 to upgrade the status of the Koala to endangered. Whilst this PD is only required to assess the Koala as a vulnerable species (consistent with Section 158A of the EPBC Act), the offset calculations have been undertaken on the basis of the koala listed as a vulnerable and endangered species.

3.1.2 State legislation

3.1.2.1 Biocertification Assessment

Eco Logical Australia Pty Ltd (ELA) was commissioned by Lendlease Communities (Figtree Hill) Pty Limited (Lendlease) in 2015 on behalf of Campbelltown City Council (CCC) to undertake a Biodiversity Certification Assessment Report (BCAR) and prepare a Biodiversity Certification Strategy (BCS) for Mount Gilead Stage 2 (ELA 2023a, **Appendix H**). The purpose of the assessment is to obtain '*biodiversity certification*' of land proposed for residential development and associated infrastructure from the Minister for the Environment and identify and provide commitments regarding the securing of biodiversity offsets.

The Biodiversity Certification Assessment Methodology (BCAM) assesses the impact of the proposal on ecological matters and proposed conservation measures. This assessment is measured using the number of credits 'required' for impacts to existing vegetation, and the number of credits 'generated' by the protection and conservation management of offset areas. Biodiversity certification can only be conferred by the Minister where an "improve or maintain" biodiversity outcome is met. Subject to the

Minister's approval of the request for a red flag variation, the proposal has been assessed as being able to meet an '*improve or maintain*' outcome and is eligible for biodiversity certification.

If the Minister confers biocertification on the requested land, CCC as the consent authority for future development applications is no longer required to assess impacts to biodiversity values as these have already been addressed by the Minister and '*conservation areas*' will be required to be managed in perpetuity for conservation.

The application for biodiversity certification was originally submitted to the Minister for the Environment in August 2019 by CCC.

The application for biocertification of Mt Gilead Stage 2 was undertaken in parallel with the Greater Macarthur Growth Area land use study (DPE 2015) and the Cumberland Plain Assessment Report (CPAR) (Openlines 2020) being led by the Department of Planning, Industry and Environment (DPIE) and Cumberland Plain Conservation Plan 2020-2056 (CPCP) (DPIE 2020) but is not part of the Strategic Assessment and is not subject to the proposed land uses in the CPCP. However, the Minister for the Environment requested that the assessment be revised to take into consideration the recommendations of the Chief Scientist and Engineers Independent Report on the Protection of the Campbelltown Koala population in April 2020.

The application for biodiversity certification was revised and updated in 2020, 2022 and 2023 to address the CSE's recommendations (in particular the proposed width of koala movement corridors - see section 8) and re-submitted in August 2020. It was subsequently publicly exhibited between December 2020 and February 2021 and following the exhibition and the submissions received, was further updated and re-submitted to CCC and the DPE in September 2022 and amended further in July 2023. It is expected that the application will be determined by the Minister in late 2023.

The application for Biodiversity Certification is consistent with the DPE structure Plan as outlined in the NSW Department of Planning & Environment's Greater Macarthur 2040 Interim Plan for the Greater Macarthur Growth Area and the December 2021 update. The interim plan outlines a 'Vision for Greater Macarthur' which includes Mount Gilead with Menangle Park as a 'Priority Precinct' due to proximity to the Campbelltown-Macarthur regional city and the relatively direct access to existing infrastructure. Additionally, actions for facilitating growth within this Priority Precinct are detailed including upgrades to adjacent roads such as Appin Road and the Hume Highway (DP&E 2015, 2018).

3.1.2.2 Planning proposal for MGS2

Lendlease have prepared its Concept Masterplan (Figure 2) that addresses and is consistent with the Department of Planning's Structure Plan (DPE 2022 and Figure 2), the recommendations of the NSW CS&E regarding the Campbelltown Koala population and the recommendations from the draft and final CPCP, including proposed E2 Zoning for retained vegetation/wildlife corridors) and has incorporated all of the Koala corridors identified by the DPE's indicative Koala corridor map as they apply to the site (**Appendix K** and Figure 32). The Master plan meets all of these requirements and has proposed fully funded, registered on-site conservation areas (Biodiversity Stewardship Agreements) for proposed offset areas that will be actively managed from year 1 of development.

3.1.2.3 Consistency with objectives and outcomes of the Cumberland Plain Conservation Plan (CPCP) and EPBC Strategic Assessment

The Cumberland Plain Conservation Plan (CPCP) is a strategic conservation plan which aims to conserve native vegetation throughout western Sydney whilst still delivering housing, jobs and infrastructure.

Mt Gilead Stage 2 is being undertaken in parallel with the Greater Macarthur Growth Area land use study (DPE 2015) and the Cumberland Plain Assessment Report (CPAR) (Openlines 2020) being led by the Department of Planning, Industry and Environment (DPIE) and Cumberland Plain Conservation Plan 2020-2056 (DPIE 2022). However, Mt Gilead Stage 2 is not part of the Strategic Assessment and is not subject to the proposed land uses in the CPCP. The CPCP recognises that Mt Gilead Stage 2 is subject to an existing application for Biodiversity Certification.

The former DPE publicly exhibited the Greater Macarthur Land Release Strategy in 2015 (DPE 2015) and the Greater Macarthur 2040 Interim Plan for the Greater Macarthur Growth Area (GM2040) in November 2018 and the December 2021 update (DPIE 2020 and 2021). The GM2040 report included a Structure Plan incorporating the Menangle and Gilead Precinct showing urban capable land, indicative transport corridors, indicative Koala corridors and environmental conservation lands subject to the Cumberland Plain Conservation Plan (Figure 2).

The draft CPCP was publicly exhibited in 2020 and was now submitted to the NSW Environment Minister for determination as a Strategic Biodiversity Certification application under the NSW Biodiversity Conservation Act and to the Commonwealth DAWE for assessment under Part 10 of the EPBC Act. The CPCP was approved by the NSW Minister for the Environment in August 2022 (DPIE 2022), but the Commonwealth decision has not yet been made.

In November 2022, following the NSW approval of the CPCP, the DPE released a further update to the Greater Macarthur 2040 Interim Plan and Structure Plan, shown in Figure 2 (DPE 2022), informed by and incorporating the outcomes of the CPCP, including urban capable land, indicative transport corridors, proposed new National Parks (including the George's River Koala National Park), strategic conservation areas (including proposed conservation areas in Mt Gilead Stage 2), and 'avoided' land (being the retained Koala corridors identified by DPE).

The approved CPCP ensures that impacts to biodiversity vales are avoided and minimised where feasible and unavoidable impacts are offset through the CPCPs conservation program. The conservation program includes specific measure to protect Koalas in south-western Sydney through:-

- establishing the Georges River Koala Reserve, protecting a Primary Koala corridor – the Mt Gilead proposal contributes by protecting 26.89 ha of important koala habitat at Browns Bush in a Biodiversity Stewardship site
- securing additional areas of Koala habitat and using ecological restoration to improve connectivity of the habitat - – the Mt Gilead proposal permanently protects 151.18 ha of existing Koala habitat and will restore a further 53.90 ha of modified/degraded/cleared land providing a secure corridor between the Georges and Nepean River Primary corridors
- install Koala exclusion fencing between Koala habitat and the urban interface - – the Mt Gilead proposal includes over 25km of Koala exclusion fencing between the urban/road interface

- constructing Koala crossing to facilitate safe movement across infrastructure including Appin Rd – the amended Mt Gilead Stage 1 Koala Management Plan provides two Koala crossings near Noorumba Reserve and Beulah Biobank site.

3.1.2.4 Consistency with the Chief Scientist and Engineer Koala recommendations and Campbelltown City Council Koala Management Plan

Whilst not Government policy, the proposal has considered the recommendations of the NSW Chief Scientist & Engineers (CS&E) in regards to the protection of the Campbelltown Koala population and aligns with Campbelltown City Council (CCC) Koala Plan of Management.

The Gilead Koala Conservation Reserve is consistent with the recommendations of the NSW Office of the Chief Scientist and Engineer's recommendations for the Protection of the Campbelltown Koala population and the Department of Planning and Environment's 24 planning principles for the Greater Macarthur Growth Area (**Appendix I**), the Departments explanation of how average Koala corridor widths were determined (**Appendix J**) and it's strategic assessment and publication of indicative Koala corridors for the Macarthur Growth Area (**Appendix K** and Figure 32). It will be subject to a Gilead Koala Conservation Plan including on-going management and mitigation of threats, community education and involvement and ongoing monitoring. The proposed BSA sites and retained open space, not including the retained rural land around the Gilead Homestead, will form an approximately 300 ha fully fenced, dog and vehicle prohibited, Gilead Koala Conservation Reserve.

3.1.2.5 Mt Gilead Koala Conservation Plan

The proponent has prepared a Gilead Koala Conservation Plan (**Appendix L** - Lendlease 2022) to serve as a comprehensive conservation management framework to guide the design, planning, construction, habitation, monitoring and adaptive management of Koalas in the study area, as well as an EPBC Act Koala Management Plan (**Appendix M** -ELA 2023c) to address the avoidance and mitigation of impacts during development as an Appendix to the Construction Environmental Management Plan (**Appendix N** – ELA 2023b).

3.1.2.6 Consideration of Cumulative impacts in the Greater Macarthur Area

The Greater Macarthur 2040 Interim Plan for the Greater Macarthur Growth Area (DPIE 2018), and the various updates (DPIE 2021, DPE2022) set out the proposed Strategic Planning framework for the Greater Macarthur Area and have wholistically, at a regional scale, assessed, via the Strategic Assessment (Openlines 2020), the cumulative impacts of further urban development in the region (and its associated infrastructure needs, including major transport corridors), and developed a regional conservation plan / offset strategy for unavoidable impacts (the CPCP – DPE 2022). Whilst not part of the CPCP, the Mt Gilead Stage 2 proposal has been developed consistent with the outcomes of the Strategic Assessment and CPCP, and the subsequently updated Greater Macarthur Structure Plan (DPE 2022), however, fully meets all of its offset requirements 'within the action area' (see Section 9 of this Report). These offset areas are proposed to be submitted for registration within 12 months of project approval but on-ground conservation works will commence within 30 days of project approval with the fencing of conservation areas to remove grazing stock, weed control and tree planting.

3.2 Public consultation

The DPE publicly exhibited the Greater Macarthur Land Release Strategy in 2015 (DPE 2015) and the Greater Macarthur 2040 Interim Plan for the Greater Macarthur Growth Area (GM2040) in November 2018. The GM2040 report included a Structure Plan incorporating the Menangle and Gilead Precinct showing urban capable land, indicative transport corridors, indicative Koala corridors and environmental conservation lands subject to the Cumberland Plain Conservation Plan (CPCP).

Lendlease have prepared a Concept Masterplan (Figure 2) that addresses the Structure Plan, notes the recommendations from the CPCP including proposed E2 Zoning for retained vegetation/wildlife corridors and have made submissions to DPE regarding the rezoning of the land.

The Biodiversity Certification Assessment commenced in 2015 with detailed ecological studies throughout 2015, 2016, 2017 and 2020. The application was submitted to the Minister for the Environment in August 2019 by CCC and has now been revised and updated, as requested by the Minister, following the Chief Scientist and Engineers Independent Reports on the Protection of the Campbelltown Koala population in April 2020, February 2021 and May 2021, the release of the Cumberland Plain Assessment Report and draft Cumberland Plain Conservation Plan in August 2020 (DPIE 2020) and final Cumberland Plain Conservation Plan in August 2022 (DPE 2022). It was subsequently publicly exhibited between December 2020 and February 2021 and following the exhibition and the submissions received, was further updated and re-submitted to CCC and the DPE in September 2022 and amended further in July 2023 (ELA 2023a). It is expected that the application will be determined by the Minister in late 2023.

Once assessed for adequacy, this PD Report will also be publicly exhibited, any submissions received considered and a final application made to DAWE for approval.

4. Matters of National Environmental Significance

4.1 DAWE requirements

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance (MNES) requires approval from the Australian Government Minister of the Environment (the Minister). An assessment of MNES relevant to the proposed action was conducted prior to the referral of the proposed action using:

- literature review, including a search of DAWE's Protected Matters Search Tool (PMST)
- review of relevant databases including the NSW Atlas of Wildlife
- extensive biodiversity and ecological surveys of the action area conducted between 2013 and 2020 as outlined below in Table 3, Table 4 and Table 5.

From the information provided in the referral, DAWE considered that the following communities and species listed under the EPBC Act (MNES) are likely to be significantly affected by the proposed action:

- Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest – critically endangered
- Shale Sandstone Transition Forest – critically endangered
- *Pomaderris brunnea* (Rufous Pomaderris) - vulnerable
- *Phascolarctos cinereus* (Koala) – vulnerable (at time of Controlled Action decision)
- *Lathamus discolor* (Swift Parrot) – critically endangered
- *Pteropus poliocephalus* (Grey-headed Flying-fox) - vulnerable
- *Chalinolobus dwyeri* (Large-eared Pied Bat) – vulnerable.

In addition to the MNES listed above, DAWE considered the following species as having potential to be significantly affected and that further information was required on the likelihood of occurrence of these species and if present, or likely to be present, an assessment of relevant impacts against the significant impact criteria, proposed avoidance and mitigation measures and if relevant, proposed offset measures:

Flora:

- *Syzygium paniculatum* (Magenta Lilly Pilly) – Vulnerable.

Fauna:

- *Dasyurus maculatus* (Spot-tailed Quoll) – Endangered
- *Hoplocephalus bungaroides* (Broad-headed Snake) – Vulnerable
- *Litoria littlejohni* (Littlejohn's Tree Frog) – Endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petauroides volans* (Greater Glider) – Endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
- *Petrogale penicillata* (Brush-tailed Rock-wallaby) – Vulnerable
- *Pseudomys novaehollandiae* (New Holland Mouse) – Vulnerable
- *Synemon plana* (Golden Sun Moth) – Vulnerable.

4.2 Protected Matters Search Tool

A search of the EPBC Act Protected Matters Search Tool (PMST) and NSW BioNet database was undertaken on 3 February 2023 and returned ten (10) listed threatened ecological communities, 59 listed threatened species and 14 migratory birds as potentially occurring within 5 km of the proposed action area. These MNES are listed in Appendix E along with the likelihood of occurrence based on targeted field surveys and habitat present on the site (Appendix O). There is no marine habitat on site, so marine species have been excluded from these lists. Figure 7 and Figure 8 show the general location of these records within a 10 km radius of the action area.

A number of MNES that have been recorded in the locality and occur in CPW and SSTF vegetation types (e.g. *Pimelea spicata*, *Pterostylis saxicola*, Giant Burrowing Frog, Green and Golden Bell Frog) have already been excluded from consideration in the PD report by ELA and DAWE (based on the results of extensive surveys over several years and seasons that did not record these species in the study area.

The additional species that were identified for further assessment by DAWE are not considered to have potential habitat within the action area or occur within the broader locality based on their documented habitat requirements and known distribution as detailed below or if considered 'potential to occur' were not recorded during extensive, targeted survey of the study area. It is therefore considered highly unlikely that they occur within the action area and accordingly no further assessment in this PD report is required.

These species are:

- *Syzygium paniculatum* (Magenta Lilly Pilly) – Vulnerable
  - Magenta Lilly Pilly occurs on sandy soil or stabilised dunes in coastal areas or in littoral rainforest on sandy soils. These habitat features are not present in the action area. Magenta Lilly Pilly was not recorded form the Grey Myrtle Dry Rainforest patches along Woodhouse Creek and the Nepean River in the study area, almost all of which is proposed to be protected in Biodiversity Stewardship sites
  - The records in the PMST search and NSW BioNet are from a proposed Biodiversity Stewardship site at Airds, north of the study area, in rainforest associated with the Georges River.
  - Magenta Lilly Pilly is also not listed as a species known to occur in Cumberland Plain Woodland or Shale Sandstone Transition Forest (DEWHA 2009, DotE 2014).
- *Hoplocephalus bungaroides* (Broad-headed Snake) – Vulnerable
  - This species is typically associated with exposed sandstone outcrops and benching in open woodland and heath on Triassic sandstone in the Sydney basin.
  - The development footprint in the action area is not located on Triassic or Permian sandstone. The development footprint is located on shale soils
  - There are no records for this species within 10 km of the action area. The records in the PMST are from extensive areas of Triassic and Permian sandstone in the Sydney water supply catchments and Dharawal and Heathcote National Parks to the east of the study area.
  - This species is not associated with the vegetation communities present in the action area.

- *Litoria littlejohni* (Littlejohn's Tree Frog) – Endangered species but listed as vulnerable at the time the Controlled Action decision was made and assessed as a vulnerable species in accordance with section 158A(1)(k) of the EPBC Act
    - Littlejohn's Treefrog inhabits coastal woodland and heath and relies on rocky streams, semi-permanent dams, temporary pools and hanging swamps.
    - The action area contains numerous creek lines including, first, second, third and fourth order streams some of which are ephemeral and some permanently flowing. The creek lines were in varying condition – some did not contain a defined bed, bank or channel and was dominated by exotic flora species. Some creek lines were in moderate to good condition with rocky substrate and native vegetation present
    - The action area also contains farm dams
    - Given the presence of creek lines and dams that may provide habitat for the Littlejohn's Tree Frog, survey was completed. This species was not identified in the action area during survey.
- *Petrogale penicillata* (Brush-tailed Rock-wallaby) – Vulnerable
    - The Brush-tailed Rock-wallaby is associated with rock ledges, caves and crevices in a variety of vegetation types.
    - The development footprint does not impact any potential habitat for this species in the form of rocky outcrops, complex structures with fissures or caves but which are common and widespread in the extensive water supply catchment areas and national parks to the east of the study area
    - There are no records for this species within a 10 km radius of the action area. Other than a 1996 record from Holsworthy (likely to be a data error), the most recent records in the broader locality is from the Cordeaux Dam catchment area (30km south of the study area),from the 1960's.
    - This species was not recorded during diurnal assessments, spot lighting surveys or from any remote cameras during survey
- *Pseudomys novaehollandiae* (New Holland Mouse) – Vulnerable
    - This species is known to occur in open heath, woodland with a heathy understorey and sand dunes which are not present in the action area (but are common and widespread in the extensive water supply catchment areas and national parks to the east of the study area).
    - The species has been recorded in the Holsworthy Defence area (north of the study area) in 2020 and in the Heathcote and Royal National Parks to the east.
    - This species is not known to occur in Cumberland Plain Woodland or Shale Sandstone Transition Forest
- *Synemon plana* (Golden Sun Moth) – Vulnerable
    - The Golden Sun Moth has been recorded in native grasslands and grassy woodlands containing wallaby grass (*Austrodanthonia spp.*), speargrass (*Austrostipa spp*. and *Bothriochloa*, as well as degraded grasslands dominated by the exotic Chilean needlegrass. It occurs in two communities listed under the EPBC Act – 'Natural Temperate Grasslands of the Southern Tablelands' and the 'Natural Temperate Grasslands of the Victorian Volcanic Plain' (DAWE 2021 Conservation Advice for *Synemon plana* (Golden Sun Moth), Canberra).

- The Golden Sun Moth is found in these grasslands from Bathurst to the Victorian-South Australia border (DAWE 2021).The distribution of this species is limited to Queanbeyan, Gunning, Young and Tumut (some 200km south of the study area).
- The approved conservation advice, whilst listing a number of grassy woodlands as habitat does not include CPW or SSTF (these communities being well outside the recorded range for this species.
- The study area is not shown on the Golden Sun Moth map which includes areas where the species is known to occur, likely to occur or may occur (DAWE 2021). It was not recorded during any field survey of the site, including assessments undertaken on warm sunny days in the months of October and November.

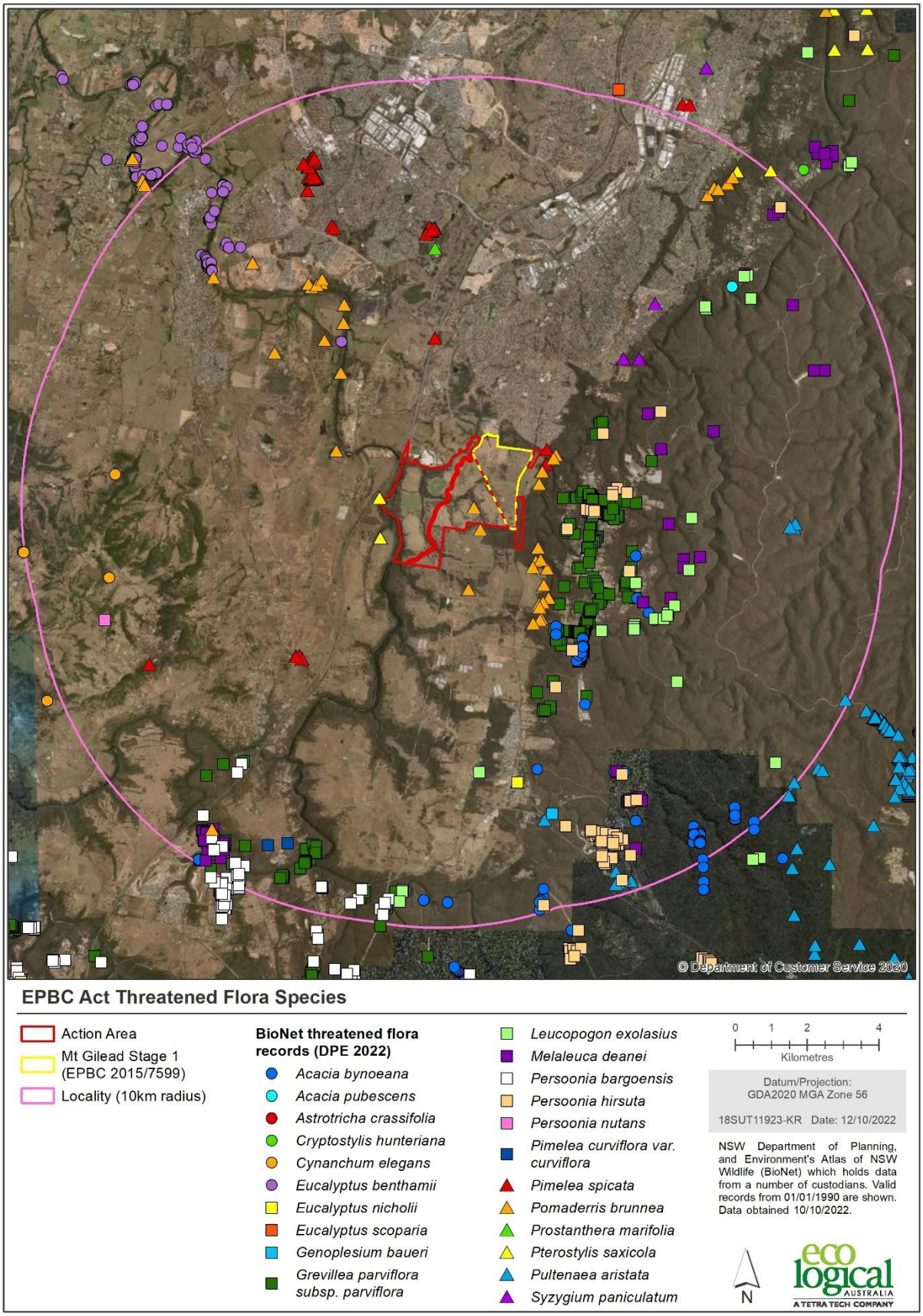


Figure 7: EPBC Act listed threatened flora species within a 10 km radius of the action area

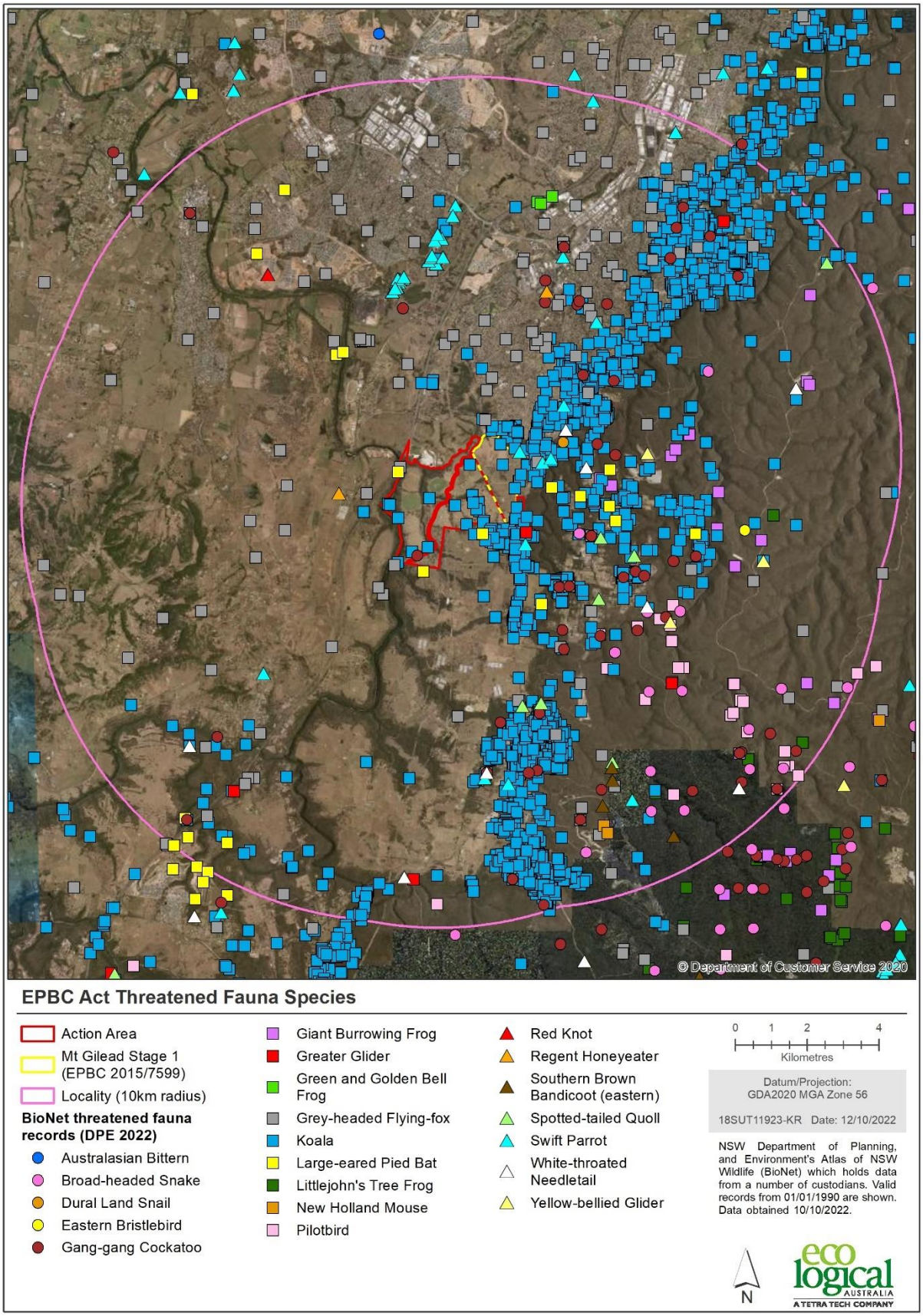


Figure 8: EPBC Act listed threatened fauna species within a 10 km radius of the action area

4.3 Field survey methodology

4.3.1 Threatened ecological communities

Field surveys were conducted by ELA across the action area between 2013-2017 and in 2020 to validate the presence, extent and condition of vegetation occurring within the action area (Figure 12, Figure 13, Figure 14 and Figure 15). In total over 800 survey hours and 92 full floristic 20 x 20 m plots were completed within the action area. The full floristic plots followed the BioBanking Assessment Methodology (BBAM (OEH 2014)) with the floristic information and cover abundance of species recorded used to justify the determination of vegetation communities based on published characteristic and diagnostic species. The BBAM is summarised as follows:

- preliminary mapping of the extent of vegetation within the site using digital aerial photography and available vegetation data and survey and historic data
- identify and map the plant community type (ecological community) through a quantitative analysis of survey data – i.e. field validate/refine the preliminary mapping
- stratify the site into vegetation zones including areas of low, moderate/good condition
- conduct further survey and plots in each vegetation zone for each ecological community
- measure various attributes within the plots, including percent foliage cover, native plant species richness, number of trees with hollows, total length of fallen logs
- plots of 0.04 ha (20m x 20m) for species richness
- plots and transects are stratified randomly within a vegetation zone, accounting for the level of variation in broad condition of the vegetation zone
- a minimum number of plots must occur in line with BBAM, for example, a vegetation zone of 0-4 ha must have 1 plot per 2 ha.

The survey techniques used in the action area (based on the BBAM) are consistent with the EPBC Act survey guidelines and requirements which recommends:

- developing a simple map of the vegetation, landscape qualities and management history of the site
- thorough and representative samples for vegetation cover and species richness
- complete plots which provide a good representation of the species present across a whole patch of vegetation
- plots of 0.04 ha (quadrats of 20m x 20m).

The conservation listing advice for the critically endangered Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF) were followed to determine vegetation condition categories (Section 4.4). A 30 m TEC buffer was applied to all areas where a change in use of the land was proposed.

4.3.2 Threatened flora

Targeted flora surveys were undertaken in Summer (2006, 2015, 2016, 2017), Autumn (2006, 2015, 2016) and Spring (2015) (Table 4 and Figure 9). Traverses of the action area were undertaken, with survey effort focussing on remnant vegetation and patches of potential threatened flora habitat. Areas of the site that contained cleared land and have a long history of grazing, pasture improvement and/or cropping were not considered habitat and were not surveyed in detail. EPBC Act listed threatened flora species that were subject to target survey (as determined by a likelihood of presence assessment -

Appendix P) and the recommended survey period based on documented (NSW PlantNet) flowering times are provided in Table 3**.**

4.3.3 Threatened fauna

Threatened fauna survey was conducted across the action area from December 2016 to June 2020 by ELA, November 2017 by Biolink targeting Koala (Biolink 2018) and by Wild Conservation targeting koala with infra-red thermal drone cameras in June/July 2021 and 2022 (**Appendix Q** and **R**).

Fauna survey techniques included a combination of remote cameras, hair tubes, nest boxes/hanging baskets, spotlighting, call playback and active searches. The survey techniques, habitat types, target species and survey effort for fauna surveys are outlined in Table 5 and Table 6.

EPBC Act listed threatened fauna species that were subject to target survey (as determined by a likelihood of presence assessment –**Appendix P**) were:

- Mammals - Koala, Grey-headed Flying-fox, Large-eared Pied Bat, Spot-tailed Quoll, Greater Glider
- Amphibians - Green and Golden Bell Frog, Littlejohn's Tree Frog, Giant Burrowing Frog
- Birds - Painted Honeyeater, Swift Parrot, Regent Honeyeater
- Migratory birds – White Throated Needletail, Black-faced Monarch, Satin Flycatcher, Rufous Fantail.

A summary of the threatened fauna survey effort is provided in Table 5 and is shown in Figure 8.

Table 3: Months in which targeted flora surveys were conducted for species considered 'likely' or 'potential' to occur

Refer to likelihood tables at Appendix G and months where the species can be surveyed (Source NSW Threatened Species Profile database).

Months when targeted surveys for threatened flora were undertaken are highlighted in yellow (and shown in Figure 9).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia bynoeana	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
Acacia pubescens	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Cynanchum elegans	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Eucalyptus benthamii	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Grevillea parviflora subsp. *parviflora*	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Isotoma fluviatilis subsp. *fluviatilis*	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	No
Persoonia bargoensis	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	Yes
Pimelea curviflora var. *curviflora*	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**
Pimelea spicata	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Pomaderris brunnea	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Pterostylis saxicola	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	No
Syzygium paniculatum	No	No	No	Yes	Yes	Yes	No	No	No	No	**Yes**	**Yes**
Thesium australe	**Yes**	**Yes**	No	No	No	No	No	No	No	No	**Yes**	**Yes**

Table 4: Flora survey across the action area

Survey date	Survey methodology / target	Survey area	Survey effort	Reference
16 and 28 February & 1 and 6 March 2006	Random meanders & opportunistic observations	Mt Gilead Property (Stage 1 and 2)	56 person hours (Steve Ward, Bruce Mullins)	ELA (2006) Mt Gilead Preliminary Flora and Fauna Assessment
25 and 26 March, 4 April, 27 June & 20 September 2013	Floristic plots and targeted threatened fauna survey	Mt Gilead MDP Lands (Stage 1 area)	80 person hours Bruce Mullins, Belinda Failes	ELA (2014) Mt Gilead Rezoning Assessment
9-10 April 2015	Floristic plots	Mt Gilead MDP Lands (Stage 1 area)	32 person hours, BCAA Enhua Lee and Mitch Palmer	ELA (2015) Macarthur-Onslow and Noorumba-Mt Gilead Biobank Assessments
28 January & 3, 4 and 9 February 2015	Floristic plots & opportunistic observations	Mt Gilead MDP Lands (Stage 1 area)	110 person hours Bruce Mullins, Brian Towle, John Gollan and Rebecca Dwyer	ELA (2015) Mount Gilead Balance lands due diligence
29 September 2015	Targeted threatened flora surveys	Mt Gilead Stage 2 area	16 person hours (Brian Towle, Tammy Paartalu)	ELA (2020) Mt Gilead Stage 2 Biocertification Assessment
1 and 21 October 2015	Targeted threatened flora surveys	Mt Gilead Stage 2 area	32 person hours (Brian Towle, Tammy Paartalu)	ELA (2020) Mt Gilead Stage 2 Biocertification Assessment
February 2016	Vegetation community validation, targeted threatened species surveys	Illawarra Coal and properties immediately north of BCAA.	48 person hours Greg Steenbeeke and Suzanne Eacott	ELA (2020) Mt Gilead Stage 2 Biocertification Assessment
15 March 2016	Targeted threatened flora surveys	Mt Gilead Stage 2 area	12 person hours (Brian Towle, Tammy Paartalu)	ELA (2020) Mt Gilead Stage 2 Biocertification Assessment
29 August 2016	Floristic plots	Mt Gilead Stage 2 area	8 hours Bruce Mullins	ELA (2018) Mt Gilead Biocertification Assessment
9, 10, 12, 16, 18, 19, 20, 23 & 25 January 2017	Floristic Plots and random meanders	Balance Lands	288 hrs Brian Towle, Liz Norris, Suzanne Eacott, Alex Gorey	ELA (2020) Mt Gilead Stage 2 Biocertification Assessment
May-July 2020	32 Floristic Plots and random meanders	Lands subject to Conservation Measures (Biodiversity Stewardship sites)	128 person hours Bronwyn Callaghan, Katy Wilkins, Alex Gorey, Griffin Taylor-Dalton, Michelle Frolich, Robert Humphries	Mt Gilead Stage 2 Biobank Assessments (ELA 2020a-d)

Table 5: EPBC fauna species subject to targeted survey (and method)

Previous studies	Survey area	Effort	Results
ELA (2006)	Mt Gilead property (810 ha).	Four-day survey on 16th and 28th February 2006 and the 1st and 6th March 2006 (total of 56 person hours). Fauna habitat features were recorded opportunistically. Targeted Koala searches were undertaken at six sites.	No threatened fauna species were recorded, but key habitat features were present which could support a range of common and threatened fauna species. Potential Koala habitat as defined by the State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) was recorded
ELA (2014)	Mt Gilead Stage 1 (210 ha). Rezoning Assessment	Five-day survey on 25th and 26th March, 4th April, 27th June, and 20th September 2013. Birds were surveyed over 20-30 minute intervals at four sites over four mornings, depending on whether one or two observers were present. Microbat surveys were undertaken using two ultrasonic Anabat detectors at three sites (one Anabat at two sites and one Anabat at one site) targeting areas where bats are likely to be present over two consecutive nights over a period of 12 hours between 1800 hours and 0600 hours. Habitat features for fauna across the action area, such as hollow-bearing trees, rocks and rocky outcrops, water bodies, were opportunistically recorded. As some features were assessed to be unsuitable for the frog target species (*Heleioporus australiacus* (Giant Burrowing Frog) and *Litoria aurea* (Green and Golden Bell Frog)), targeted survey for these were not undertaken. Riparian and aquatic habitat assessments included mapping the top of bank using a differential GPS, classifying the condition and recovery potential of steam reaches, categorising each stream using the Strahler method, and identifying heavily degraded streams or areas of overland flow that do not meet the definition of 'river' and are suitable for removal. Assessments were undertaken over one and a half days.	No EPBC Act listed bat species were detected. Seven BC Act listed species (six bats and one bird) were recorded: Eastern Bentwing Bat, East-coast Freetail Bat, Eastern False Pipistrelle, Yellow-bellied Sheathtail Bat, Southern Myotis, Greater Broad-nosed Bat, and Little Lorikeet. One migratory species was recorded: Cattle Egret. There was potential for Koala to be present, but a low likelihood for Cumberland Plain Land Snail to be present. The overall rating of the riparian and aquatic condition varied from degraded to moderate.

Previous studies	Survey area	Effort	Results
ELA 2016	Mt Gilead Stage 1 (210 ha). Biocertification Assessment	48 diurnal person hrs, 30 November, 7 & 12 December 2016 24 nocturnal person hours Assessment for presence of *Litoria aurea* (Green and Golden Bell Frog), *Heleioporus australiacus* (Giant Burrowing Frog) and *Litoria littlejohni* (Littlejohn's Tree Frog) habitat.	No threatened frogs recorded.
ELA 2015-2018	Mt Gilead Stage 2	General / non-specific fauna surveys, searches and / or habitat assessments for threatened invertebrate, birds, reptiles and mammal General visual searches and surveys for specific threatened species habitats (hollow-bearing trees, koala feed trees, crevice, cracks and caves in rock formations, termite mounds). 133 person hours. Searches for direct evidence of the presence or site occupancy of a threatened species (including direct sighting, listening for calls or observations of carcasses). Searches for indirect evidence of the presence or site occupancy of fauna species (tracks, scats and other signs of fauna including foraging digs made by bandicoots and scratches on trees made by Koalas. General / various sized terrestrial mammals, bird or reptile species. Remote movement sensing camera trap stations were baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines. -1085 remote camera survey nights Small sized hair-tubes (opening of tube is 50 mm in diameter) baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines targeting small sized mammal species (0.01 to 0.150 kg in average body mass) – 3,575 hair tube nights Large sized hair-tubes (opening of tube is 150 mm in diameter) baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines targeting medium to large sized mammal species (0.150 to 10 kg in average body mass – 3,510 hair tube nights	Koala recorded. , One threatened microbat recorded; *Chalinolobus dwyeri* (Large-eared Pied Bat). Green and Golden Bell Frog, Littlejohn's Tree Frog and Giant Burrowing frog not recorded

Previous studies	Survey area	Effort	Results
		Nest boxes and hanging basket style nest boxes that have been designed to accommodate Eastern Pygmy Possums (opening into nest box >30 mm in diameter) – 14 nest boxes for 910 survey nights Microchiropteran Bats - 50 anabat nights Anabat ultra-sonic microbat call recorders Various nocturnal mammals and birds Spotlighting and nocturnal searches. Spotlighting was undertaken from moving vehicle and on-foot Green and Golden Bell Frog surveys – 14 person hours Random dip netting and visual surveys using polarised sunglasses for tadpoles Call playback and active searches during optimal climatic conditions (following at least 50mm of rain, warm stormy nights with a forecast for further rain to occur Giant Burrowing Frog Surveys – 60 person hours Nocturnal call play back and active searches on foot along 5 km of waterway. Surveys consisted of moving through creek lines and paddock run off areas. Areas of slow flowing water or large pools were targeted during these surveys Surveys were conducted during optimal climatic conditions (following at least 50mm of rain, warm stormy nights with a forecast for further rain to occur	
RMS 2018	Appin Rd between Noorumba and Beulah	Spotlighting (2 nights x 2 people x 2 hours) Call playback (2 nights x 2 people x 2 hours) Diurnal bird survey (10, 20 minute surveys, 16 hours opportunistic observations) Koala SAT assessments (2 SAT assessments)	The following EPBC Act threatened species were recorded in the action area:- Koala Cattle Egret (EPBC Act migratory species)

Previous studies	Survey area	Effort	Results
Biolink 2018	Mt Gilead Menangle Creek, Woodhouse and Mallaty Creek corridors	21-23 November 2017, 25 Koala SAT sampling sites	Koala, or evidence of Koala, recorded at 12 of 25 sampling locations across Mt Gilead property
ELA 2020	Mt Gilead Stage 2 Stewardship Agreement sites	Remote movement sensing camera trap stations were baited with universal bait (consisting of rolled oats, honey, peanut butter) – 23 cameras for 42 nights - 966 trap nights Spotlighting (3 nights x 4 people x 2 hours)	The following EPBC Act threatened species were recorded during surveys: Koala and Greater Glider
Wild Conservation 2021 (**Appendix Q**)	Mt Gilead Stage 2	12 nights of infra-red thermal drone surveys between 27 June and 15 July 2021 covering 770 ha	19 Koala detected across study area (18 in existing or proposed conservation areas and 1 in proposed development areas)
Wild Conservation 2022 (**Appendix R)**	Mt Gilead Stage 2	12 nights of infra-red thermal drone surveys between 26 June and 26 July 2021 covering 770 ha	25 Koala detected across study area (10 in existing conservation areas, three in proposed conservation areas, 10 to the east of the study area in the prosed Georges River National Park, and 1 in the proposed development area)

Table 6: Summary of survey techniques and survey effort for fauna surveys

Target species or guilds	Survey method	General habitat type	Total survey effort*	Consistency with EPBC Act survey guidelines
General / non-specific fauna surveys, searches and / or habitat assessments for threatened invertebrate, birds, reptiles and mammal	General visual searches and surveys for specific threatened species habitats (hollow-bearing trees, koala feed trees, crevice, cracks and caves in rock formations, termite mounds).	Pasture with scattered paddock trees or open and disturbed woodland habitats	75 person hours.	N/A
	Searches for direct evidence of the presence or site occupancy of a threatened species (including direct sighting, listening for calls or observations of carcasses).	Woodland habitat	30 person hours.	
	Searches for indirect evidence of the presence or site occupancy of fauna species (tracks, scats and other signs of fauna including foraging digs made by bandicoots and scratches on trees made by Koalas).	Riparian, sandstone creek-line with woodlands and / or rainforest habitats	28 person hours.	
General / various sized terrestrial mammals, bird or reptile species	Remote movement sensing camera trap stations were baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines.	Pasture with scattered paddock trees or in open and disturbed woodland habitats	Total of 697 survey nights at fourteen (14) locations.	**Yes.** Spot-tailed Quoll: Daytime searches for den sites and signs of activity, remote cameras and hair tubes Koala: Spotlighting, call playback, remote cameras, SAT technique Greater Glider: There are no survey guidelines for the Greater
		Pasture with scattered trees near to or at farm dam habitats	Total of 66 remote camera survey nights.	
		Riparian, sandstone creek-line with woodlands and / or rainforest habitats	Total of 322 survey nights at five (5) locations. Additional 23 cameras for 42 nights - 966 trap nights in May-July 2020	
	Small sized hair-tubes (opening of tube is 50 mm in diameter) baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines targeting small sized	Pasture with scattered trees near to or at farm dam habitats	43 hair-tubes set for 65 consecutive days. Total survey effort of 2,795 hair-tube survey nights.	

Target species or guilds	Survey method	General habitat type	Total survey effort*	Consistency with EPBC Act survey guidelines
	mammal species (0.01 to 0.150 kg in average body mass).	Sandstone creek-line, riparian vegetation or within woodlands, Swamp She-oak Forest and / or rainforest habitats	12 hair-tubes set for 65 consecutive days. Total survey effort of 780 survey nights.	Glider, however survey methods suitable for nocturnal gliders were used
	Large sized hair-tubes (opening of tube is 150 mm in diameter) baited with universal bait (consisting of rolled oats, honey, peanut butter) and sardines targeting medium to large sized mammal species (0.150 to 10 kg in average body mass).	Pasture with scattered trees near to or at farm dam habitats	42 hair-tubes set for 65 consecutive days. Total survey effort of 2,665 hair-tube survey nights.	
		Sandstone creek-line, riparian vegetation or within woodlands, Swamp She-oak Forest and / or rainforest habitats	13 hair-tubes set for 65 consecutive days. Total survey effort of 845 survey nights.	
	Nest boxes and hanging basket style nest boxes that have been designed to accommodate Eastern Pygmy Possums (opening into nest box >30 mm in diameter).	Pasture with scattered trees near to or at farm dam habitats	8 nest boxes/hanging baskets for 65 consecutive nights. Total survey effort of 520 survey nights.	
		Sandstone creek-line, riparian vegetation or within woodlands, Swamp She-oak Forest and / or rainforest habitats	6 nest boxes/hanging baskets for 65 consecutive nights. Total survey effort of 390 survey nights.	
Microchiropteran bats including targeted surveys for *Chalinolobus dwyeri* (Large-eared Pied Bat),	Anabat ultra-sonic microbat call recorders.	Pasture with scattered paddock trees or open and disturbed woodland habitats	27 anabat recording nights	**Yes.** Echolocation surveys from October to March. Harp trapping optional
		Sandstone creek-line with woodlands and rainforest habitats	8 anabat recording nights	

Target species or guilds	Survey method	General habitat type	Total survey effort*	Consistency with EPBC Act survey guidelines
		Pasture with scattered trees and farm dam habitats	15 survey nights and in addition a further 15 hours (over three separate survey nights) were conducted using a hand held whilst conducting other surveys at a farm dam	
Various nocturnal mammals and birds	Spotlighting and nocturnal searches. Spotlighting was undertaken from moving vehicle and on-foot.	All broad habitat types	4 survey nights Additional spotlight surveys were not undertaken after it had been determined that the target nocturnal species, (Grey-headed Flying-fox, Koalas and Squirrel Glider) were present within the BCAA Additional Spotlighting targeting Greater Glider was undertaken in June/July 2020 (3 nights x 4 people x 2 hours)	Consistency with EPBC Act guidelines described above
Targeted *Litoria aurea* (Green and Golden Bell Frog (GGBF)) surveys	Random dip netting and visual surveys using polarised sunglasses for tadpoles.	GGBF survey were conducted at one farm dam and associated creek line only.	4 person hours.	**Yes.** Conducted between Sept – March, within 1 week of >50mm of rain using call detection and spotlighting. Minimum of 4 nights Dip netting for larvae (DEWHA 2010b)
	Call play back and active searches during optimal climatic conditions (following at least 50mm of rain, warm stormy nights with a forecast for further rain to occur.		10 hours over three survey nights.	

Target species or guilds	Survey method	General habitat type	Total survey effort*	Consistency with EPBC Act survey guidelines
	Random dip netting and visual surveys using polarised sunglasses for tadpoles. Surveys were conducting while moving through sandstone dominated creek lines on foot. Dip netting was conducted in any large pools that were encountered.		28 person hours of daytime searching within sandstone creek lines.	No specific survey guidelines. General survey guidelines recommend targeted searches in suitable habitat and call play back
Targeted surveys for Giant Burrowing Frog and Little John's Tree Frog	Nocturnal call play back and active searches on foot. Surveys consisted of moving through creek lines and paddock run off areas. Areas of slow flowing water or large pools were targeted during these surveys Surveys were conducted during optimal climatic conditions (following at least 50mm of rain, warm stormy nights with a forecast for further rain to occur.	Riparian, sandstone creek-lines / gorge habitats with woodlands and / or rainforest habitats	32 survey hours.	

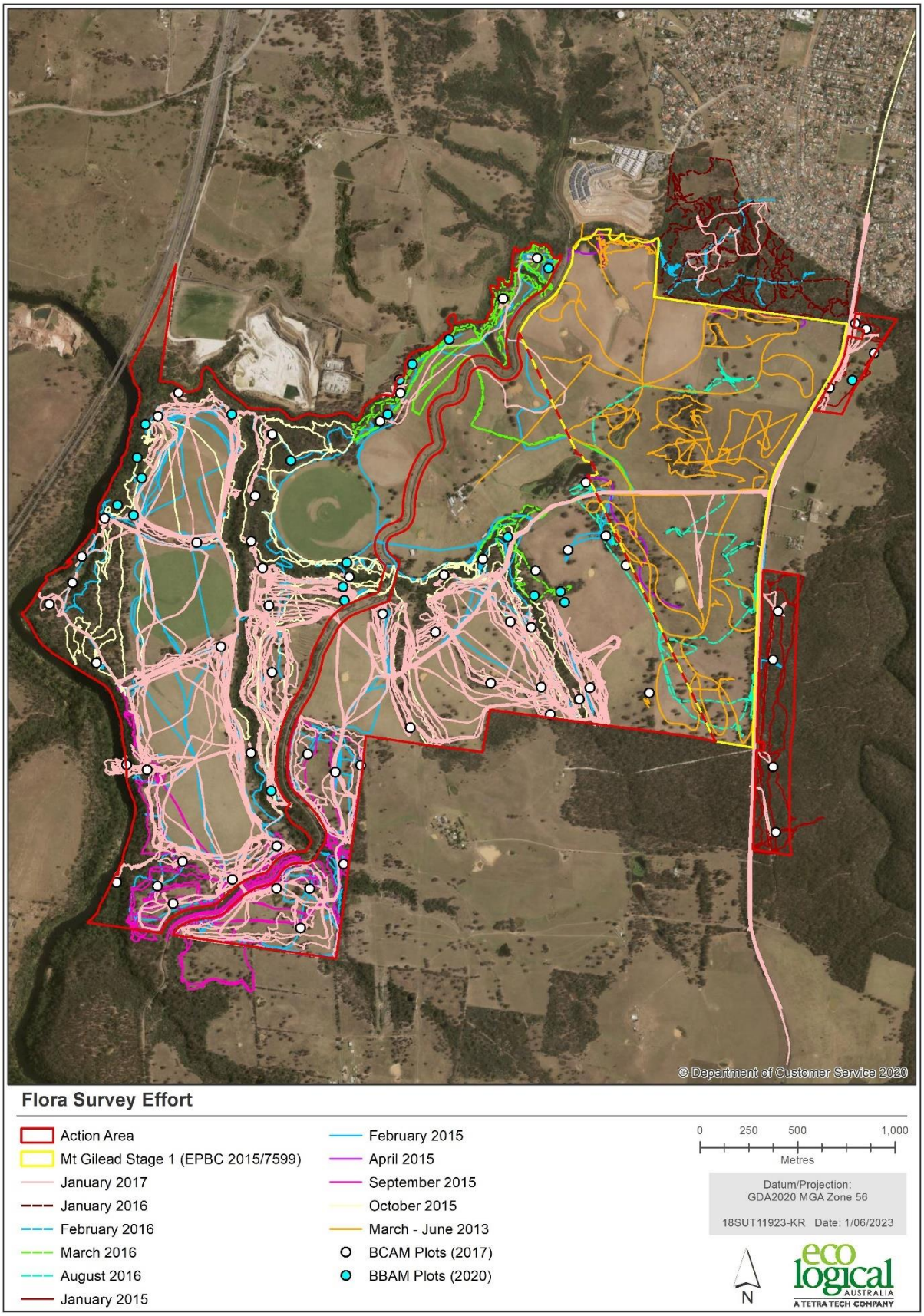


Figure 9: Survey effort for EPBC Act listed threatened flora species across the action area

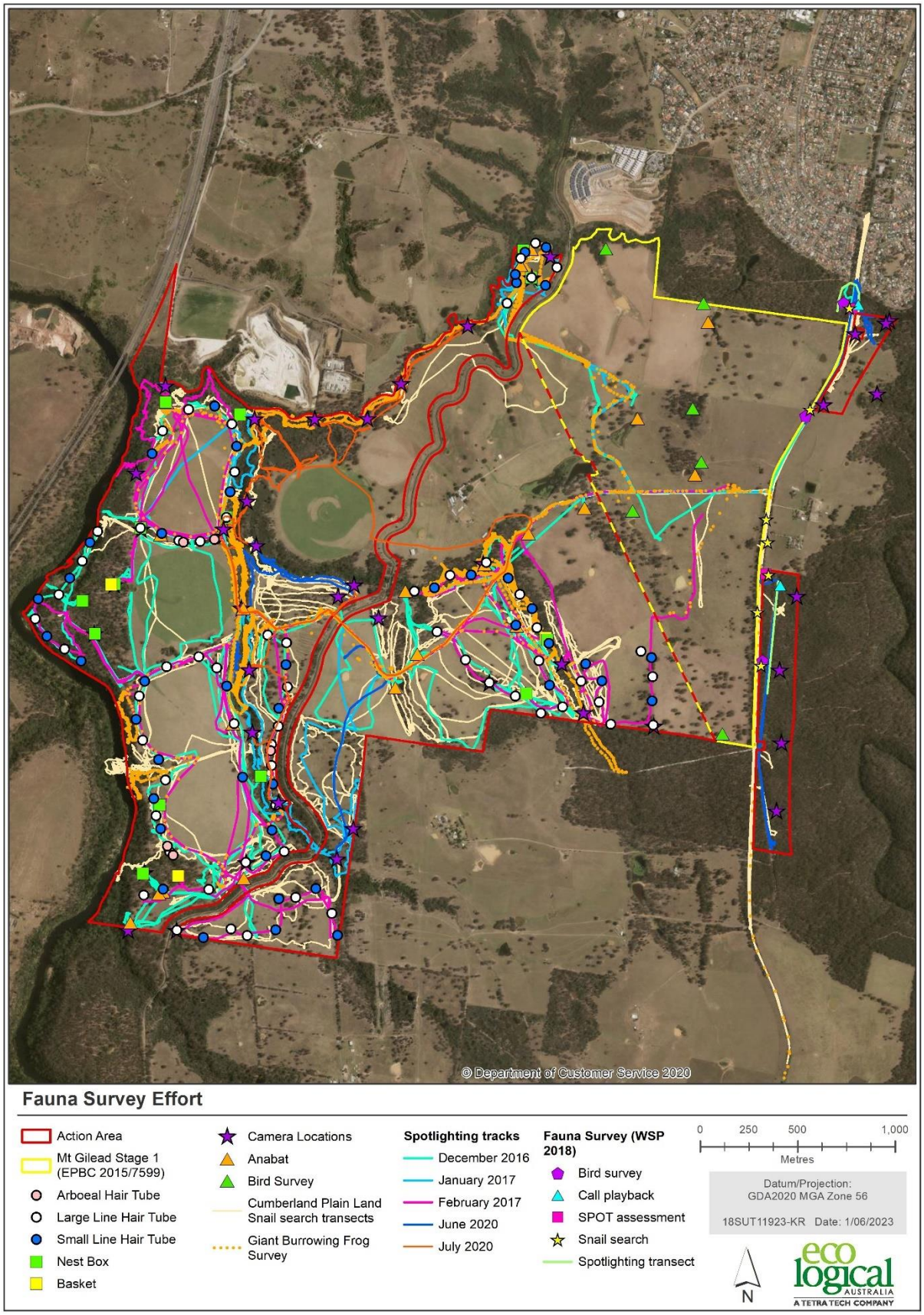


Figure 10: Survey effort for EPBC Act listed threatened fauna species in the action area

Figure 1. Map of the drone flight paths as plotted on Google Earth.

Figure 11: 2021 and 2022 Koala drone surveys (June to July 2021 and 2022 - Source Figure 1 in Wild Conservation 2021 and 2022)

4.4 Vegetation communities

Field survey validated the presence of two EPBC Act listed vegetation communities in the action area:

- Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest (Equivalent to the NSW vegetation types HN528 Grey Box – Forest red Gum grassy woodland on flats and HN529 Grey Box – Forest red Gum grassy woodland on hills)
- Shale Sandstone Transition Forest (Equivalent to the NSW vegetation type HN556 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest on the edges of the Cumberland Plain).

Whilst it was not listed at the time the controlled action decision was made, field survey also identified the presence of *River-flat Eucalypt Forest on coastal floodplains of southern New South Wales and eastern Victoria* (River-flat Eucalypt Forest) Equivalent to the NSW vegetation type HN526 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain). Some patches of the community met the EPBC Act definition of River-flat Eucalypt Forest. The referral decision was made on 24 February 2020 and River-flat Eucalypt Forest was gazetted as a critically endangered ecological community on 15 December 2020. In accordance with section 158(1)(j) of the EPBC Act, this PD Report does not need to consider this community. The remainder of the action area is comprised of:

- Grey Myrtle Dry Rainforest (not an EPBC Act listed community)
- Cleared land.

It is noted that the 'Grey Myrtle Dry Rainforest' can form part of 'Western Sydney Dry Rainforest and Moist Woodland on Shale' (which is listed as a critically endangered ecological community under the EPBC Act). The Grey Myrtle Dry Rainforest occurring in the action area was not identified as forming part of the EPBC Act listed community due to geology and soil types present across the action area.

The areas of Grey Myrtle Dry Rainforest (GMDR) within the action area were restricted to deeply incised drainage lines where underlying Hawkesbury Sandstone bedrock was exposed which formed the parent material for the sandy soils present within areas of this vegetation type. The Western Sydney Dry Rainforest and Moist Woodland on Shale community occurs on clay soils derived from Wianamatta Shale. Additionally, the dominance of *Backhousia myrtifolia* (Grey Myrtle) in the community within the action area is distinct from the Western Sydney Dry Rainforest and Moist Woodland on Shale community which does not commonly include this species.

Table 7: Areas of vegetation communities in the study area

EPBC vegetation type	Equivalent NSW Vegetation type	Total area (ha)	EPBC Act condition (ha)
Cumberland Plain Woodland	HN528 & HN529	32.88	28.78
Shale Sandstone Transition Forest	HN556	185.33	173.91
River-flat Eucalypt Forest	HN526	28.65	24.45
Grey Myrtle Dry Rainforest	HN538	8.34	N/A
Cleared land		385.58	N/A
Total		**644.27**	**227.15**

4.4.1 Shale Sandstone Transition Forest

Field survey identified Shale Sandstone Transition Forest (SSTF) as the dominant vegetation community in the study area. SSTF that met the EPBC Act definition of the community was mainly present along the riparian corridors in the action area, namely Nepean River, Nepean Creek, Woodhouse Creek and a number of unnamed tributaries. SSTF in a highly modified form was also the dominant vegetation community in areas adjacent to the riparian corridors.

4.4.1.1 Justification for EPBC Act listed SSTF

EPBC Act condition patches of the community were mapped according to the description in the Conservation Advice for SSTF (Table 8). The biometric plot data and vegetation mapping was used to determine the size of each patch. The biometric plot data was used to determine the condition of each patch, specifically:

- size of the patch (including proximity to another patch)
- percentage of native groundcover species present (determined by plot data)
- contiguity with another patch (as per the EPBC Act definition of contiguity)
- presence of trees with hollows, or large trees above the large tree benchmark (determined by plot data).

These variables were used to assign each patch to an EPBC Condition Category and to be consistent, as far as practical, with the Biocertification Assessment Report that breaks the vegetation down into 19 condition zones as discussed with the then DAWE (**Appendix S**).

4.4.1.2 Description of conditions present in the action area

SSTF was present in three EPBC condition categories: condition A, condition B and condition D. Condition A was present along portions of Nepean Creek, adjacent to Woodhouse Creek and scattered in some area in the southern portion of the action area (Figure 15).

SSTF in condition A had an over-storey dominated by *Eucalyptus tereticornis*, *E. crebra* and *Corymbia maculata*. The shrub layer was largely absent, however, the under-storey was comprised of a mixture of native and introduced grasses, sedges, herbs and scramblers comprising > 30% of the groundcover thus meeting the EPBC Act condition threshold of Category A for groundcover for SSTF. The patches were also >0.5 ha and were contiguous with remnant native vegetation >1 ha in size (Table 9).

SSTF in condition B was present in two small patches in the north west portion of the action area adjacent to the Nepean River and Nepean Creek (Figure 15). The canopy in these patches was sparse and consisted of *Eucalyptus eugenioides* (Narrow-leaved Stringybark). The midstorey was diverse and contained *Kunzea ambigua* (Tick Bush), *Acacia decurrens* (Black Wattle) and *Grevillea mucronulata*.

SSTF in condition D was the dominant condition of SSTF in the action area (Figure 15). Condition D was present along the riparian corridors and in Lot 1 DP 603675. The canopy consisted of *Eucalyptus punctata* (Grey Gum), *Eucalyptus pilularis* (Blackbutt), *Angophora bakeri* (Narrow-leaved Apple) and *Eucalyptus crebra* (Narrow-leaved Ironbark). The midstorey consisted of *Persoonia linearis* (Narrow-leaved Geebung) and *Bursaria spinosa* (Native Blackthorn). The groundcover was diverse and contained *Lomandra multiflora*, *Aristida vagans, Hovea heterophylla, Billardiera scandens, Entolasia stricta* and *Leucopogon juniperinus*. Exotic species were largely absent, with some scattered patches of *Lantana camara* (Lantana), *Senecio madagascariensis* (Fireweed) and *Bidens pilosa* (Beggar's Ticks). These

patches were determined to meet condition D due to the patch size >2 ha and the groundcover comprised of >50% native species.

The remaining areas of SSTF in the action area did not meet the EPBC Act definition of the community due to patch size and low cover of native species in the groundcover layer.

Table 8: EPBC Act condition thresholds for SSTF

Category and rationale	Thresholds
A. Moderate condition class, represented by medium to large-size patch as part of a larger native vegetation remnant and/or with mature trees	Patch size >0.5ha AND >30% of the perennial understorey vegetation cover is made up of native species AND The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) >1ha in area AND / OR The patch has at least one tree with hollows or at least one large locally indigenous tree (>80cm dbh). Where patches are >1ha, a density of at least one mature tree/tree with hollows per hectare is required.
	OR
B. Moderate condition class represented by medium to large size patch with high quality native understorey	Patch size >0.5ha AND >50% of the perennial understorey vegetation cover is made up of native species
	OR
C. High condition class represented by medium to large size patch with very high quality native understorey	Patch size >0.5ha AND >70% of the perennial understorey vegetation cover is made up of native species
	OR
D. High condition class represented by large size patch with high quality native understorey	Patch size >2ha AND >50% of the perennial understorey vegetation cover is made up of native species
Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons. Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil. *Contiguous* means the patch of the ecological community is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.	

Table 9: SSTF to be affected, conserved and retained across the study area

EPBC Veg Zone	EPBC Condition Category	Total Area Development Site (ha)	APZ (impact ha)	Outer Buffer (total ha)	Inner Buffer (total ha)	Conservation Area (Excluding Buffers)	Total
9	SSTF Condition D	4.39	0.96	5.37	3.54	87.77	102.03
10	SSTF Condition B	3.32	0.15	1.15	0.74	6.04	11.40
11	SSTF Condition A	18.58	0.52	1.32	1.21	3.01	24.64
	Total	**26.29**	**1.63**	**7.84**	**5.49**	**96.82**	**138.07**
	Non EPBC Condition SSTF	7.14	0.00	0.55	0.41	1.80	9.90
	Restore to EPBC Condition SSTF			5.32	7.12	22.62	35.06

4.4.2 Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest

Field survey identified scattered patches of CPW scattered throughout the study area. This community was present in two conditions; Condition A and Condition C in the action area (Figure 14 and Figure 22).

4.4.2.1 Justification for EPBC Act listed Cumberland Plain Woodland

EPBC Act condition patches of the community were mapped according to the description in the Conservation Advice for CPW (Table 10, DEWHA 2009). The biometric plot data and vegetation mapping was used to determine the size of each patch. The biometric plot data was used to determine the condition of each patch, specifically:

- size of the patch (including proximity to another patch)
- percentage of native groundcover species present (determined by plot data)
- contiguity with another patch (as per the EPBC Act definition of contiguity)
- presence of trees with hollows, or large trees above the large tree benchmark (determined by plot data).

These variables were used to assign each patch to an EPBC Condition Category and to be consistent, as far as practical, with the Biocertification Assessment Report that breaks the vegetation down into 19 condition zones, as discussed with DAWE (**Appendix S**).

4.4.2.2 Description of conditions present in the action area

Condition A was present adjacent to the Sydney Water pipeline in the south and in the centre of the study area and along the northern boundary of the action area along Menangle Creek (Figure 15). CPW in condition A was also the dominant community in Lot 1 DP 622362 and Lot 2 DP 603674. Patches of the community in condition A were comprised of a canopy of *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). The midstorey was sparse and was comprised of *Bursaria spinosa*. The groundcover was comprised of a range of native grasses, forbs and sedges including *Dichondra repens* (Kidney Weed), *Cyperus gracilis, Rytidosperma* sp. and *Microlaena stipoides* var. *stipoides* (Weeping Grass). Patches were determined to meet condition A as the patch size was >0.5 ha and the groundcover was comprised of >50% native perennial cover (Table 11).

Patches of the community in condition C was limited to mostly the western portion of the action area (Figure 15. Patches of the community mapped as condition C contained a canopy of *Eucalyptus tereticornis, Eucalyptus moluccana, Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus fibrosa*. The midstorey was absent and the groundcover contained *Einadia hastata, Aristida* sp., *Alternanthera*

dentata and *Desmodium varians*. The groundcover also contained a moderate proportion of exotic species, including *Sida rhombifolia* (Paddy's Lucerne), *Tagetes minuta* (Stinking Roger) and *Bromus catharticus* (Prairie Grass). These patches were mapped as condition C because they were ≥ 0.5 ha in size, contained >30% native perennial understorey and were contiguous with a native vegetation remanent >5 ha in size.

The remaining areas of CPW in the action area did not meet the EPBC Act definition of the community due to patch size and low cover of native species in the groundcover layer.

Table 10: Condition thresholds for Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest

Category and Rationale	Thresholds
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch[1] size is ≥0.5ha; **AND** ≥50% of the perennial understorey vegetation cover[2] is made up of native species.
OR	
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥5ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species.
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥0.5 ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous[3] with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥5ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥0.5 ha in size; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; AND The patch has at least one tree with hollows per hectare or at least one large tree (≥80 cm dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.

[1] A *patch* is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

[2] Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do not alter functionality as per footnote 3 and the Description and Condition Thresholds are met).

3 Contiguous means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

Table 11: CPW to be affected, conserved and retained across the action area

EPBC Veg Zone	EPBC Condition Category	Total Area Development Site (ha)	APZ (impact ha)	Outer Buffer (total ha)	Inner Buffer (total ha)	Conservation Area (Excluding buffers)	Total
3	Condition A	0.91	0.00	0.21	0.09	10.27	11.48
4	Condition C	6.68	0.00	0.33	0.36	1.20	8.57
Total	**Total**	**7.59**	**0.00**	**0.54**	**0.45**	**11.47**	**20.05**
	Non EPBC Condition CPW	2.90	0.00	0.16	0.24	2.66	5.96
	Restore to EPBC Condition CPW			1.45	1.82	7.24	10.51

4.4.3 River-flat Eucalypt Forest on coastal floodplains of southern New South Wales and eastern Victoria

A long history of clearing, grazing, weed invasion and some gravel extraction /quarrying has fragmented and modified the River-flat Eucalypt Forest (RFEF) in the study area. EPBC Act condition patches of the community were mapped according to the descriptions in the Conservation Advice for RFEF (DAWE 2020) as summarised in Table 13. Table 12 provides a summary of the area and condition of RFEF across the study area.

However, as RFEF was not listed at the time of the controlled action decision, has not been assessed in this PD report (Refer to section 158A(1)(j) of the EPBC Act).

Table 12: RFEF to be affected, conserved and retained across the study area

EPBC Veg Zone	EPBC Condition Category	Total Area Development Site (ha)	APZ (impact ha)	Outer Buffer (total ha)	Inner Buffer (total ha)	Conservation Areas (Excl. buffers)	Total Area
1	Condition C	0.35	0.00	0.14	0.14	21.90	22.53
Total	Total	0.35	0.00	0.14	0.14	21.90	22.53
2	Non EPBC Condition RFEF	0.03	0.00	0.00	0.00	4.17	4.20

Table 13: Condition thresholds and patch categories of River-flat Eucalypt Forest

Biotic Threshold	Patch Size threshold		
	Large patch Patch size ≥2 ha	**Small contiguous patch** Patch size ≥ 0.5 ha within a larger area of native vegetation ≥ 5 ha	**Small patch** Patch size ≥0.5 ha
High condition ≥ 80% of its total perennial understorey vegetation cover1 is comprised of native species AND Ground cover richness2 ≥ 10 native species per sample plot AND ≥ 20 large trees3 per ha	CLASS A1 Large or contiguous patch in high condition		CLASS B1 Small patch in high condition
Good condition with arboreal mammals ≥ 50% of its total perennial understorey vegetation cover1 is comprised of native species AND Ground cover richness2 ≥ 6 native species per sample plot AND At least 10 large trees3 per ha AND Evidence of 4 or more species of arboreal mammals detected in the patch	CLASS A2 Large or contiguous patch in good condition with arboreal mammals		CLASS B2 Small patch in good condition with arboreal mammals
Good condition ≥ 50% of its total perennial understorey vegetation cover is comprised of native species AND Ground cover richness ≥ 6 native species per sample plot AND At least 10 large trees per ha	CLASS B3 Large or contiguous patch in good condition		CLASS C1 Small patch in good condition
Moderate condition ≥ 30% of its total perennial understorey vegetation cover1 is comprised of native species AND Ground cover richness ≥ 4 native species per sample plot2	CLASS C2 Large or contiguous patch in moderate condition		N/A

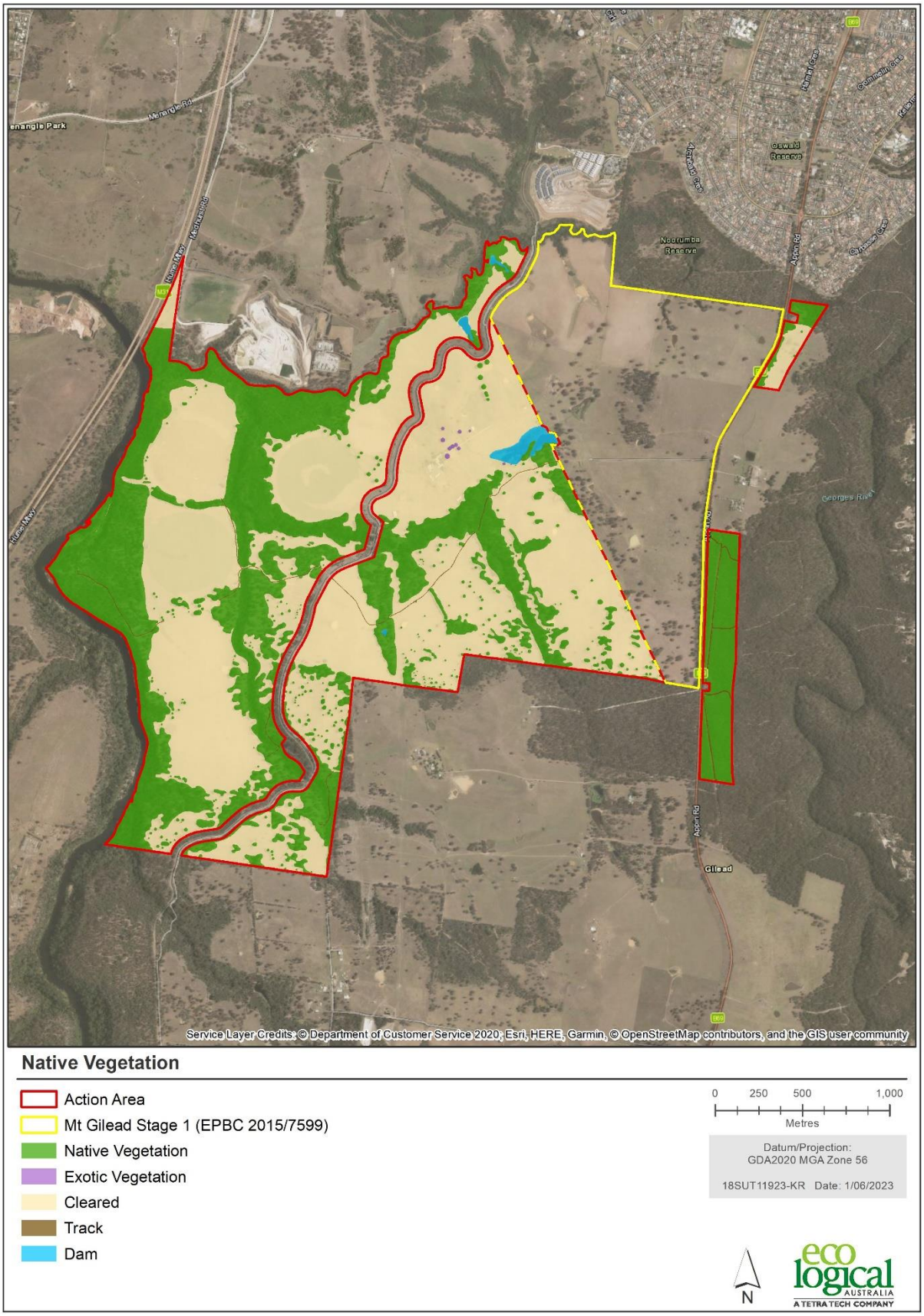


Figure 12: Extent of native vegetation across the action area

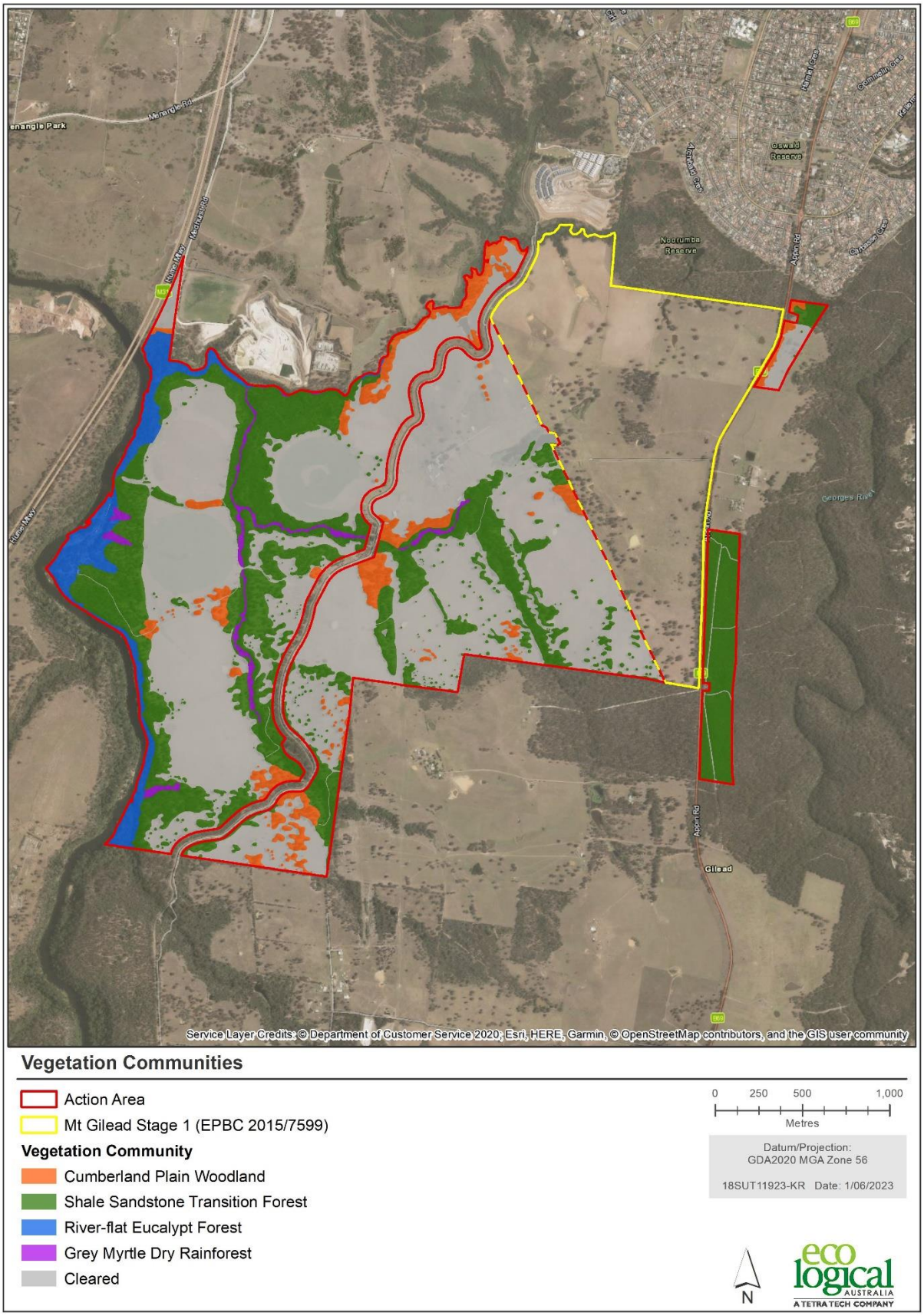


Figure 13: Distribution of vegetation communities across the action area

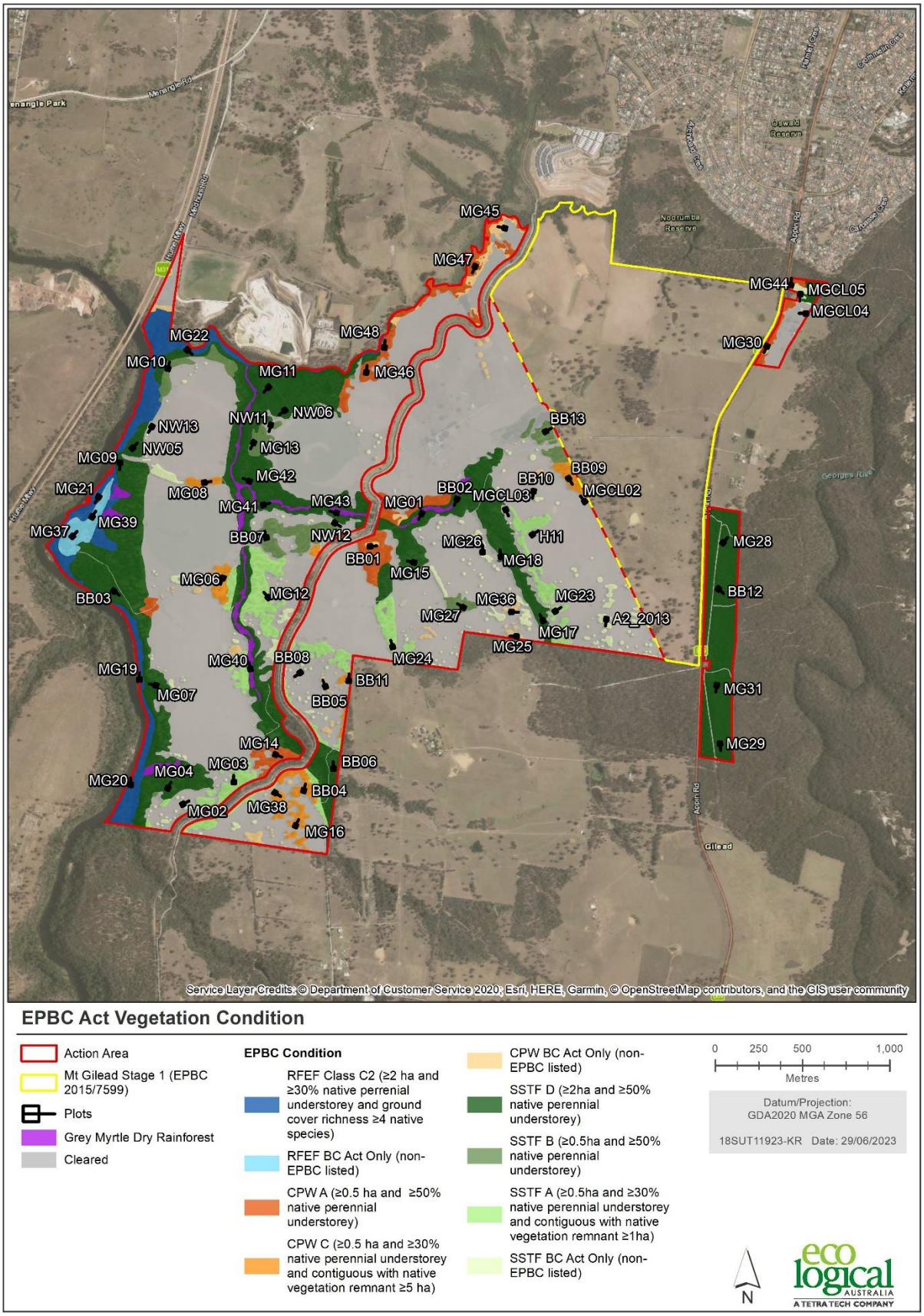


Figure 14: Distribution of EPBC Act vegetation communities and plot locations across the referral area

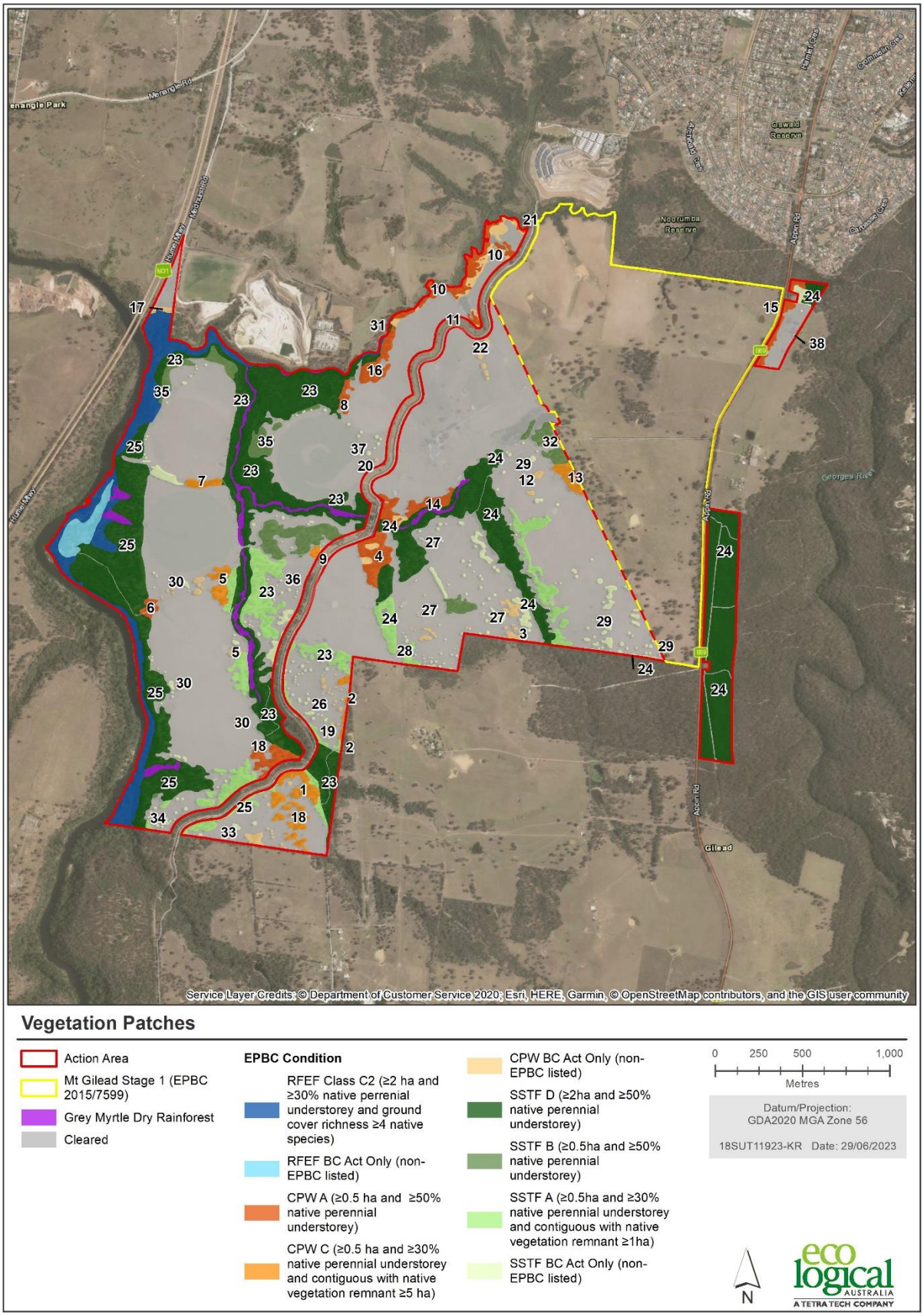


Figure 15: EPBC Act vegetation communities labelled as patches across the action area

4.5 Threatened flora

A total of 287 native and 137 exotic flora species were recorded in the biometric plots used for this assessment. A full list of species recorded in plots is provided in **Appendix T**.

One threatened flora species was recorded by ELA during field survey, *Pomaderris brunnea* (Rufous Pomaderris). A total of 252 *Pomaderris brunnea* individuals have been recorded within the study area, with an additional five plants recorded within the Sydney Water Upper Nepean Canal corridor that bisects the study area. Within the action area *Pomaderris brunnea* was restricted to patches of SSTF, or at the ecotone of this community and adjacent vegetation types.

Whilst there have been recent records of *Pterostylis saxicola* and *Pimelea spicata* near the study area (November 2018 and January 2019 respectively), these species were not recorded in the study area despite extensive surveys over several years during the known flowering times of these species and by staff very familiar with the species. Given the historical land use of the majority of the impact areas (pasture improvement, grazing and cropping, it is considered that these species are unlikely to be present, but may be in the proposed offset areas). Similarly other EPBC Act threatened flora species known to occur in the locality and with suitable habitat present in the study area, were not recorded.

4.6 Threatened fauna

A total of 124 native vertebrate fauna species, comprising 68 birds, 17 microbats, one megabat, 11 terrestrial and arboreal mammals, 11 frogs, 13 reptiles, three fish and one NSW threatened invertebrate, were recorded in the action area. A full list of species recorded by ELA is provided in Appendix I together with a list of species recorded by remote cameras, hair tubes and anabats. Of these species, the following are listed as MNES:

- Phascolarctos cinereus (Koala)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Pteropus poliocephalus* (Grey-headed Flying-fox).

In addition to the species recorded by ELA, there have been a number of recent observations of the Swift Parrot in the locality (near Browns Bush in May 2018, Noorumba Reserve in 2019 and around St Helens Park in May 2020 and August 2021). There are also historical records from the Beulah Estate south of the study area (National Parks Association submission on Stage 1). It is likely that the Swift Parrot forages in the study area from time to time and accordingly has been assumed to be present.

The Spot-tailed Quoll was not observed during surveys despite extensive spotlighting surveys and remote camera use. The Spot-tailed Quoll has been recorded in the extensive forested lands to the east of the study area and given its mobility and broad habitat preferences it is likely that it could forage in the study area from time to time and accordingly has been assumed to be present.

Similarly, the Greater Glider (*Petaurus volans*) which is now listed as an endangered species under the EPBC Act, has recently been recorded near the study area (east of Appin Road) in October 2018 and May 2019 (NSW BioNet 2022), but was not recorded in the study area despite extensive spotlighting surveys and remote camera use. It is noted that the bushland east of Appin Road includes wetter forest types

with which is the preferred habitat of this species. Based on this extensive survey effort over several years, it is reasonable to conclude that this species is not present in the study area.

No other threatened fauna species were identified during targeted survey and none are predicted likely to occur (refer to **Appendix P**).

The impacts to the Large-eared Pied Bat, Koala and Grey-headed Flying-fox are discussed below in Section 5. The other MNES identified as requiring assessment in the PD requirements that were not ruled out in Section 4.1 (Greater Glider and Spot-tailed Quoll) are also addressed in Section 5.

These EPBC Act threatened species records are shown in Figure 16.

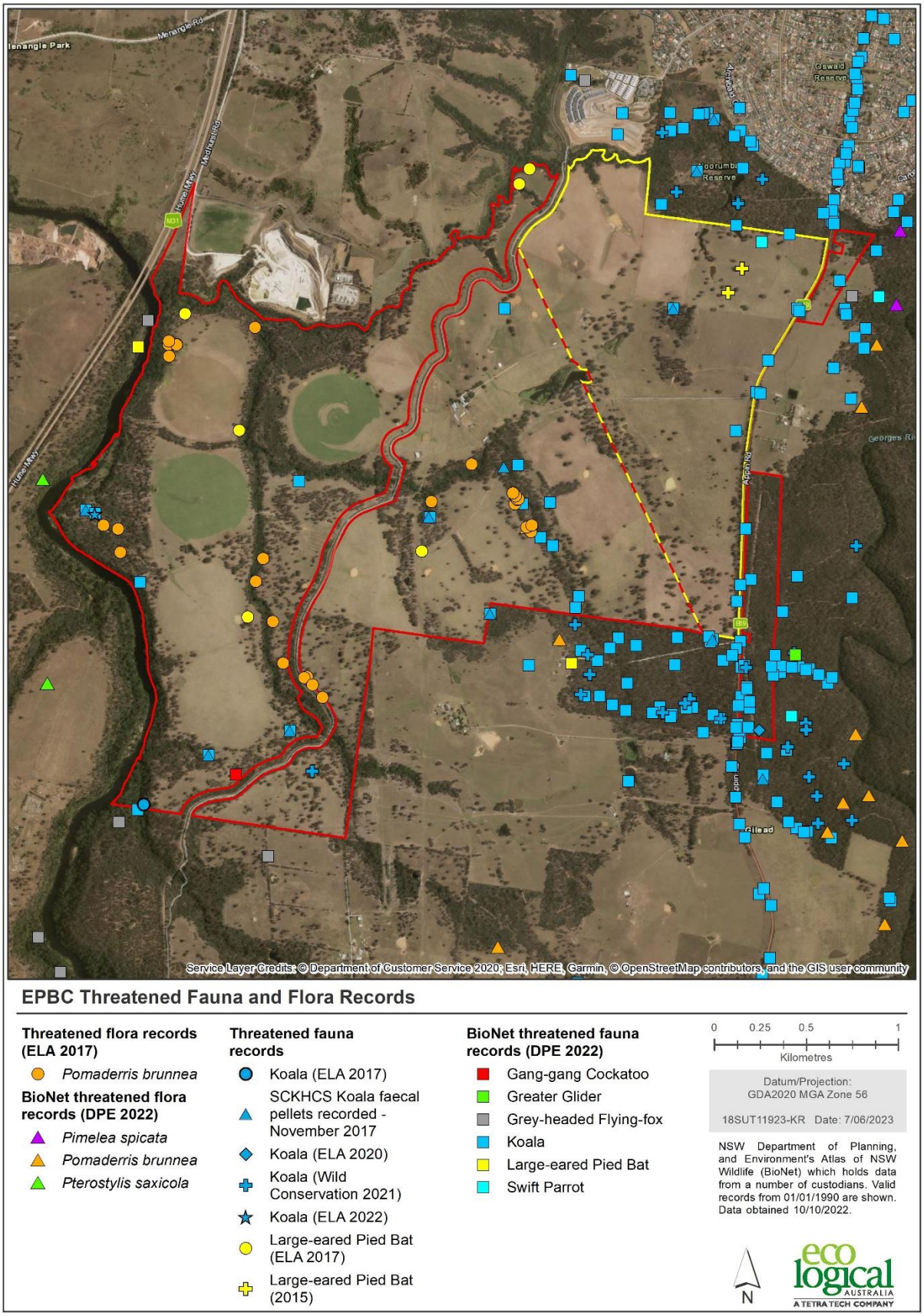


Figure 16: EPBC Act listed threatened flora and fauna records from within and adjacent to the action area (ELA and BioNet)

5. Impacts to threatened ecological communities

5.1 Threatened ecological communities at Mt Gilead

Figure 14 shows the amount of EPBC Act listed vegetation present within the action area, which was determined through field survey and consideration of the condition thresholds for CPW, SSTF and RFEF in the EPBC Act approved conservation advice (TSSC 2008 & 2014; DAWE 2020). Impacts to each community resulting from the proposed action are discussed below.

5.1.1 Location and physical environment

The action area is located within the Sydney Basin Bioregion towards the eastern edge of the Cumberland sub-region close to the boundary of the Sydney Cataract subregion. The action area occurs within the Mitchell Landscape of the Cumberland Plain with the Upper Nepean Gorges landscape entering a small section of the western boundary of the action area. The Woronora Plateau occurs to the east. At this broad scale, the action area is within the geographic envelope that supports SSTF, CPW and RFEF. The topography on the action area ranges from 116 m ASL in the northwest corner to 200 m ASL in the southeast corner, which is also within the elevation limits for these two communities.

5.1.2 Geology and soils

The action area is underlain by the Triassic Ashfield Shale of the Wianamatta Group deposited over the Hawkesbury Sandstone. In general, there are only limited bedrock outcrops across this area, with shale underlying the northern portion of the action area and sandstone in the southern portion of the action area.

A majority of the action area occurs on the Blacktown Soil Landscapes (Hazelton and Tille 1990), which occurs on gently undulating rises over Wianamatta Group shales. The ground slopes are usually less than 5% and the vegetation typically comprises cleared and partly cleared eucalypt, woodlands and tall open forests. The soils range from shallow to moderately deep (less than 1m thick) and are hard setting, mottled textured clay soils. The soils are typically moderately reactive with a highly plastic subsoil, have a low soil fertility and poor soil drainage (Hazelton and Tille 1990).

The riparian corridors occur on the Hawkesbury soil landscape, which is categorised by rugged, rolling to very steep hills on Hawkesbury Sandstone with a local relief of 100 m – 200 m. Slopes are generally > 25 % with crests, ridges, narrow incised valleys and steep side slopes with rocky benches, scarps and boulders. This soil landscape is vegetated with eucalypt woodland and both dry and wet sclerophyll forest. The soils are shallow and sandy with shale lenses (Hazelton and Tille 1990).

5.1.3 Vegetation and biogeographical context

The vegetation patterns on the action area reflect soil lithology, topography and historical landuse. Due to the relatively small size of the action area, climate is relatively homogenous and does not influence the vegetation patterns across the action area.

Two main geologies and associated lithology's are present on the action area. The Blacktown Soil landscape is mapped across a majority of the action area and is comprised of clay soils overlaying Hawkesbury Sandstone. Strips of the Hawkesbury Soil Landscape are mapped along the riparian

corridors in the action area (Hazelton and Tille 1990). The depth of the Hawkesbury Sandstone is a significant factor in determining the distribution of CPW and SSTF.

The approved listing advice for SSTF (TSSC 2014) states:

> *Shale Sandstone Transition Forest is found on soils that are primarily derived from shale substrates and thus tend to have a clay texture, but also have some influence from weathered sandstone substrates. This most commonly occurs where the Wianamatta Group shale underlying the Cumberland Plain grades into sandstone, mainly from the Hawkesbury Group, which dominates the surrounding elevated plateaux* (TSSC 2014).

The approved listing advice for CPW (TSSC 2008) states:

> *The ecological community is predominantly associated with clay soils, that are derived from Wianamatta Shale geology…Minor occurrences may be present on other soil groups, notably Holocene Alluvium in well drained areas, and soils derived from the Mittagong Formation which occurs particularly on the plains and in the vicinity of shale outcrops. On rare occasions, the ecological community may be associated with Tertiary Alluvia, Hawkesbury Sandstone and Aeolian Deposits, which are typically more characteristic of adjacent sandstone heath ecological communities (Tozer, 2003). A part of the ecological community also is associated with shale soils with high concentrations of iron-indurated gravel or overlain by Tertiary Alluvium and those sites are marked by the shale-gravel transition forest component of the ecological community (Tozer et al., 2006).*

5.2 Shale Sandstone Transition Forest

5.2.1 Community description

SSTF is a critically endangered ecological community that occurs within the Sydney Basin in New South Wales. Its location is defined primarily by the geological substrate, where the shale based geology of the Cumberland Plain is influenced by underlying sandstone near the surface.

SSTF is found to the west of Sydney, on the edges of the Cumberland Plain (particularly the southern edge), as well as on the sandstone-dominated Hornsby, Woronora, and Lower Blue Mountains Plateaux that adjoin the plain and occurs between other ecological communities found respectively on shale or sandstone substrates.

While the transitional nature of the ecological community means that its character is not simply described, some of its constituent plant species are considered strongly indicative. The presence of considerable numbers of these species, together with the context provided by landscape, substrate and adjacent ecological communities, assist in a positive identification of Shale Sandstone Transition Forest.

The dominant species vary with factors such as the position in the landscape and extent of sandstone substrate influence, but the canopy is typically composed of trees of approximately 20 m including the species *Eucalyptus punctata* (Grey Gum), *E. crebra* (Narrow-leaved Ironbark) and *E. fibrosa* (Broad-leaved Ironbark). Other Eucalypt species likely to be present include *E. tereticornis* (Forest Red Gum) - especially in areas with low sandstone influence. There is sometimes a mid-canopy, often dominated by short eucalypts as well as *Allocasuarina littoralis* (Black She-oak), with other species found particularly

in areas of high sandstone influence including *Syncarpia glomulifera* (Turpentine) and *Acacia decurrens* (Black Wattle). The understorey layers can be either shrubby or grassy. The shrub layer is dominated by *Bursaria spinosa* (Native Blackthorn) in areas with low sandstone influence, with other common species including *Kunzea ambigua* (tick bush) and *Persoonia linearis* (Narrow-leaved Geebung). The ground layer is diverse and dominated by native grasses and herbs.

SSTF generally occurs in areas receiving between 800mm and 1100mm mean annual rainfall. Typically, it occurs at elevations < 200 m Above Sea Level (ASL), although it may occur up to 350 m ASL in parts of the Lower Blue Mountains and western Woronora Plateau that are associated with the rain-shadow extending south-west of the Cumberland Plain. It also may occur at approximately 600 m ASL at its southern limit in the Southern Highlands.

The key diagnostic characteristics describing Shale Sandstone Transition Forest are:

- limited to the Sydney Basin Bioregion
- occurs at the transition between shales and sandstones of the Wianamatta and Hawkesbury Groups, including the Mittagong Formation
- occurs as forest or woodland, and may have a primarily shrubby or primarily grassy understorey, or be a mixture
- canopy is a mix of species typically including two or more of the following: *Eucalyptus punctata* (Grey Gum), *E. crebra* (Narrow-leaved Ironbark*), E. fibrosa* subsp. *fibrosa* (Broad-leaved Ironbark), *E. tereticornis* subsp. *tereticornis* (Forest Red Gum), *E. resinifera* subsp. *resinifera* (Red Mahogany), *E. eugenioides* (or *E. globoidea* depending on local species present and degree of sandstone influence) and *Angophora bakeri* (Narrow-leaved Apple)
- where present the mid layer of the understorey varies in structure and floristics
    - Where present, the small tree layer is likely to be dominated by *Eucalypt* species and *Allocasuarina littoralis* (Black She-oak)
    - Where shrubs are present, the mid layer is likely to be dominated by *Bursaria spinosa* (Blackthorn) in areas with low sandstone influence, with other common species including *Leucopogon juniperinus*, *Kunzea ambigua* (Tick Bush), *Persoonia linearis* (Narrow-leaved Geebung), *Ozothamnus diosmifolius* (Rice Flower) and *Hibbertia aspera* (Rough Guinea Flower)
- where present, the ground layer of the understorey is typically diverse and dominated by grasses and herbs including: *Aristida vagans* (Three-awned Spear grass), *Austrostipa pubescens* (Spear Grass), *Cheilanthes sieberi* subsp*. sieberi* (Poison Rock Fern), *Dichondra repens* (Kidney Weed), *Echinopogon ovatus* (Forest Hedgehog Grass), *Entolasia marginata* (Bordered Panic), *Entolasia stricta* (Wiry Panic), *Lepidosperma laterale* (Saw Sedge),*Lomandra multiflora*, *Microlaena stipoides* var. stipoides (Weeping Grass), *Oxalis perennans* (Wood-sorrel), *Pimelea linifolia* subsp. *linifolia*, *Pomax umbellata*, *Phyllanthus hirtellus*, *Pratia purpurascens* (White Root), *Solanum prinophyllum* (Forest Nightshade) and *Themeda triandra* syn. *T. australis* (Kangaroo Grass). The ground layer may also contain small shrubs, including *Hibbertia aspera* (Rough Guinea Flower).

5.2.2 Assessment of the 2019/2020 bushfires

The impact of the 2019 / 2020 bushfires to SSTF were minor and restricted to the west and south of the Sydney Basin IBRA region, with marginal areas of impact within the locality and no impacts to the action area (Figure 17 and Figure 18).

5.2.3 Condition of Shale Sandstone Transition Forest in the action area

This vegetation community is the most common native vegetation community within the action area. The canopy varied in density depending on the level of historical disturbance. In some areas, the canopy was sparse, with denser canopy recorded closer to the riparian corridors. The canopy was comprised of *Eucalyptus tereticornis*, *E. crebra*, *Corymbia maculata, Eucalyptus eugenioides, Eucalyptus punctata*, *Eucalyptus pilularis* and *Angophora bakeri.*

The community is generally represented by patches with sparse canopies or occur as scattered trees over a predominantly exotic understory. However, there are small patches which have been fenced out from grazing and/or are not as heavily grazed or cropped where the native grass *Microlaena stipoides* dominates, along with the occasional herbs/twiner, such as *Glycine clandestina* and *Dichondra repens* (Kidney Weed). Exotic species form a dominant ground cover through most of these low quality patches. Species include *Tagetes minuta* (Stinking Roger) and *Senecio madagascariensis* (Fireweed); the latter is listed as a Weed of National Significance. Two other weed species located in this ecological community have been listed as noxious in the LGA including *Xanthium spinosum* and *Rubus fruticosus* agg. (Blackberry).

Vegetation has been disturbed through clearing, prolonged grazing, fertilizer application and weed establishment. Areas where grazing pressures have been lower and/or have not be subject to pasture improvement or cropping represented the better quality patches of SSTF mapped as Condition D across the action area.

Using the plot data from the Biocertification Assessment, the percentage of perennial ground cover was determined to classify the SSTF into the EPBC condition categories (**Appendix S**).

5.2.4 Impacts to Shale Sandstone Transition Forest and buffers to retained/conserved SSTF

The approved conservation advice for the listing of SSTF as a critically endangered ecological community was reviewed to assess impacts to SSTF (TSSC 2014). The listing advice refers to the process to be followed to define discrete ‘patches’ of SSTF and the need to provide ‘buffer zones’ adjacent to these patches to protect the integrity of the ecological community.

The calculation of all direct impacts has been based on a worst-case scenario – i.e. on the assumption of complete loss of all biodiversity values including where these losses are likely to be only partial e.g. creation of bush walking paths 1.2 m (that will avoid impacting trees), establishment and maintenance of bushfire asset protection zones (which allow for the retention of canopy with crown separation and ground cover), retention of trees in open space areas; or temporary e.g. detention basins (which will be revegetated to SSTF after establishment).

The conservation advice for SSTF (TSSC 2014a) recommends that a 30 m vegetated buffer is provided between the development zone and the edge of the EPBC SSTF to be conserved to mitigate against indirect impacts to retained or conserved areas of SSTF.

The precinct layout has been designed to avoid and/or minimise, to the maximum extent possible, indirect impacts to native vegetation including indirect impacts to the proposed conservation areas. The outer perimeter of the proposed residential footprint is a perimeter road. As such, there will be no residential blocks directly adjacent to protected bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by future residents, thus minimising the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals
- allows for the required Bushfire Asset Protection Zones (APZs) to be absorbed, where possible, (i.e. overlap with) the perimeter roads (15-18m) and the dwelling setback (5m) within the individual lots. Therefore, the only impacts from APZs is the 'partial' impacts caused by the establishment and maintenance of the 'outer protection zones' which are able to retain a degree of canopy cover, as long as a 2m separation between canopies is provided (PBP 2019) and managed ground cover, and
- allows for a managed 30 m TEC buffer zone to be established between the residential lots and protected bushland areas as required by the EPBC Act Conservation Listing Advice (TSSC 2014a), see below.

The buffers comprise a 15m 'inner' and 15m 'outer' zone and have been created from the outer edge of the perimeter road and extend for 30m and in some parts include the outer APZ or parts of the proposed Biodiversity Stewardship sites. Impacts have been calculated for all APZ areas as a 40% reduction or loss in biodiversity values as shown in Table 14 (i.e. the area being lost (impacted) being 40% of the original area with 60% of the current biodiversity values remaining). Where the buffers extend into the proposed conservation areas, indirect impacts will be mitigated by the fully funded in perpetuity active conservation management and restoration of the proposed conservation areas as described in Section 9. Accordingly any indirect impacts to CPW and SST within the outer and inner buffer zones are fully managed and mitigated. An allowance of a 20% (80% of the current biodiversity values remaining) and 5% reduction (95% of the current biodiversity values remaining), respectively, in the quality of these vegetation types has been included in the impact assessment on the basis of these mitigation measures, consistent with Stage 1, as shown in Table 14.

All proposed conservation areas, including portions of outer APZs and all buffer zones, will be permanently fenced (Koala exclusion fencing) and actively managed for fully funded conservation in-perpetuity under registered Biodiversity Stewardship Agreements. This fully funded management will minimise and mitigate any potential indirect impacts including weed establishment and growth, rubbish dumping, illegal tree removal and will improve the existing condition of all vegetation within the Stewardship Agreement sites ultimately meeting EPBC Act condition criteria (discussed further in Section 9).

Any SSTF within the Stewardship Agreement sites in the outer (20% weighted impact) and inner (5% weighted impact) buffer zone areas has been calculated as an indirect impact in the impact calculations (not as conservation area) despite these areas being actively managed for conservation as part of registered offset areas (Figure 19).

The fully funded, active in perpetuity conservation management of these areas as registered Stewardship Agreement sites (i.e. access control by fencing and signage, weed and rubbish removal, supplementary planting where required to restore degraded areas) will maintain and enhance the

condition of SSTF in these areas so that any indirect impacts are fully mitigated, however, have been calculated as a 20% loss (outer buffer) and as a 5% loss (inner buffer) in the current condition of the SSTF for impact assessment purposes in this PD report. Further, whilst these areas will be managed for conservation in perpetuity, they have not been counted as available to form part of the EPBC Act offset areas (Section 9). However, as they still formally comprise a portion of the Stewardship Agreement site, they are mapped accordingly (Figure 19).

In applying these rules, the area of SSTF directly impacted by the proposed action is 26.29 ha (development footprint), 1.63 ha of partial impacts (APZ), which when calculated at a 40% loss of site value equates to 0.65 ha of partial impacts, and 13.33 ha of indirect / mitigated impacts (inner and outer buffers), which at a 20% loss of site value in the outer buffer and 5% loss in the inner buffer equates to a total of 28.78 ha of mitigated direct and indirect impacts as shown in Table 14. The APZ has been calculated as a partial impact as impacts to the APZ will be limited to selected removal of some trees, allowing retention of canopy in some areas and retention of native, managed ground cover (in many areas, there will be no or very little impacts to SSTF when establishing APZs as the current condition of the vegetation (under an agricultural management regime) is already under the APZ thresholds).

Table 14: Impacts to SSTF in the development footprint, APZ and 30 m buffers

EPBC Veg Zone	EPBC Condition Category	Total Area Development Site (ha)	APZ (impact ha)	APZ (40% impact ha)	Outer Buffer (total ha)	Outer Buffer (20% impact ha)	Inner Buffer (total ha)	Inner Buffer (5% impact ha)	Total Impacts (No Mitigation)	Total Impacts (after mitigation)	Conservation Area (Excluding Buffers)
9	SSTF Condition D	4.39	0.96	0.38	5.37	1.07	3.54	0.18	14.26	6.03	87.77
10	SSTF Condition B	3.32	0.15	0.06	1.15	0.23	0.74	0.04	5.36	3.65	6.04
11	SSTF Condition A	18.58	0.52	0.21	1.32	0.26	1.21	0.06	21.63	19.11	3.01
	Total	**26.29**	**1.63**	**0.65**	**7.84**	**1.57**	**5.49**	**0.27**	**41.25**	**28.78**	**96.82**
	BC Act only	7.14			0.55		0.41		8.10	7.27	1.80
	Restoration to EPBC				5.32		7.12		0	0.00	22.62
	Management of EPBC Condition SSTF in buffer Areas				7.84		5.49				

***SSTF in inner and outer buffer areas will be actively managed for conservation in accordance with Stewardship Site Agreements (weed control, regeneration and restoration), separated from urban development, urban runoff and over shadowing by perimeter roads and fenced to prevent inappropriate access, thus mitigating/reducing any adverse indirect impacts.

Of these impacts, a majority are associated with direct impacts to the flatter and higher areas of the action area, with some encroachment into the outer edge of the riparian corridor vegetation. Impacts have largely been concentrated where the SSTF is in poor condition, as a result of historical agricultural practices. Direct impacts to areas of the community in better condition are associated with creek crossings.

The impacts to SSTF associated with the proposed action have largely avoided fragmentation or isolation of patches of the community, with a majority of impacts concentrated on the edges of larger patches or have been previously affected as a result of agricultural activities. Some minor fragmentation of the community would occur to allow for access to drainage / open space areas and bridge crossings. However, bridges for creek crossings will be designed to allow for contiguity of vegetation beneath it.

The fragmentation associated with access and bridge crossings is unlikely to decrease the structure or function of the community. Seed dispersal, pollination and fauna movement would not be obstructed.

The proposed action will impact on the soil and potentially the soil seed bank. No ground water extraction is likely to impact on this community and no surface water changes are likely to occur.

Substantial portions of the action area are degraded as a result of historical land clearing, extensive pasture improvement, ongoing grazing and establishment of agricultural weeds. The proposed action is not considered likely to cause a substantial reduction in the quality or integrity of an ecological community by assisting any invasive species harmful to the ecological community becoming established. A Construction Environmental Management Plan (CEMP) has been prepared (**Appendix N**) and will be implemented to minimise the risks associated with the introduction of any invasive weeds or pathogens (refer to Mitigation Measures in Section 8).

While the loss of 28.78 ha of mitigated EPBC Act condition SSTF (after mitigation) is not consistent with the recovery of the ecological community, the proposed action will conserve and manage in-perpetuity 96.82 ha of EPBC Act Condition D, B and A SSTF outside of the buffer zones as part of two Biodiversity Stewardship sites. A further 37.81 ha of BC Act condition SSTF and cleared land will be conserved, restored to EPBC Act Condition SSTF and managed in-perpetuity as part of the Biodiversity Stewardship sites. Although not contributing to the offset calculations, an additional 13.33 ha of EPBC Act SSTF will be conserved and managed in the 30 m buffers. The SSTF within the Biodiversity Stewardship sites (including the portions that form the 30 m buffer) will undergo active management to maintain and for some patches improve the condition of the community.

Residual impacts to the community have been considered in Sections 8 and 9 where both mitigation and offsets are discussed and detailed further. Impacts to SSTF (as listed under both the BC and EPBC Acts) have been limited by a range of avoidance, mitigation and management actions to be carried out pre-development, during development, and post development. These are outlined in more detail in Section 8.

5.2.5 Application of the Significant Impact Criteria

The significant impact criteria (DoTEE 2013) were applied with respect to SSTF which concluded that a significant impact is likely to occur to SSTF (Table 15) and this impact will be fully offset (meeting over 300% of the EPBC Offset target as per Table 29.

Table 15: Application of the Significant Impact Criteria with respect to Shale Sandstone Transition Forest (SSTF)

Impact Assessment Criteria	Application
An action is likely to have a significant impact on a critically endangered community if there is a real chance or possibility that it will:	
reduce the extent of an ecological community	The proposed action will reduce the extent of the ecological community in the short term by directly impacting 26.29 ha of Condition D, B & A Shale Sandstone Transition Forest (SSTF) and modifying a further 1.63 ha in a bushfire Asset Protection Zone. 110.15 ha of Condition D, B & A SSTF (including 13.33 ha in 30m buffer zones) will be conserved and managed in two BSAs and an additional 37.81 ha of degraded non-EPBC SSTF will be restored to EPBC Act condition.

Impact Assessment Criteria	Application
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	SSTF is currently in a highly fragmented state in the action area reflecting past and present agricultural land use practices and clearing history. The proposed action will further fragment some of these patches, however, the majority of impacts to SSTF are limited to removal of vegetation on the edge of existing patches (Figure 19).
adversely affect habitat critical to the survival of an ecological community	No critical habitat has been declared for SSTF under the EPBC Act. The Cumberland Plain Recovery Plan (DECCW 2011) and Conservation Investment Strategy (OEH 2015) do not identify the SSTF to be impacted in the action area to be 'Priority Conservation lands' (PCLs), 'Core Areas' of SSTF or regional corridors.
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 will destroy abiotic factors and modify ground water levels and surface water drainage in the impact area
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 will directly impact 26.29 ha of Shale Sandstone Transition Forest (SSTF) and modifying a further 1.63 ha in a bushfire Asset Protection Zone The patches of SSTF to be conserved will improve in condition over time, as a result of the in-perpetuity, fully funded management of 96.82 ha (excluding buffer areas) of the community as part of two Biodiversity Stewardship Agreement sites and the restoration of a further 37.81 ha – total area managed for SSTF, including buffer zones 147.96 ha.
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, 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 will involve residential subdivision and provision of associated ancillary infrastructure. The proposed action will retain and manage in perpetuity 110.15 ha (including buffer areas) of the community under two Biodiversity Stewardship Agreement sites (Figure 56**)**. The action has included a 30 m buffer to the edge of the development to account for potential indirect impacts such as weed invasion, sedimentation and erosion and changes to hydrology that may impact the patches of the community to be conserved. The 30 m buffer is considered sufficient to manage and mitigate these indirect impacts such that they do not have a long-term impact on the community retained in the referral area.
Interfere with the recovery of the ecological community	The proposed action will permanently remove 26.29 ha of the community, modify a further 1.63 ha, have minimal indirect impacts to a further 13.33 ha of the community in managed buffer zones and conserve and manage 110.15 ha of Shale Sandstone Transition Forest in large, more viable patches in-perpetuity. The proposed action is therefore likely to promote the recovery of the community at a local level.

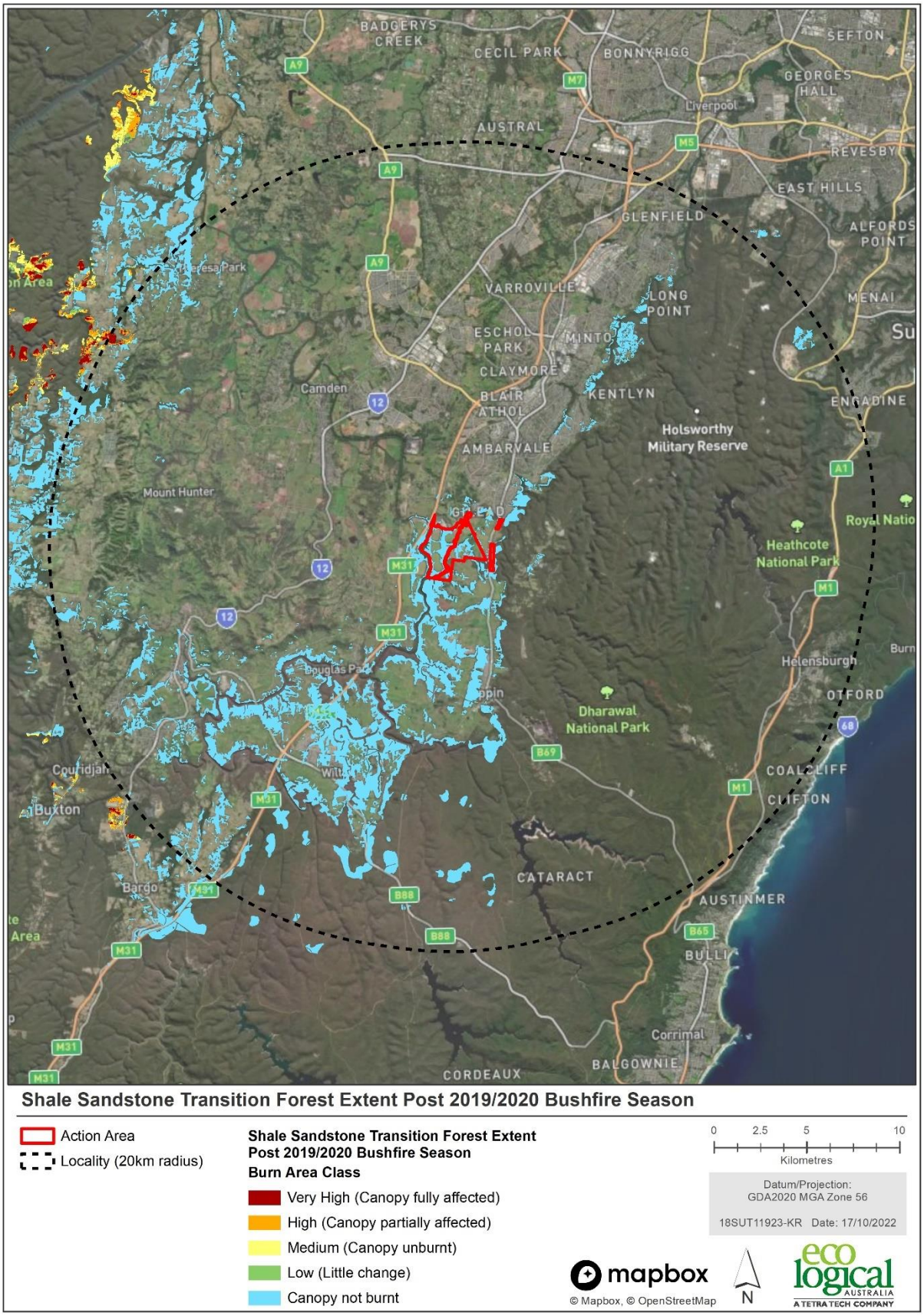


Figure 17: Impacts of the 2019/2020 bushfires within a 20km radius of the study area in relation to SSTF

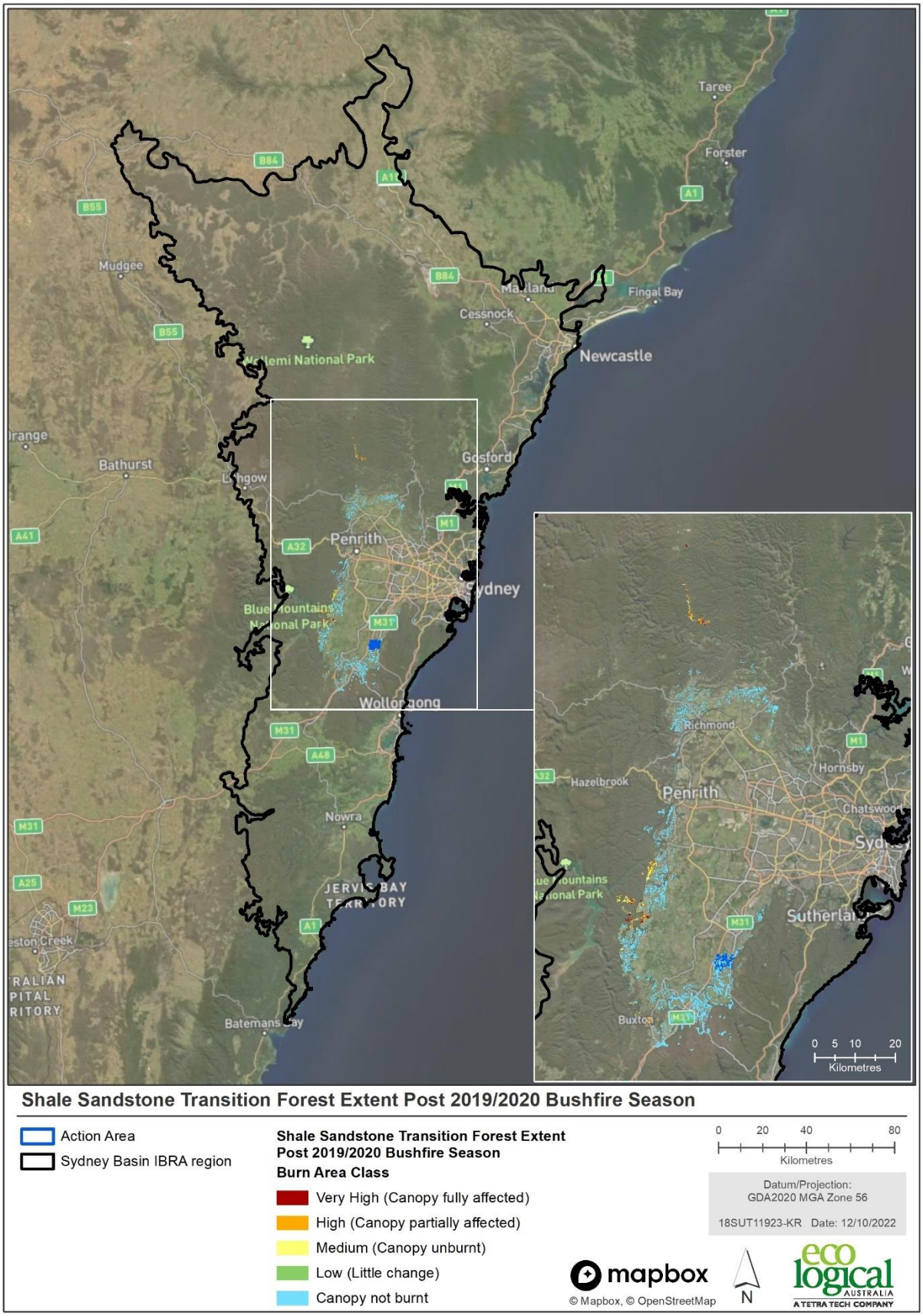


Figure 18: Extent of SSTF in relation to the 2019/2020 bushfires in the IBRA region

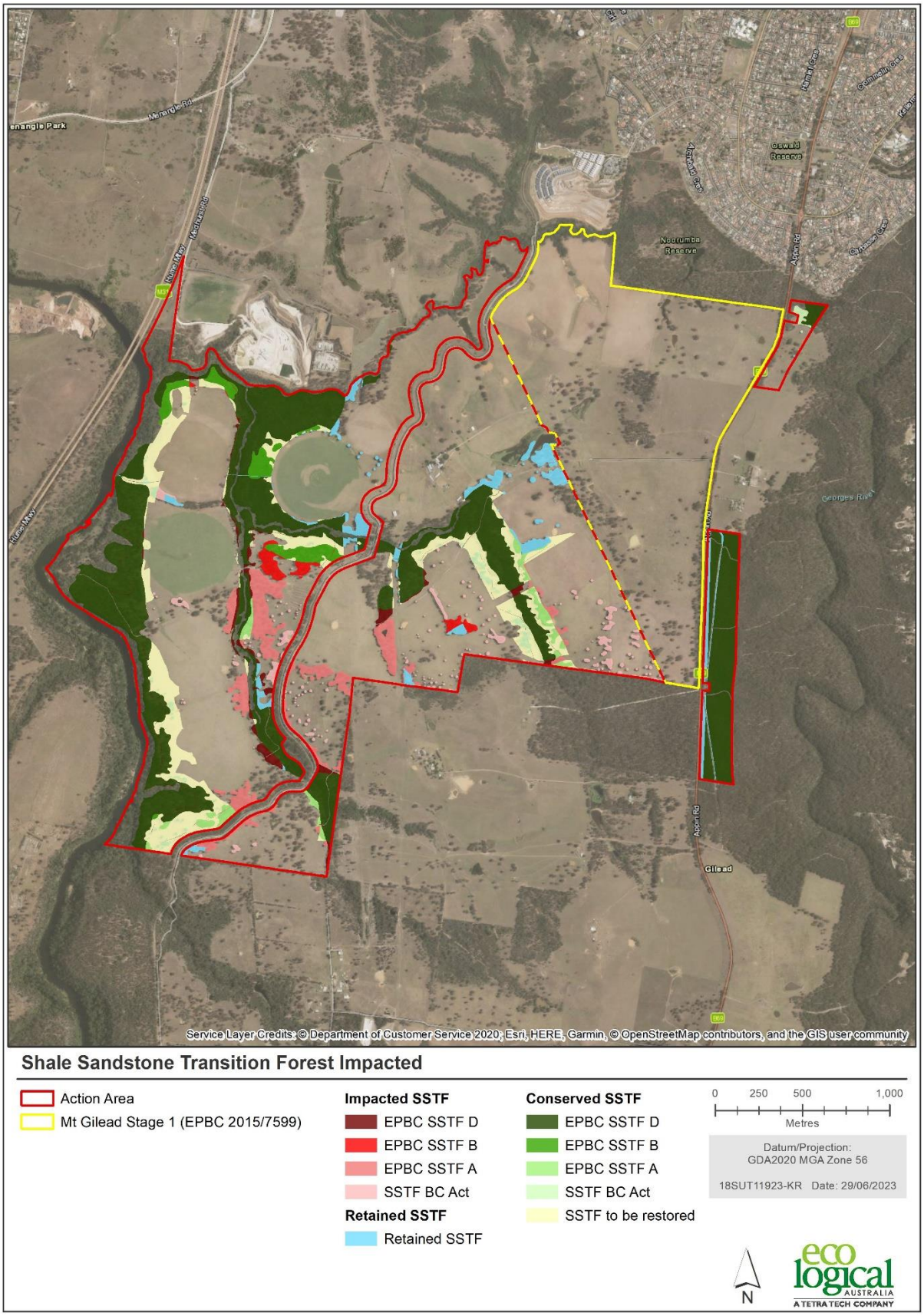


Figure 19: Shale Sandstone Transition Forest to be affected and conserved across the action area

5.3 Cumberland Plain Woodland

5.3.1 Community description

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) is listed as critically endangered under the EPBC Act. The CPW complex represents occurrences of the coastal plain grassy eucalypt woodlands that are endemic to shale hills and plains of the Sydney Basin Bioregion and predominantly occupies the Cumberland Sub-region.

The ecological community is predominantly associated with clay soils that are derived from Wianamatta Shale geology. A part of the ecological community is also associated with shale soils with high concentrations of iron-indurated gravel or overlain by Tertiary Alluvium and those sites are marked by the shale-gravel transition forest component of the ecological community (DEWHA 2010). Under the EPBC Act, the community is characterised by the following structural features:

- a medium-height eucalypt woodland with a lower tree layer, dominated by a Grey Box – Forest Red Gum (*Eucalyptus moluccana – E. tereticornis*) canopy;
- an open, low shrub layer dominated by a Blackthorn (*Bursaria spinosa*) understorey;
- an abundant grassy groundcover comprised of several different grass species.

The composition of the understorey (shrubby or grassy) can vary depending on the site's disturbance history, such as grazing or farming practices. Fire frequency is also known to affect the structure of associated plant species occurring within the community.

In NSW, CPW is further defined as two sub-communities - Shale Hills and Shale Plains Woodland. The composition of both of these sub-communities is consistent with the EPBC Act listing definition of CPW. Therefore, any references to Shale Hills and Shale Plains Woodland can be considered as references to the EPBC Act listed community of CPW, and, considered as part of the EPBC Act listed community of CPW provided condition thresholds for patches are met.

The original extent of CPW has been significantly reduced since the introduction of agricultural and urban uses across the Cumberland Plain following European settlement. A field survey undertaken by Tozer (2003) coupled with detailed interpretation of colour aerial photography from between 1997 and 1998, determined that only 9% of the original extent (pre-1750) of the community remained with greater than 10% canopy cover, with a further 14% remaining as scattered trees across the landscape (NPWS 2002).

A more recent study by the NSW Scientific Committee and Simpson (2008) re-assessed the status of the community in order to determine changes in distribution since November 1998. Comparing the 1997-1998 mapping undertaken by Tozer (2003) with ortho-rectified digital photography obtained in 2007, it was found that the remaining extent of the community had declined by approximately 442 ha or around 5.2% of its distribution nine years ago. Such clearing is likely to be a consequence of dispersed, small-scale clearing associated with urban development.

5.3.2 Assessment of the 2019/2020 bushfires

The impact of the 2019 / 2020 bushfires to CPW were minor and restricted to the west and south of the Sydney Basin IBRA region, with marginal areas of impact within the locality and no impacts to the action area (Figure 20 and Figure 21).

5.3.3 Condition of Cumberland Plain Woodland in the action area

A long history of grazing, pasture improvement and weed invasion has fragmented and modified vegetation of this community. Patches of the community are scattered throughout the action area, with better condition CPW in proximity to riparian corridors and areas that historically have been exposed to low to no levels of disturbance. There are small patches of BC Act CPW to be affected in areas that have historically been substantially degraded through agricultural practices. These patches did not meet minimum EPBC condition thresholds. The CPW is generally found on clay soils in lower topography within Mt Gilead. It contains several large remnant trees including: *Eucalyptus tereticornis*, *E. moluccana* and *E. crebra*. The shrub layer is absent throughout most of the action area and ground cover diversity is low, however still meets EPBC condition thresholds.

Some resilience is present within the soil seed bank with evidence of some native ground cover species present including: *Microlaena stipoides* (Weeping Grass), *Chloris truncata* (Windmill Grass) and *Aristida ramosa* (Purple Wiregrass). The majority of the vegetation community has a high incursion of exotic groundcover including *Pennisetum clandestinum* (Kikuyu) and *Ehrharta erecta* (Panic Veldtgrass), particularly within the areas that did not meet the EPBC Act condition thresholds.

Using the plot data from the Biocertification Assessment, the percentage of perennial ground cover was determined to classify the CPW into the EPBC condition categories (**Appendix S**).

5.3.4 Impacts to Cumberland Plain Woodland and buffers to retained and conserved CPW

The approved conservation advice for the listing of CPW as a critically endangered ecological community was reviewed to assess impacts to CPW (TTSC 2008). The listing advice refers to the process to be followed to define discrete 'patches' of CPW and whilst not specifically referring to 'buffer zones', in consultation with DAWE, consideration of 30 m buffer zones, consistent with SSTF, has been applied for all areas of CPW identified for protection / conservation.

The calculation of all direct impacts has been based on a worst-case scenario – i.e. on the assumption of complete loss of all biodiversity values including where these losses are likely to be only partial e.g. creation of bush walking paths 1.5 m (that will avoid impacting trees), establishment and maintenance of bushfire asset protection zones (which allow for the retention of canopy with crown separation and ground cover), retention of trees in open space areas; or temporary e.g. detention basins (which will be revegetated after establishment)

The precinct layout has been designed to avoid and/or minimise, to the maximum extent possible, indirect impacts to native vegetation including indirect impacts to the proposed conservation areas. The outer perimeter of the proposed residential footprint is a perimeter road. As such, there will be no residential blocks directly adjacent to protected bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by future residents, thus minimising the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals
- allows for the required Bushfire Asset Protection Zones (APZs) to be absorbed, where possible, (i.e. overlap with) the perimeter roads and the dwelling setback within the individual lots. Therefore, the only impacts from APZs is the partial impacts caused by the establishment and maintenance of the outer protection zones which are able to retain a degree of canopy cover,

as long as a 2m separation between canopies is provided (PBP 2019) and managed ground cover, and

- allows for a managed 30 m TEC buffer zone to be established between the residential lots and protected bushland areas as required by the EPBC Act Conservation Listing Advice (TSSC 2014a), see below.

The buffers comprise a 15m 'inner' and 15m 'outer' zone and have been created from the outer edge of the perimeter road and extend for 30m and in some parts include the outer APZ or parts of the proposed Biodiversity Stewardship sites. Impacts have been calculated for all APZ areas as a 40% reduction in biodiversity values as shown in Table 16 (i.e. the area being lost (impacted) being 40% of the original area with 60% of the current biodiversity value remaining). Where the buffers extend into the proposed conservation areas, indirect impacts will be mitigated by the fully funded in perpetuity active conservation management and restoration of the proposed conservation areas as described in Section 9. Accordingly any indirect impacts to CPW within the outer and inner buffer zones are fully managed and mitigated. An allowance of a 20% (with 80% of the current biodiversity values remaining) and 5% reduction (with 95% of the current biodiversity values remaining), respectively, in the quality of these vegetation types has been included in the impact assessment on the basis of these mitigation measures, consistent with Stage 1, as shown in Table 16.

All proposed conservation areas, including portions of the inner and outer 15 m of the 30 m buffer zones, will be permanently fenced (Koala exclusion fencing) and actively managed for fully funded conservation in-perpetuity under registered Biodiversity Stewardship Agreements. This fully funded management will minimise and mitigate any potential indirect impacts including weed establishment and growth, rubbish dumping, illegal tree removal and will improve the existing condition of all vegetation within the Stewardship Agreement sites ultimately meeting EPBC Act condition criteria (discussed further in Section 9).

The fully funded, active in perpetuity conservation management of these areas as registered Stewardship Agreement sites (i.e. access control by fencing and signage, weed and rubbish removal, supplementary planting where required to restore degraded areas) will maintain and enhance the condition of CPW in these areas so that any indirect impacts are fully mitigated (noting that the majority of vegetation in these areas is already in relatively poor condition given historic landuse practices – grazing and pasture improvement), however, have been calculated as a 20% (outer buffer) and 5% (inner buffer) reduction in the current condition of the CPW for impact purposes. Further whilst these areas will be managed for conservation in perpetuity, they have not been counted as part of the EPBC Act offset areas (**Section 8**) but are shown as conservation areas (Figure 22).

In applying these rules, the area of CPW directly impacted by the proposed action is 7.59 ha (development site), 0.00 ha of partial impacts associated with the APZ, and 0.99 ha of indirect impacts associated with the application of a 30 m buffer. Although indirect impacts have been calculated by applying a 30 m buffer, the impacts have been discounted to account for the in-perpetuity conservation and management of the CPW within the buffer, as part of the BSA management. Impacts to the outer buffer have been calculated at 20% impact (0.11 ha) and the inner buffer has been calculated at 5% impact (0.02 ha), resulting in a total direct and indirect mitigated impacts of 7.72 ha.

The proposed action will conserve and manage in-perpetuity 11.47 ha of EPBC Act listed Category A & C CPW (outside of the buffer areas). An additional 13.57 ha of non EPBC Act Condition CPW will also be

restored/enhanced and to EPBC Act Condition. Although not contributing to the offset calculations, an additional 0.98 ha of EPBC Act CPW will be conserved and managed in the 30 m buffers. The conservation measures across the action area will result in a total of 26.02 ha of CPW being conserved and managed.

The proposed action is not considered likely to cause a substantial reduction in the quality or integrity of the ecological community by assisting any invasive species harmful to the ecological community becoming established. A CEMP has been developed (**Appendix N**) and will be implemented to minimise the risks associated with the introduction of any invasive weeds or pathogens (**Section 8**).

The removal/impacts to 7.72 ha of CPW is not consistent with the recovery of the ecological community, however, 26.02 ha of the community will be conserved and restored in-perpetuity as part of two BSA sites across the action area.

Table 16: Impacts to Cumberland Plain Woodland

EPBC Veg Zone	EPBC Condition Category	Total Area Development Site (ha)	APZ (impact ha)	APZ (40% impact ha)	Outer Buffer (total ha)	Outer Buffer (20% impact ha)	Inner Buffer (total ha)	Inner Buffer (5% impact ha)	Total Impacts (No Mitigation)	Total Impacts (after mitigation)	Conservation Area (Excluding buffers)
3	Condition A	0.91	0.00	0.00	0.21	0.04	0.09	0.00	1.21	0.96	10.27
4	Condition C	6.68	0.00	0.00	0.33	0.07	0.36	0.02	7.37	6.76	1.20
Total	**Total**	**7.59**	**0.00**	**0.00**	**0.54**	**0.11**	**0.45**	**0.02**	**8.58**	**7.72**	**11.47**
	BC Act only	2.90	0.00	0.00	0.16	0.03	0.24	0.01	3.30	2.94	2.66
	Restoration to EPBC				1.45		1.82	0.00	0.00	0.00	7.24
	Management of EPBC CPW in buffer Areas				0.54		0.45				

*** CPW in inner and outer buffer areas will be actively managed for conservation in accordance with BSA Agreements, separated from urban development, urban runoff and over shadowing by perimeter roads with stormwater management and fenced to prevent inappropriate access, thus mitigating/reducing any adverse indirect impacts

5.3.5 Application of the Significant Impact Criteria

The significant impact criteria (DoTEE 2013) were applied with respect to Cumberland Plain Woodland which concluded that a significant impact is likely to occur to CPW (Table 17) and this impact will be fully offset (meeting over 390% of the EPBC Offset target as per Table 29).

Table 17: Application of significant impact criteria to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest

Impact Assessment Criteria	Application
An action is likely to have a significant impact on a critically endangered community if there is a real chance or possibility that it will:	
reduce the extent of an ecological community	The proposed action will reduce the extent of the ecological community in the short term by removing or indirectly impacting 7.72 ha (after mitigation) of EPBC Act Condition A and C Cumberland Plain Woodland. 11.47 ha of Condition A and C of the community (outside of buffer zones) will be conserved and managed in-perpetuity under two Biodiversity Stewardship Site Agreements (BSAs) and an additional 13.57 ha of degraded non-EPBC CPW will be restored to EPBC Act condition thresholds increasing the overall extent of CPW. A further 0.98 ha of EPBC Condition CPW will be managed for conservation in the buffer areas.
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	CPW is currently in a highly fragmented state in the referral area reflecting past and present agricultural land use practices and clearing history. The proposed action will further fragment some of these patches, however, the majority of impacts to CPW are limited to removal of vegetation on the edge of existing patches (Figure 22).
adversely affect habitat critical to the survival of an ecological community	No critical habitat has been declared for Cumberland Plain Woodland under the EPBC Act. The Cumberland Plain Recovery Plan (DECCW 2011) and Conservation Investment Strategy (OEH 2015) do not identify the CPW to be impacted in the referral area to be 'Priority Conservation lands' (PCLs), 'Core Areas' of CPW or regional corridors
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 will destroy abiotic factors and modify ground water levels and surface water drainage in the impact area (8.69 ha)
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 will directly and indirectly impact 7.72 ha of mitigated EPBC Act Condition A and C Cumberland Plain Woodland and permanently conserve 11.47 ha of EPBC Condition CPW in the action area. An additional 13.57 ha of non-EPBC Condition CPW will be restored and enhanced to EPBC Act Condition CPW as and 0.98 ha of EPBC Condition CPW will be managed for conservation in the buffer areas. The patches of CPW to be conserved will improve in condition over time, as a result of the in-perpetuity, fully funded management of the community as part of three BSAs.

Impact Assessment Criteria	Application
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, 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,**	The proposed action will involve residential subdivision and provision of all associated ancillary infrastructure. This will result in direct and indirect impacts to 7.72 ha of Cumberland Plain Woodland in the action area. The proposed action will conserve and manage in perpetuity 11.47 ha of current EPBC Condition CPW and restore and enhance a further 13.57 ha of non-EPBC Condition CPW in two BSAs (Figure 56). The assessment has included a 30 m buffer to the edge of the development to account for potential indirect impacts such as weed invasion, sedimentation and erosion and changes to hydrology that may impact the patches of the community to be conserved. The 30 m buffer is considered sufficient to manage and mitigate these indirect impacts such that they do not have a long-term impact on the community retained in the action area.
Interfere with the recovery of the ecological community	The proposed action will result in direct and indirect impacts to 7.72 ha of the community, and conserve and manage 11.47 ha of current EPBC Condition CPW and restore and enhance a further 13.57 ha of non-EPBC Condition CPW in two BSAs in large, more viable patches in-perpetuity. The proposed action is therefore likely to promote the recovery of the community at a local level.

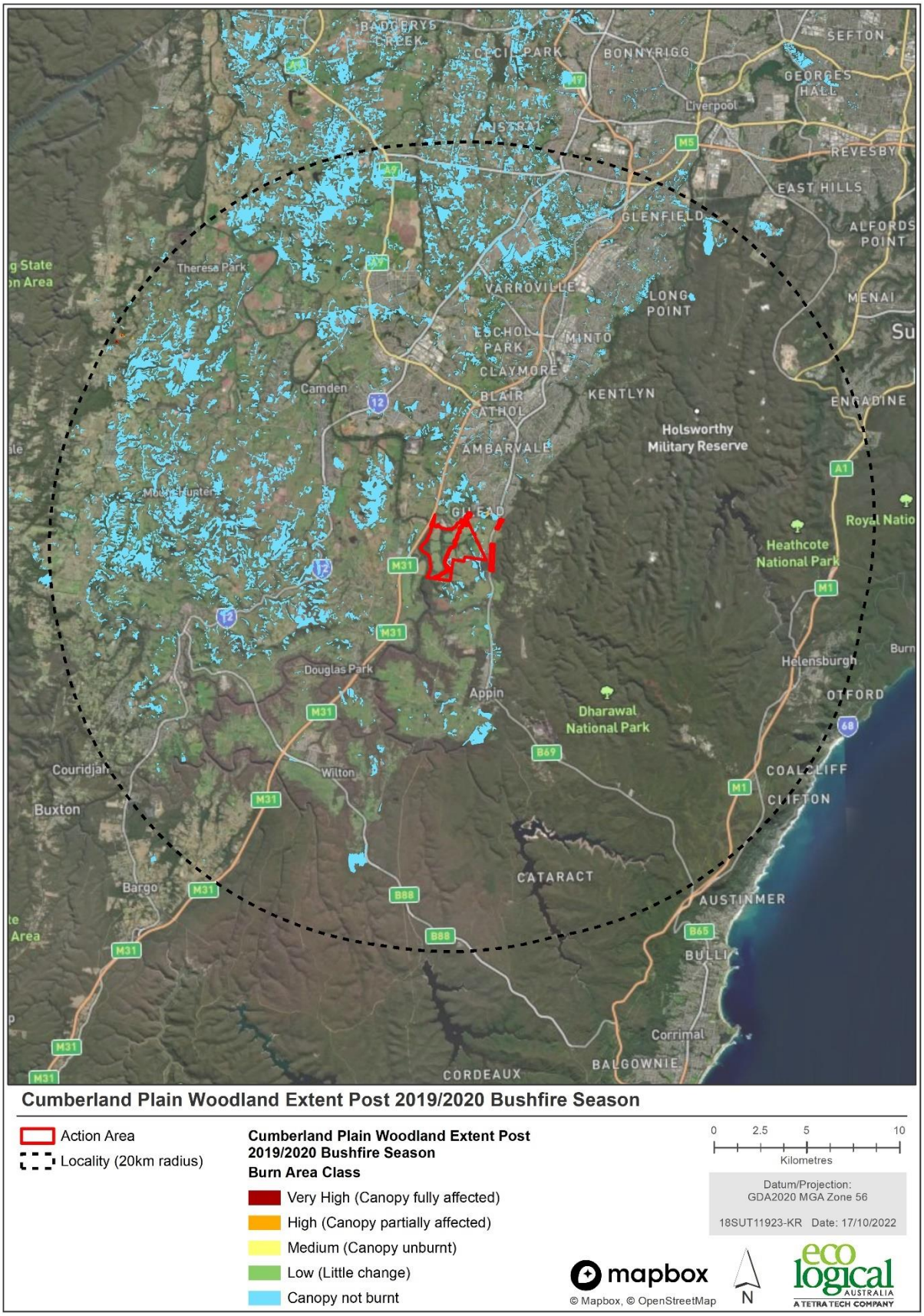


Figure 20: Impacts of the 2019/2020 bushfires within 20km of study area in relation to CPW

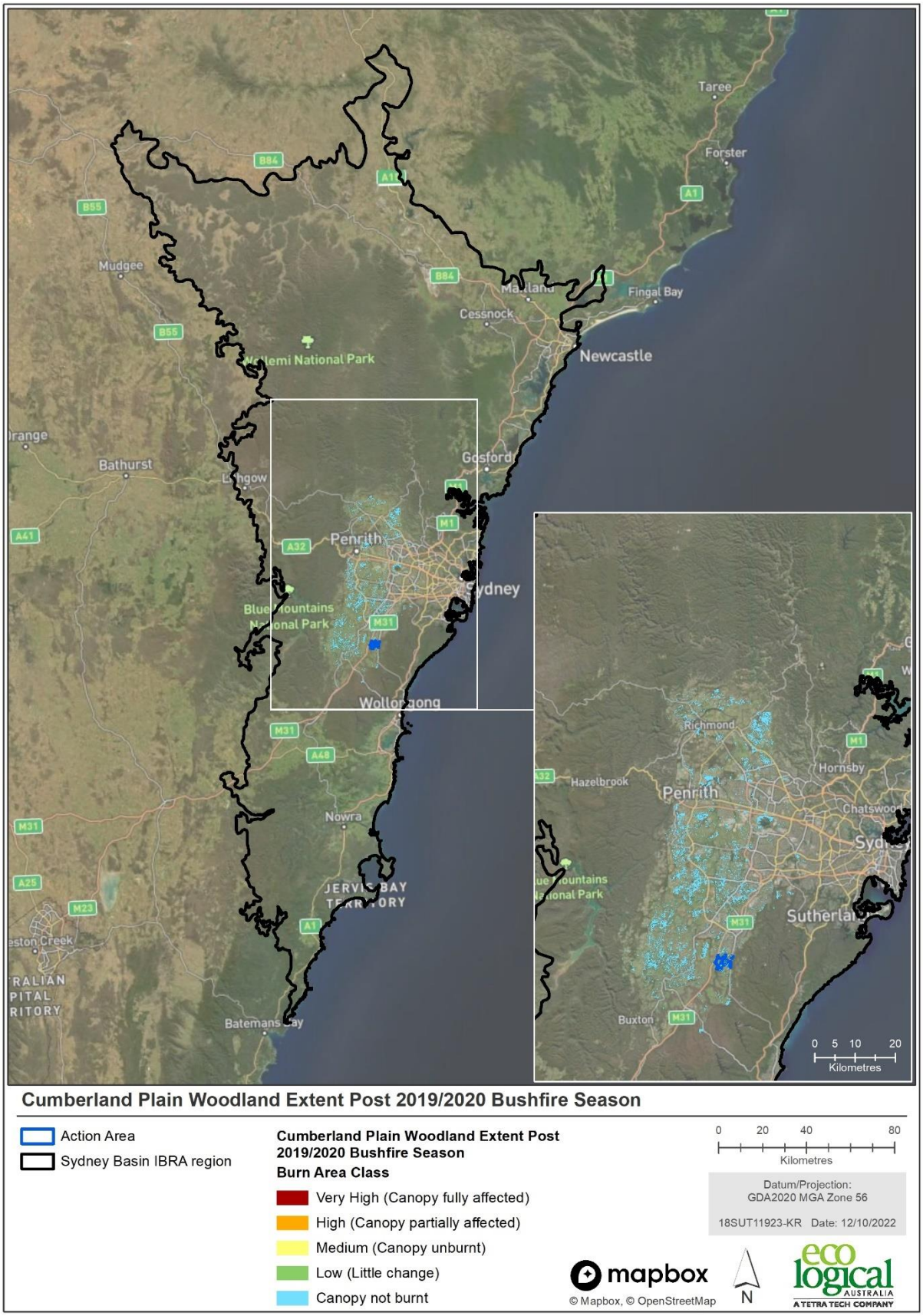


Figure 21: Extent of CPW in relation to the 2019/2020 bushfires in the IBRA region

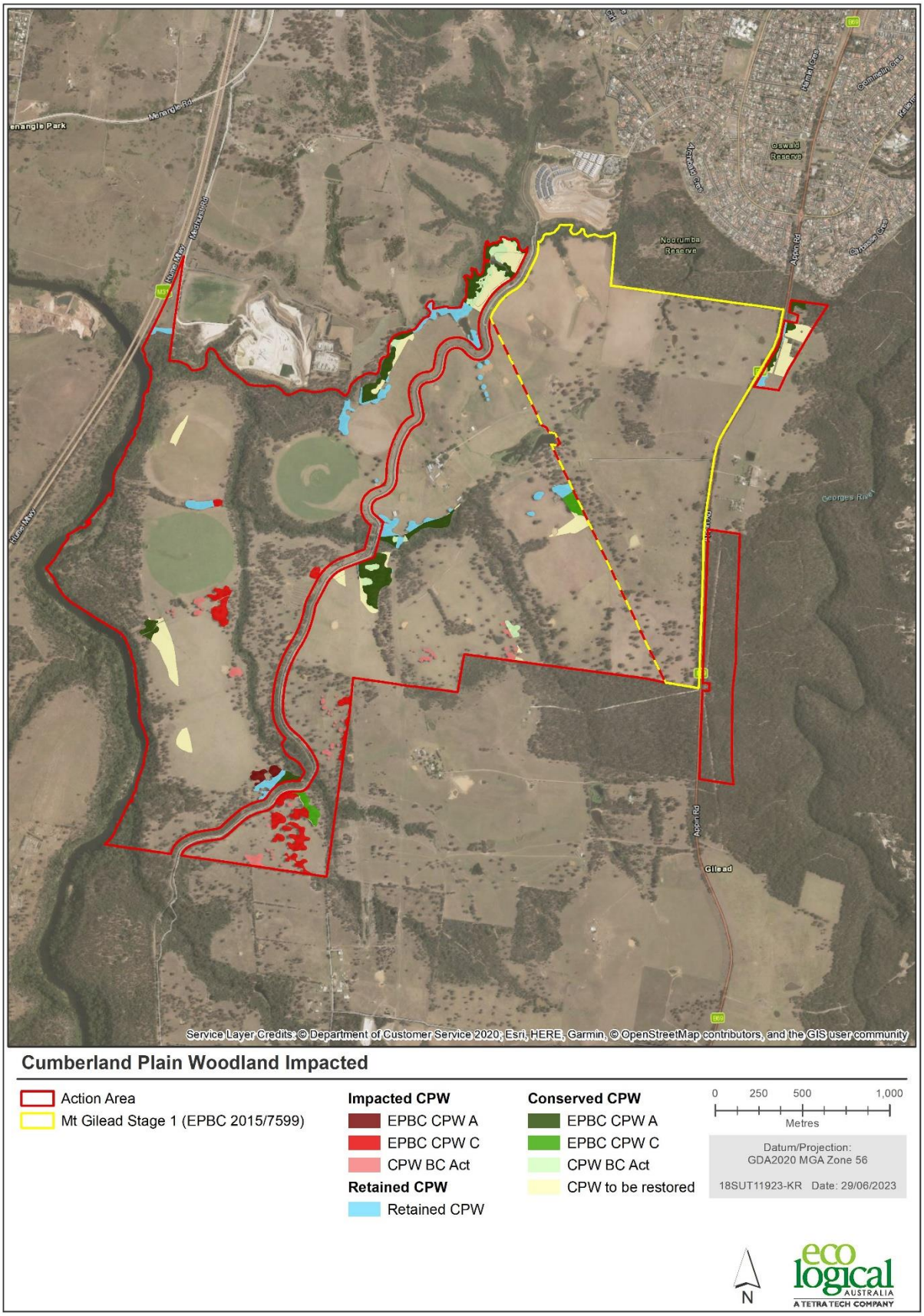


Figure 22: Cumberland Plain Woodland to be impacted and conserved across the action area

6. Impacts to threatened flora

6.1 Pomaderris brunnea (Rufous Pomaderris)

6.1.1 Species description

Pomaderris brunnea is a shrub with a limited geographic range. This species occurs in the Sydney Basin, NSW North Coast and New England Tableland IBRA regions in NSW and the South East Corner Bioregion in Victoria (NSW Scientific Committee 2014; DAWE 2021). It is listed as endangered in NSW and vulnerable nationally.

In NSW, *Pomaderris brunnea* grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. In the north of the range the associated overstorey species are *Eucalyptus laevopinea*, *E. saligna* and *E. campanulata*. Southern populations occur in open eucalypt woodland dominated by *E. amplifolia* with an understorey shrubland dominated by *Allocasuarina* spp. and *Bursaria* spp. Sites on alluvial floodplains are dominated by eucalypts including *E. elata, E. piperita* and *E. punctata* with the understorey commonly consisting of *Bursaria spinosa* and *Pteridium esculentum*.

6.1.2 Distribution and abundance and security

In 2014, as part of a determination to upgrade the listing of the species from vulnerable to endangered in NSW, the NSW Scientific Committee (2014) stated that *P. brunnea* was known from 24 scattered populations in five regions in NSW (Walcha, Wollemi and lower Colo, the Upper Hunter Valley, the Capertee Valley) with 18 of the 24 sites around the Nepean River and associated tributaries around Camden and Bargo (NSW Scientific Committee 2014).

Bremner (in litt June 2012 to NSW Scientific Committee) reported 190 plants in 10 of 18 sites in south-west Sydney.

A review of the BioNet Atlas in 2022 shows additional records for this species to the 24 locations reported by the NSW Scientific Committee (Figure 23). These include:

- A Biodiversity Stewardship Agreement Site at Kentlyn in 2019 – 8 plants 2019
- A Biodiversity Stewardship Agreement Site at Macquarie Fields – 11 plants in 2019
- Lake Burragorang, Yerranderie State Conservation Area - 150 individuals recorded in 2016.

In 2021 DAWE notes that the species had been recorded from 35 locations/subpopulations (33 in NSW and two in Victoria) with at least 1,200 plants in NSW (mainly as a result of increased survey effort following the 2011 Recovery Plan (Sutter 2011) which has now ceased effect . Of the 33 NSW locations, records at four are over 40 years old and it is not known if the species is still extant at these sites (DAWE 2021). Of the sub populations in NSW, around 20 are within proximity to the action area and total over 1,000 plants (Figure 23:

- two at Spring Farm (west and east) – 500 – 600 plants (re-introduced in 2005)
- two at Elizabeth Macarthur Agricultural Institute (south and south east) – numbers not known
- one at Nepean River, Douglas Park – 30 plants in 2016.
- One at Tahmoor – 3 plants in 1997

- Two at Bargo (Wirrimbirra Sanctuary and Dogtrap Creek (300-350 plants)
- Cordeaux Dam
- Upper Nepean SCA
- Pheasants Nest
- Picton
- Appin
- Camden Airport
- Georges River and
- Lake Buragorang

A total of 252 *Pomaderris brunnea* individuals were identified at 10 locations in the study area during surveys between 2016 and 2020, with an additional five plants recorded outside the action area within the Sydney Water corridor which bisects the action area.

There are also an unknown number of plants in the Beulah Biobank site on the southern boundary of the study area, and a further 24 locations (number of plants unknown) recorded east of Appin Road in February and May 2019 as part of the DPI&E Greater Macarthur Strategic Assessment/Cumberland Conservation Plan Program (Openlines 2020 and DPIE 2020).

Within the study area, *Pomaderris brunnea* was restricted to Shale Sandstone Transition Forest, or at the ecotone of this community and adjacent vegetation communities. The *Pomaderris brunnea* individuals in the action area are all within the riparian corridors of a higher Strahler stream order classification including Nepean River, Nepean Creek and Woodhouse Creek.

The location of records of and the extent of potential habitat for *Pomaderris brunnea* within the study area are shown in Figure 24.

Whilst the conservation status of many of these additional population are unknown, and likely not secure, within the Gilead area and locality, the population within the Beulah Biobank site is permanently protected for conservation as a registered Biobank site, the populations east of Appin Road are proposed Biodiversity Stewardship sites and a further 209 ha of potential habitat, known to contain at least 249 individuals, is proposed for permanent protection within the study area.

6.1.3 Assessment of the 2019 / 2020 bushfires

Mapping of the extent of the 2019 / 2020 bushfires shows that the impacts to the locality were marginal, with very small portions of the western extent affected (Figure 25). Within the IBRA region, four known locations for *Pomaderris brunnea* were affected by the fires. However, within the action area and other areas within the IBRA region known to contain *Pomaderris brunnea* were not affected by the 2019 / 2020 fires. Given that there are numerous known locations of *Pomaderris brunnea* un affected by the bushfires, the importance of the action area for this species is unlikely to have increased.

6.1.4 Direct impacts

The proposed action would remove two (2) *Pomaderris brunnea* individuals within the development footprint (Figure 24). The proposed action would conserve and manage in-perpetuity the remaining 249 *Pomaderris brunnea* individuals in the action area as part of the proposed Stewardship Agreement sites

with a further individual 'retained' in passive open space adjacent to these BSAs. It is noted that since the field surveys were completed and grazing has been removed from some of the offset areas, additional plants have been recorded regenerating. It is therefore quite likely that there are significantly more than 249 plants in the offset areas.

6.1.5 Indirect impacts

Indirect impacts to *Pomaderris brunnea* individuals include weed invasion, sedimentation and erosion and changes to hydrology and water flows. All indirect impacts associated with the proposed action would be managed as part of the implementation of the CEMP (**Appendix N**) and the proposed Stewardship Agreement site management plans. The management actions associated with the Stewardship Agreement sites will continue in-perpetuity and will be complemented by the CEMP which will also manage potential indirect impacts in the development footprint during construction. Therefore, potential indirect impacts would be managed at all stages of the development such that they would be negligible.

6.1.6 Application of the Significant Impact Criteria

DAWE considered that there were 'likely to be significant residual impacts' to *Pomaderris brunnea* resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts to 255 plants, with only two plants being impacted, that the proposed action is unlikely to constitute a significant impact to this species (Table 18) and this impact will be fully offset (meeting 3,675% of EPBC Offset target met as per Table 29).

Table 18: Application of the Significant Impact Criteria with respect to *Pomaderris brunnea*

Criteria	Application
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an **important population** of a species	The Conservation Advice for *Pomaderris brunnea* (DAWE 2021) states that there is insufficient information available to be able to describe important populations for this species and that until such information is available, all populations of the species should be considered important. The action is not likely to lead to a long-term decline in the size of this important population as the proposed action will only affect two individuals out of a local population of over 250 plants (including 255 remaining in the action area and additional plants within the Beulah Biobank site). As part of the proposed action, 249 of these plants would be conserved and managed in-perpetuity as part of the on-site Stewardship Agreement sites. The proposed action would thus permanently remove less than 1% of the local subpopulation. Although this is a decrease in the number of individuals, the proposed action is unlikely to lead to a long-term decrease in the size of the population as the active conservation management of the 249 individuals and their habitat is likely to lead to a long-term increase in the size of the local population.
reduce the area of occupancy of an important population	The proposed action will lead to a small reduction in the area of occupancy of an important population. The development footprint is concentrated in areas of cleared land that have been pasture improved and used for agricultural purposes. In some areas, small portions of the development footprint overlap with areas of suitable habitat for *Pomaderris brunnea,* however, this habitat is considered to be in poor/degraded condition as a result of past agricultural practices and pasture improvement. However, a

Criteria	Application
	majority of the suitable habitat (208 ha) and area where the species is present is located in the Stewardship Agreement sites and will not be affected as part of the proposed action. The reduction in area of occupancy is considered negligible and is unlikely to cause a significant impact to this important population of *Pomaderris brunnea*.
fragment an existing important population into two or more populations	The proposal will not fragment an existing important population into two or more populations. The proposed action will permanently conserve 249 individuals that are within vegetation that is connected throughout the landscape, and between individuals. The Stewardship Agreement sites will conserve this connectivity in-perpetuity.
adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the species has not been defined under section 207A of the EP&A Act (DAEWE 2021)
disrupt the breeding cycle of an important population	The proposed action is unlikely to disrupt the breeding cycle of *Pomaderris brunnea*. The proposed action would affect two plants within the action area. This species reproduces by producing seeds when the plant is at least 4 – 6 years old. The proposed action would reduce the number of individuals in the action area by <1%. The remaining 99% (or 249 individuals) will be conserved in Stewardship Agreement sites (BSAs) within the action area. As part of the BSAs, indirect impacts such as weed invasion, sedimentation and erosion and changes to hydrology would be managed such that the impacts would be negligible and would not impact the breeding cycle of this 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 action would affect habitat for two *Pomaderris brunnea* individuals which is in poor/degraded condition. As part of the proposed action, 249 *Pomaderris brunnea* individuals and their habitat would be conserved and managed in-perpetuity as part of the on-site Stewardship Agreement sites. The habitat to be conserved and managed is 208 ha in area, will be managed to improve or maintain the quality of habitat, will increase the extent of habitat through restoration of cleared lands within the Stewardship Agreement sites and contains 249 individuals. The area of habitat to be affected is unlikely to contribute to the species' decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed action would not result in invasive species that are harmful to *Pomaderris brunnea* becoming established in the species' habitat. The 249 individuals /208 ha of habitat will be conserved and managed as part of three BSAs where indirect impacts such as weed invasion will be managed in-perpetuity. The development footprint has also been buffered 30 m to further mitigate any indirect impacts, including invasive species impacting the conserved *Pomaderris brunnea* individuals.
Introduce disease that may cause the species to decline	There are no diseases known that may lead to a decline in the species. The proposed action includes a commitment to implement a CEMP (see section 8.4 and **Appendix N**) that will include a hygiene protocol to minimise the risk of introducing *Phytophthora cinnamomi* and other soil pathogens.
Interfere substantially with the recovery of the species	The proposed action will not interfere substantially with the recovery of the species, on the contrary, the conservation commitments will lead to a substantial improvement in the recovery of the species. The proposed development may also contribute to understanding the extent and size of the population and areas that could form critical habitat.

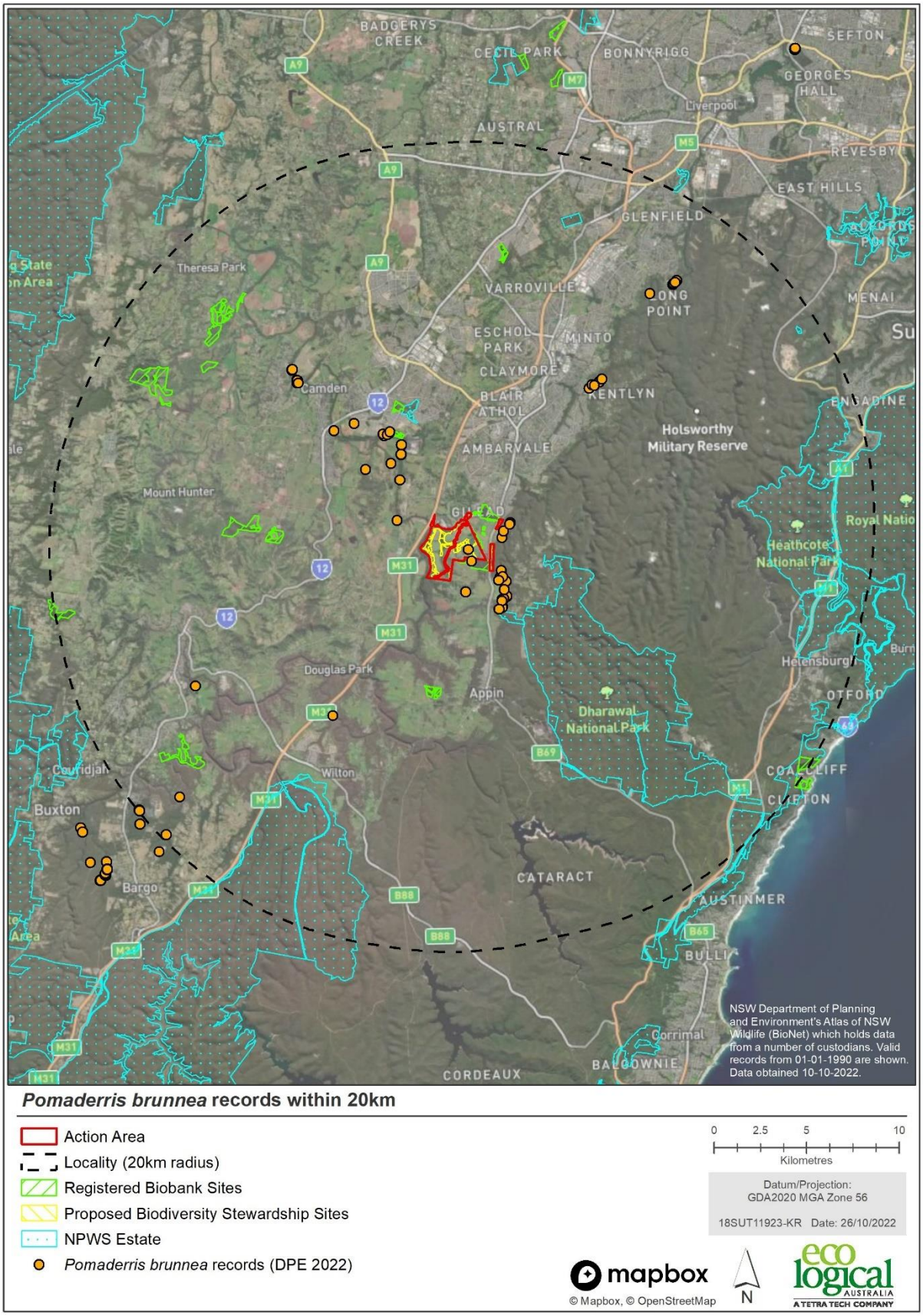


Figure 23: Records for *Pomaderris brunnea* within a 20 km radius of the action area

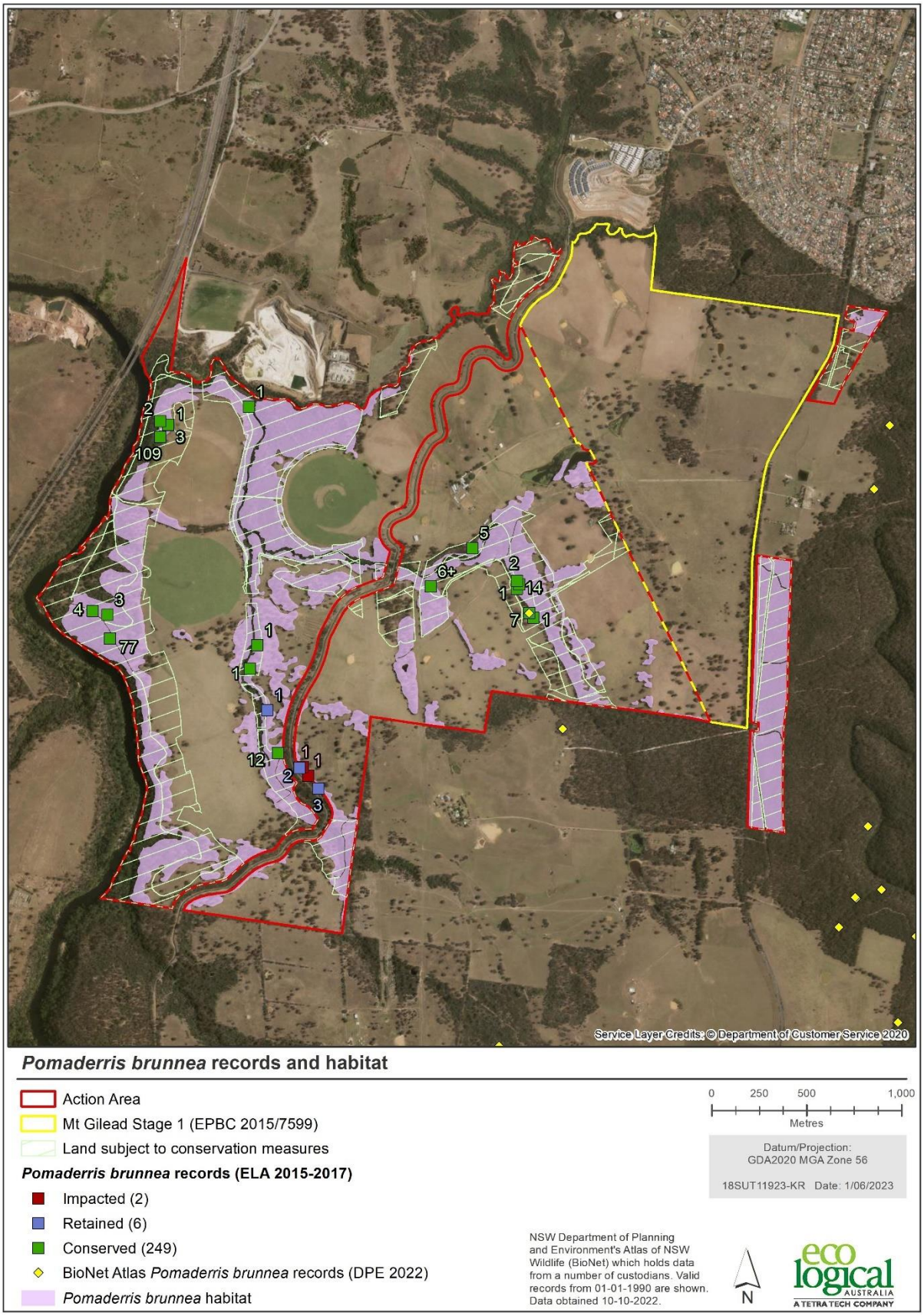


Figure 24: Records for *Pomaderris brunnea* in the action area and areas of potential habitat

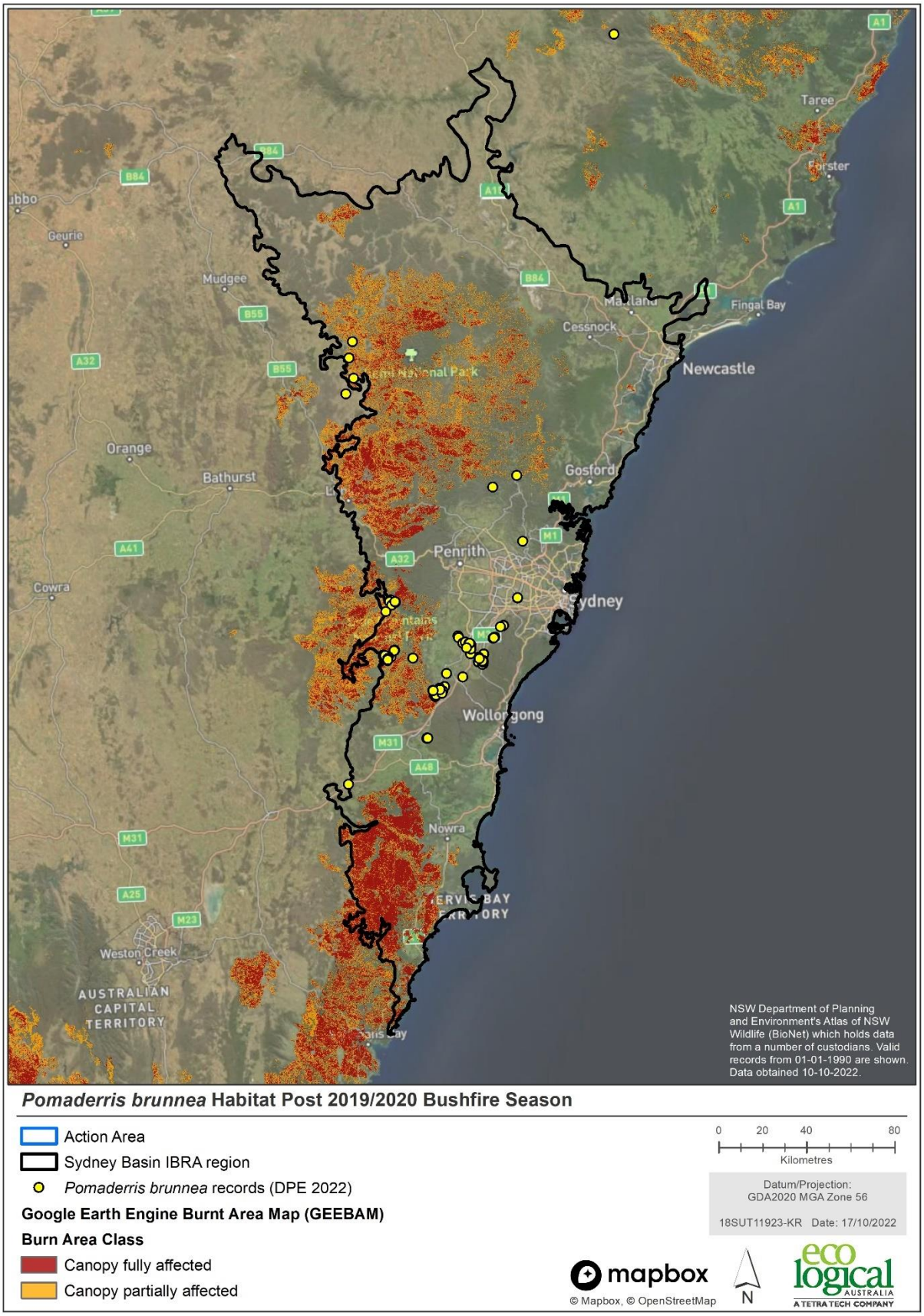


Figure 25: Impacts of the 2019 / 2020 bushfires in relation to *Pomaderris brunnea*

7. Impacts to threatened fauna

7.1 Koala *(Phascolarctos cinereus)*

7.1.1 Species ecology

The NSW/ACT and Qld population of the Koala was listed as a vulnerable species under the EPBC Act in May 2012. The species conservation status was updated to endangered on 12 February 2022 following the impacts of the 2019/2020 summer bushfires on the species. However, in accordance with section 158A of the EPBC Act, the species is still considered a 'vulnerable' species for the purposes of this PD report, as it was listed as vulnerable at the time of the Controlled Action decision (24 February 2020).

Koalas are associated with a wide range of temperate, tropical and sub-tropical forests as well as semi-arid communities. Koalas organise themselves into breeding aggregations, comprised of a dominant male, a small number of females, and juveniles. They feed almost exclusively on leaves of Eucalyptus species, although they have been known to forage on other genera as well (DotEE 2016). The home range of a Koala depends largely on the quality of the Koala habitat present. In areas of good condition habitat, the home ranges are smaller (1 – 15 ha) and where habitat is in poor condition, home ranges can be >80 ha (DECC 2008). In the Campbelltown area, it has been estimated that Koala occupy home ranges with an average size of 36 ha, but range from 11 to 61 ha (Ward 2002; Biolink 2018).

The quality of the vegetation as Koala habitat is influenced by:

- tree species and size
- size and disturbance history of the habitat patch
- structural diversity of the vegetation
- soil nutrients, climate and rainfall.

This corresponds to their diet which is comprised mostly of eucalyptus leaves (DECC 2008). Throughout NSW, the Koala feeds on 66 eucalypt and seven non-eucalypt species, however, within a site, the species will show a strong preference to a small selection of preferred species. The preferred species varies widely depending on the region and possibly seasons (DECC 2008). There is evidence to suggest that vegetation which is structurally diverse with mature trees >50 cm DBH are preferred by the Koala, particularly in areas with fertile soils (DECC 2008). The Koala will also use younger trees and trees with new leaves because the amount of tannins, phenolics and fibre and a higher concentration of moisture and nitrogen (DECC 2008).

Areas of vegetation that have been previously disturbed, fragmented or isolated from other areas of habitat are less likely to represent long-term habitat. This is due to the lack of structural complexity, higher chance of predation and limited resource availability throughout the patch of vegetation (DECC 2008).

In the Campbelltown area, Biolink (2018) identifies eight primary, secondary and supplementary preferred food tree species (*Eucalyptus tereticornis, E. viminalis, E. longifolia, E. moluccana, E. punctata, E. agglomerata, E. consideniana* and *E. globoidea*), four of which are present in the study area.

7.1.2 Local distribution

The "Campbelltown/Wedderburn" Koala population (referred to as the Campbelltown, Wollondilly and southern highlands regional population by the DPIE (2019)) extends from the Georges River National Park north of Heathcote Road in the Liverpool LGA, west to Heathcote National Park along the Princes Highway in the Sutherland LGA, along the Georges River Catchment in the Campbelltown LGA from Minto Heights/Kentlyn in the north, through the Holsworthy Military Area and Wedderburn Plateau to Gilead and then south to Wilton and the Southern Highlands in the Wollondilly LGA (Figure 26). The area includes the Dharawal National Park and Upper Nepean State Conservation Area as well as the Special Management Areas of the Avon, Cordeaux, Cataract and Woronora catchments and are separated by a number of major arterial roads joining major population centres including the Princes Hwy and Heathcote Road in the east, Appin and Picton Roads in the south and the Hume Motorway in the west.

These roads are a significant source of road mortality with reports of six road kills along Heathcote Road in 2018 and over 23 road kills along Appin Road between 2010 and 2018. In response to this major threat to the local Koala population, the NSW Roads and Maritime Services have installed Koala exclusion fencing and underpasses along sections of Picton Road and have proposed exclusion fencing along Appin Road as part of the upgrade of this road (RMS 2018).

The "area of extent" of the northern part of this regional population is approximately 51,000 ha (excluding records to the east of the Princes Hwy and south of Picton Road), although not all of this area is high quality Koala habitat and not all is occupied by Koalas. High quality Koala habitat, and areas occupied by Koala is patchy throughout this range with higher quality habitat and high numbers of observations since the 1980's being in the Georges River corridor (Figure 26). Koala records have been less frequent in areas of poorer quality habitat or modified habitat on rural land.

Biolink (2018) estimates the 'area of occupancy' within the Campbelltown LGA at 6,857 ha, 46.42% of which is estimated to be currently occupied, allowing a population estimate of 177 +/- 12 Koalas. This estimate has been revised to 300-400 Koalas (in the Campbelltown LGA) as part of a submission to the NSW Upper House Koala enquiry (DPIE 2020). A recent study of the broader Campbelltown-Wollondilly Koala population by DPIE (2019) has estimated Koala density in high quality habitat at 0.052 koalas/ha, leading to an estimate of 433 Koalas in the Campbelltown, Appin and Wilton areas (the Greater Macarthur Growth Area), with 8,292.46 ha of 'core' Koala habitat mapped into primary, secondary and tertiary corridors.

7.1.3 Assessment of the 2019 / 2020 bushfires on the local Koala population

The 2019 / 2020 bushfires did not affect any Koala habitat within the action area or the Campbelltown area. Within the broader region, impacts to preferred Koala habitat were minimal, with impacts concentrated at the western extent of the locality (Figure 26). Within the Sydney Basin IBRA region, impacts will be temporary and are concentrated along the western and southern extents of the region (Figure 29). In relation to Koala habitat, areas that were temporarily affected are likely to contain Koala habitat which has been determined through the presence of records in these areas. Koalas have an average home range of around 36 ha in the region depending on the condition and quality of the habitat. As such, any Koalas affected by the 2019 / 2020 bushfires are unlikely to increase their reliance on the action area. This is because the action area is about 20 km east of the nearest fire affected area. However, in consideration of survival, the action area may increase in temporary importance whilst the

affected habitat regenerates to a state such that it can provide habitat and be recolonised by Koala's in the future.

7.1.4 Distribution of Koalas in the study / action area

Evidence of the Koala (faecal pellets and sightings; BioLink 2018; ELA 2016, ELA 2017, ELA 2018, ELA 2019, ELA 2020, Wild Conservation 2021 & 2022) were identified across the action area (Figure 30). The species was recorded by remote cameras along the Nepean River corridor (2016), and spotlighting surveys in the proposed Brown Bush BSA site in 2020 and a single animal within the development precincts in thermal imaging drone surveys in 2021 and five in 2022 (Wild Conservation 2021 & 2022). These same surveys recorded high numbers of Koala's in the Beulah Biobank site (4), Noorumba Biobank site (3) and Browns Bush area (11). A majority of the records in the action area are concentrated along the riparian corridors, where habitat is in better condition and there are continuous links to other areas of native vegetation. There are only scattered records for the Koala in poorer condition areas of vegetation, and where these are present, they are immediately adjacent and continuous with vegetation along the riparian corridor.

7.1.5 Direct impacts

The proposed action will directly, partially and indirectly impact up to 47.87 ha of Koala habitat in various condition states (Table 21 and Figure 30) representing habitat for around two to three Koalas at 0.052 Koalas/ha (DPIE 2019). These impacts are comprised of 3.07 ha of high condition habitat (intact areas of CPW, RFEF and SSTF), 11.41 ha of moderate condition habitat (thinned and under-scrubbed / grazed areas of CPW and SSTF) and 33.39 ha of low condition habitat (scattered paddock trees of mainly SSTF comprising largely, non-browse species (Ironbark's and Spotted Gum).

The proposed action will permanently protect in dedicated conservation areas and enhance the quality (and thus carrying capacity) of 208.11 ha of habitat in an approximate 300 ha Gilead Koala Conservation Area (Figure 32). This comprises 151.58 ha of existing high, moderate and low quality Koala habitat and restoration of 56.54 ha of Koala habitat in two registered Biodiversity Stewardship sites (providing habitat for around 10-11 adult koalas at 0.052 Koalas/ha (DPIE 2019) and a further 90 or so hectares of accessible Koala habitat comprising the outer APZ, re-vegetated detention basins, open space areas and easements that buffer the conservation areas from the pressures of urban development. This entire area will be fenced with Koala exclusion fencing to prevent access by dogs (Figure 32, Figure 56 and Table 19).

None of the primary Koala corridors identified by DPIE (2019) and the CPCP (DPIE 2020b) will be affected by the proposed action (Figure 31), other than by the temporary impacts associated with roads that will span across Woodhouse, Nepean and Menangle Creeks and retain connectivity beneath. The secondary corridors identified along Menangle and Woodhouse Creeks will be retained and enhanced by the full restoration of Koala habitat and additional landscape plantings with Koala browse species in open space areas, leading to corridors which are consistent with the corridor requirements outlined by the Chief Scientist and Engineer (CS&E) for Woodhouse and Menangle Creeks. This is further described in Section 8.3.2.3. Larger habitat nodes will also be provided along the lengths of these corridors to maintain connectivity and movement options between the primary corridor in the Georges River catchment and the Nepean River corridor enhanced by proposed Koala underpasses at Glen Lorne / Noorumba Reserve and Browns Bush / Beulah Biobank site (subject to NSW Government approval) (Figure 31). The width and area of each of these corridors (greater than 105 ha and providing habitat for a single breeding

aggregate of one adult male and two female koala's) will provide sufficient habitat to sustain the home ranges of resident Koalas and allow gene flow to the broader population as described by Koala expert, Dr Steve Phillips, in his advice to Campbelltown Council (Biolink 2020). Proposed road crossings of Woodhouse, Nepean and Menangle Creeks will be elevated, fenced and provide continuity of corridors and habitat underneath.

Table 19: Koala habitat to be affected and conserved in the action area

Status	Habitat Quality			
	High	**Moderate**	**Low**	**Total**
Impacts				
Direct Impacts (Urban areas)	1.13	8.94	20.63	**30.71**
Temp Impacts (Detention Basins/Bridges)	0.53	0.61	2.70	**3.85**
Partial impacts (Open Space, APZ and bush walking path)	1.41	1.19	8.91	**11.50**
No Access	0.00	0.67	1.14	**1.81**
Total	**3.07**	**11.41**	**33.39**	**47.87**
Conservation Areas				
Existing Habitat (BSA sites)	106.33	20.77	24.47	**151.58**
Habitat to be restored (within BSA sites)				**56.54**
Retained habitat	8.99	8.61	7.58	**25.19**
Retained habitat (Browns Bush)	22.43	1.09	0.05	**23.57**
Total	**137.75**	**30.47**	**32.1**	**256.88**

***High quality Koala habitat is intact vegetation with a high proportion of preferred browse species (e.g. Red Gum, Grey Box), Moderate quality Koala habitat is thinned and pasture improved woodland with ahigh proportion of preferred browse species (e.g. Red Gum, Grey Box), Low quality Koala habitat is thinned and pasture improved woodland with a low proportion of preferred browse species, dominated by Ironbark's.

7.1.6 Indirect impacts

In addition to these direct impacts, there will be a number of potential indirect impacts to Koala resulting from 'edge effects' to conserved habitat, potential increased collision of Koala with roads and dog attacks resulting from the proposed residential development, unless these indirect impacts are appropriately mitigated and managed.

The proposed conservation areas will be registered as Biodiversity Stewardship Agreement sites that will prohibit dogs. The conservation areas are buffered by a managed 30m 'buffer zone' between the urban interface/outer perimeter roads and offset areas to reduce the impacts of edge effects. The two Stewardship Agreement sites within the action area form part of the Mt Gilead Koala Conservation Area which includes areas of outer APZ, 19.13 ha of revegetated detention basins and passive open space areas inside the Koala Exclusion Fence that will be installed along the Biodiversity Stewardship side of the perimeter roads to minimise indirect impacts. Koala grids will also be installed to prevent Koalas entering the residential development but allow for walking paths inside the fence where dogs are prohibited. There are off-leash fenced dog parks (that are not within the Koala Conservation Area) that will be part of the development.

A Koala Management Plan has been prepared (**Appendix M**) and when implemented will manage adverse Koala impacts during construction (pre-clearance surveys, fencing of protected areas) and provide for the on-going management and monitoring of the local Koala population (including the management of dogs in open space areas adjacent to conservation areas, restricting traffic on local roads to 50 kph, road signage warning of the presence of Koalas, traffic calming devices and local community education and involvement programs).

These mitigation measures are discussed in more detail in Section 8 of this report.

7.1.7 Application of the Significant Impact Criteria

With reference to the EPBC Act referral guidelines for the koala as a vulnerable species (DotEE 2014) at the date of the Controlled Action Decision (refer to Section 158A of the EPBC Act) and the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013), an application of the habitat assessment tool that assesses whether 'habitat critical to the survival of the koala' exists in the action area (Table 4 within the referral guidelines), concluded that the project will impact 'habitat critical to the survival of the koala'. This is because a score of **'8'** was calculated using the habitat assessment tool (Table 20), and scores greater than five (5) are considered to contain 'habitat critical to the survival of the koala' according to Section 6 the referral guidelines (DotEE 2014).

Table 20: Koala habitat assessment tool

Attribute	Application of coastal areas criteria	Score
Koala occurrence	Evidence of one or more Koalas within the last two years	2
Vegetation composition	The site has forest or woodland with 2 or more known Koala food tree species	2
Habitat connectivity	Area part of a contiguous landscape ≥500 ha	2
Key existing threats	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present, in areas that score 1 or 2 for Koala occurrence	1
Recovery value	It is uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context	1
Total		8

Further consideration to the scoring is discussed below. According to Section 7 of the referral guidelines, significant impacts depend on a number of factors in combination when clearing >20 ha of habitat containing known Koala food trees in an area with a habitat score ≥ 8. These factors include:

- The score calculated for the impact area (higher score = greater risk of significant impact).
- Amount of koala habitat being cleared (more habitat cleared = greater risk of significant impact).
- Method of clearing (i.e. clear-felling has greater risk of significant impact than selective felling with understorey and koala food tree retention).
- The density or abundance of koalas (relatively high density or abundance for the region means greater risk of significant impact).
- Level of fragmentation.

These factors have been considered in the application of the significant impact criteria (Table 21).

Whilst the proposed action is likely to adversely affect 'habitat critical to the survival of the koala' (Section 7 of referral guidelines) the action is not considered to substantially interfere with the recovery of the local Koala population as it will enhance the security of the population by addressing one of the main threats to the local koala population, road mortality along Appin Road (Section 8 of referral guidelines). This is because the following impacts are unlikely to occur, or will be minimal as a result of proposed mitigation measures that form part of the project:

- *Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities*.

Whilst increased koala fatalities from dog attacks may occur, as there will likely be an increase in dog numbers associated with the future residential use of the area, in addition to all conservation areas being fenced with dog proof fencing all housing lots will be required to have dog proof fencing consistent with the recommendations in the CCC Koala Management Plan (Biolink 2018) and the Figtree Hill Home Design Guidelines (Lendlease 2022), dogs will be required to be controlled at all times by owners in public spaces where there will be dedicated, fenced, dog off leash areas and dogs will be prohibited in proposed conservation areas (Stewardship Agreement sites). These areas will be actively managed and subject to enforcement powers under the Local Government and Companions Animals Acts.

- *Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.*

Whilst increased koala fatalities from vehicle strike may occur as there will be an increase in traffic volume in the area associated with an increased population, all local and perimeter roads within the proposed development will have a maximum speed limit of 50 km/h and will be associated with traffic calming measures and signage consistent with the approved Koala Management Plan for Mt Gilead Stage 1 (ELA 2019b). A draft Koala Management Plan has been prepared for Stage 2 (**Appendix M**; ELA 2023c).

- *Facilitating the introduction or spread of disease or pathogens for example Chlamydia or Phytophthora cinnamomi, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.*

Mitigation measures will be in place to prevent and minimise the introduction or spread of disease or pathogens as a result of the proposed action consistent with the approved CEMP for Stage 1 and its hygiene protocols (ELA 2019a) . A draft CEMP has been prepared for Mt Gilead Stage 2 (**Appendix N**; ELA 2023b).

- *Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.*

None of the primary Koala corridors identified by DPIE (2019) will be affected by the proposed action (Figure 31). The secondary corridors identified along Menangle and Woodhouse Creeks will be retained and enhanced by the full restoration of Koala habitat and additional landscape plantings with Koala browse species in open space areas, leading to corridors up to 400m wide. Larger habitat nodes will also

be provided along the lengths of these corridors to maintain connectivity and movement options between the primary corridor in the Georges River catchment and the Nepean River corridor. The width and area of these corridors will provide sufficient habitat to sustain the home ranges of resident Koalas and allow gene flow to the broader population. The corridor widths are consistent with the corridor requirements outlined by the Chief Scientist and Engineer (CS&E) for Woodhouse and Menangle Creeks. The width and area of each of these corridors (greater than 105 ha and providing a single breeding aggregate of one adult male and two female koala's) will provide sufficient habitat to sustain the home ranges of resident Koalas and allow gene flow to the broader population as described by Koala expert, Dr Steve Phillips, in his advice to Campbelltown Council (Biolink 2020).

Proposed road crossings of Woodhouse and Nepean Creeks will be elevated and provide continuity of corridors and habitat below. A variation to the Koala Management Plan for Mt Gilead Stage 1 (EPBC 2015/7599) proposes two Koala underpasses at Browns Bush / Beulah and Glen Lorne / Noorumba (Figure 32 and Figure 56), consistent with the recommendations of the CS&E (and Biolink 2018) to provide maximum functionality for the Woodhouse and Menangle Creek corridors. Creek crossings will be staged over 15 years such that habitat along Nepean and Menangle Creeks will remain intact until the crossing of Woodhouse Creek and protection of the corridor is complete.

- *Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.*

Water Sensitive Urban Design (WSUD), comprising vegetated swales into the streetscape, vegetated filter strips located within parks adjacent or upslope of riparian corridors, Gross Pollutant Traps strategically located at outlet of stormwater drainage systems, bio-retention/filtration system located at the outlets of stormwater drainage system) will be incorporated into the development. The bio-retention basins treat for water borne pollutants such as nutrients and suspended solids and reduce discharge rates into riparian areas after heavy rainfall events, reducing instream erosion (Refer to Section 8). No streams will be directly affected by the proposed action, and as a result of the WSUD, it is unlikely that any changes in surface flows will be to the extent that it will degrade habitat critical to the survival of the Koala.

The NSW Koala recovery plan (DECC 2008) does not identify any 'important populations' but does identify the Campbelltown-Wedderburn population as a key population in the Central Coast Koala Management Area. However, the updated EPBC Act Conservation Advice (DAWE 2022) defines important populations as those that are valued for cultural, social and economic reasons as well as for species conservation and includes those populations that have the potential to act as source populations, are disease free or that are geographical outliers within the species range. The Campbelltown Koala population meets these criteria and would be considered an 'important population' for the species in relation to the application of the EPBC Act significant impact criteria.

DAWE considered that there were 'likely to be significant residual impacts to Koala resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts, and the proposed mitigations measures that will lead to increased protection of Koala and mitigation of a significant mortality factor (Koala fencing and fauna underpasses) that the proposed action is unlikely to constitute a significant impact to this species (Table 21). Despite this conclusion, significant offsets to protect and enhance Koala habitat in the action area are provided which meet over 200% of the EPBC

offset targets as a vulnerable species by protecting existing habitat only (224% and 294% with restored habitat) or 200% with protection and management of existing habitat only as an endangered species (and 241% with restored habitat) (Table 29).

Table 21: Application of the Significant Impact Criteria with respect to the Koala

Criteria	Application
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	The action is not likely to lead to a long term decline in the size of an 'important population'. The action area forms part of the broader Campbelltown/Wollondilly Koala population, which is concentrated on the eastern side of Appin Road along the Georges River corridor south to Appin, Wilton and the southern highlands. Historical records for the Koala suggest that, although present in the action area and on the western side of Appin Road, the density is lower than the eastern side (Figure 26). The proposed action would result in the permanent loss of 30.71 ha of Koala habitat over 10 years (mostly low quality, scattered paddock trees that are not preferred Koala browse species), modification to a further 11.50 ha of koala habitat in Open Space and APZs, temporary loss of up to 3.85 ha during the establishment of detention basins that will be fully revegetated to the original vegetation types with Koala browse species, and no access to 1.81 ha of habitat that is outside of the Koala fence, i.e. up to 47.87 ha of Koala habitat (Table 19) of which 3.07 ha is in high condition, 11.41 ha is in moderate condition and 33.39 ha is in low condition (scattered paddock trees comprising mainly non Koala browse species). The habitat to be removed represents habitat for around three adult Koalas. The habitat to be removed will be offset by the permanent protection and enhancement of 208.11 ha of habitat and important movement corridors in two registered Biodiversity Stewardship Agreement sites that includes 56.54 ha of restoration of cleared land. An additional 90 or so ha of land, comprising outer APZs, open space, revegetated detention basins and easements will be managed for Koala habitat within the proposed Koala exclusion fencing, forming a 300 ha Koala Conservation Area within the study area. The Gilead Koala Conservation Area will support around 15-16 adult Koalas at average densities for the locality. A majority of the habitat to be retained is in good condition (high quality habitat), is structurally complex and contains a high proportion of feed tree species that the Koala is known to prefer in the locality. These conservation measures form part of the Mt Gilead Koala Conservation Area which will deliver a total of around 300 ha of Koala habitat that will form continuous, vegetated corridors throughout the action area liking the Georges and Nepean River primary Koala corridors. This koala habitat restoration program is proposed to commence prior to any loss of Koala habitat and restored areas will be well established before clearing is required in the later stages of development. The in-perpetuity conservation of 208.11 ha of Koala habitat in dedicated offset areas, including movement corridors would lead to a long term increase in the Koala carrying capacity of the study area fully offsetting the impacts.

Criteria	Application
reduce the area of occupancy of an important population	Whilst the proposed action will permanently remove 30.71 ha of Koala habitat (Table 21), of which 20.63 is of low quality and exists as scattered paddock trees. The proposed action will protect and enhance 208.11 ha of Koala habitat that will be managed in-perpetuity which would otherwise continue to degrade under current rural land management practices. This conservation measure forms part of the Mt Gilead Koala Conservation Area which will deliver a total of around 300 ha of Koala habitat that will form continuous, vegetated corridors throughout the action area. The land within the Gilead Koala Conservation Area contribute to the securing of movement corridors throughout the landscape. The proposed action will lead to a small reduction in the current area of occupancy of an important population, however this is unlikely to be significant given the extensive conservation and retention of habitat across the action area.
fragment an existing important population into two or more populations	The proposed action will not fragment an existing important population into two or more populations. The proposed development footprint has been designed to concentrate development in areas where the condition of the vegetation and condition of Koala habitat is poorest. As a result, up to 47.87 ha of Koala habitat would be permanently removed or modified, of which 33.39 ha is of low quality (Table 19). In conjunction with the upgrading of Appin Road (RMS 2018) the proponent has committed, as part of a variation to the Stage 1 development (EPBC 2015/7599) to provide safe fauna underpasses (subject to NSW Government approval) across Appin Road, a current road mortality hotspot, that will allow the safe movement of Koalas across Appin Road and into the secure, fully fenced Woodhouse and Menangle Creek corridors.
adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the species has not been identified at this stage in the Conservation Advice (DAWE 2022). In a recent study of the Campbelltown-Wollondilly Koala population, the DPIE (2019) considered that '*whilst the majority of habitat to be impacted constituted either 'core' or 'supporting habitat' (in terms of presence of Koalas and feed trees),* it did not consider the secondary east-west corridors to be essential for the long term survival of the regional Koala population, as long as the identified primary movement corridors (the Georges and Nepean Rivers corridors (see Figure 31) were protected. Despite this finding, the proposed action will permanently protect and enhance 208.11 ha of core Koala habitat in these secondary corridors and will implement an adaptive Koala Management Plan to monitor the long-term status of the Koala in the action area as recommended by the NSW Chief Scientist and Engineer (NSW CSE 2020). This conservation measure forms part of the Mt Gilead Koala Conservation Area which will deliver a total of around 300 ha of Koala habitat that will form continuous, vegetated corridors throughout the action area. .

Criteria	Application
disrupt the breeding cycle of an important population	The proposal will not disrupt the breeding cycle of the local Koala population. The Mt Gilead Koala Conservation Area which will deliver a total of around 300 ha of Koala habitat that will form continuous, vegetated corridors throughout the action area. This habitat provides connectivity between two identified primary movement corridors identified by DPIE (2019) for the Koala. The Mt Gilead Koala Conservation Area will permanently protect and enhance these corridors through the restoration and revegetation of Koala habitat. The installation of Koala underpasses will also facilitate movement of any resident individuals. The proposed action would not reduce the availability or connectivity of habitat across the action area such that the breeding cycle would be significantly affected.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Whilst the proposal will permanently remove or modify up to 47.87 ha of habitat for the species, the Mt Gilead Koala Conservation Area will permanently protect a total of 208.11 ha of Koala habitat that will form continuous, vegetated corridors throughout the action area. The Mt Gilead Koala Conservation Area will permanently protect and enhance these corridors through the restoration and revegetation of Koala habitat. The installation of Koala underpasses will also facilitate movement of any resident individuals. Although the proposed action would reduce or modify the availability of Koala habitat by up to 47.87 ha over an expected 10 year period, this is unlikely to impact the Koala such that the local Koala population would decline, given the conservation and retention of around 300 ha of habitat, maintenance and enhancement of Koala corridors across the action area, mitigation of current serious threats to the local Koala population (provision of fauna underpasses at Appin Road which is a Koala roadkill hotspot).
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal will not result in invasive species that are harmful to the species becoming established in the species' habitat, as the proposal will permanently protect a 208.11 ha conservation area (in Stewardship Agreement sites) where threats (including invasive species, weeds, grazing by domestic stock) will be managed leading to an improvement in habitat quality from the current degraded habitat that has resulted from generations of agricultural use (cattle grazing).
Introduce disease that may cause the species to decline	The proposal includes a commitment to implement a CEMP (see section 8.4 and **Appendix N**) that includes a hygiene protocol to minimise the risk of introducing *Phytophthora cinnamomi* and other soil pathogens that would lead to a degradation in habitat quality. The proposal will not provide any increased opportunities for Chlamydia infected animals from other populations to mix with the Chlamydia free 'Campbelltown population', as the Gilead Koala are part of the same Chlamydia free population, other than through potential increase stress to animals. The CEMP (and Koala Management Plan) will include a fauna pre-clearance survey to minimise any direct impacts to individual Koalas using habitat in the impact area, and prohibit dogs from Stewardship Agreement site areas post construction via Koala exclusion (and dog proof) fencing.

Criteria	Application
Interfere substantially with the recovery of the species	The proposal will not interfere substantially with the recovery of the species at a local level, on the contrary, the conservation commitments will contribute to the protection and recovery of the species at a local level by the protection and enhancement of significant areas of habitat that is currently not managed for conservation, permanently protecting an east-west movement corridor linking the Georges and Nepean River corridors and via a variation to the Stage 1 development (EPBC 2015/7599), provision of funds to address a major current risk to Koala along Appin Road (fauna underpasses - subject to approval from State Government authorities).

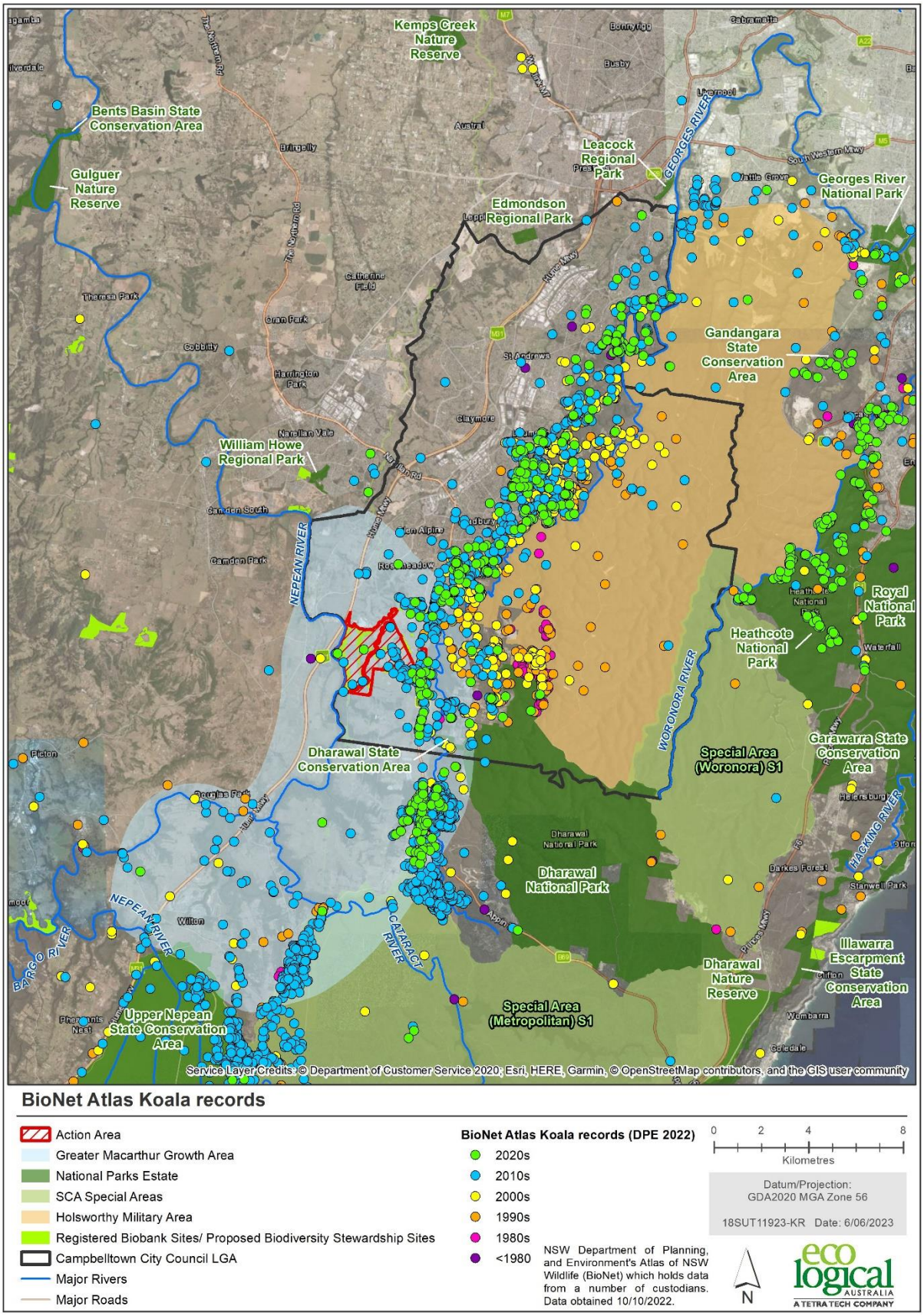


Figure 26: Koala records in the locality since 1980

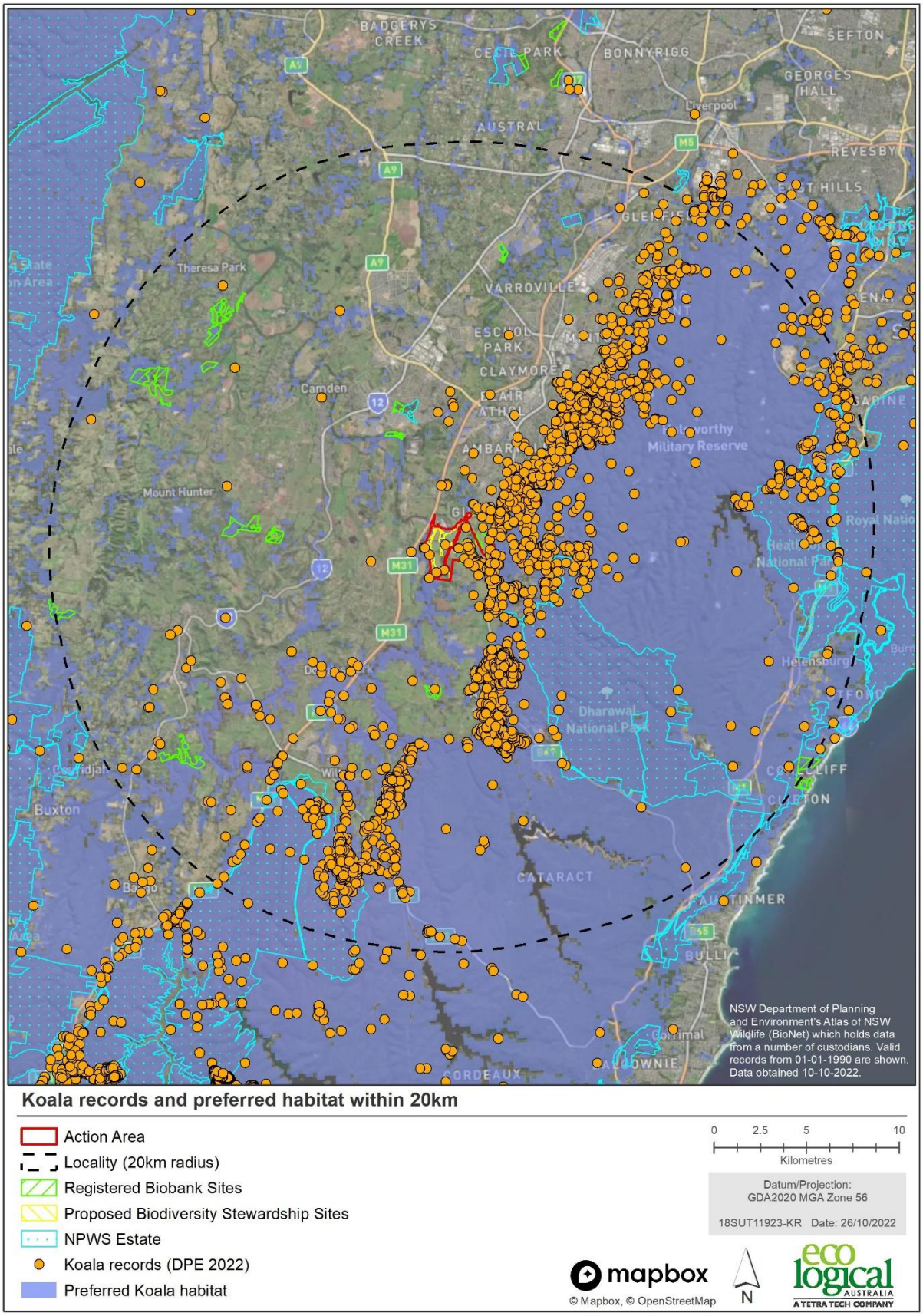


Figure 27: Koala records and preferred habitat within the locality

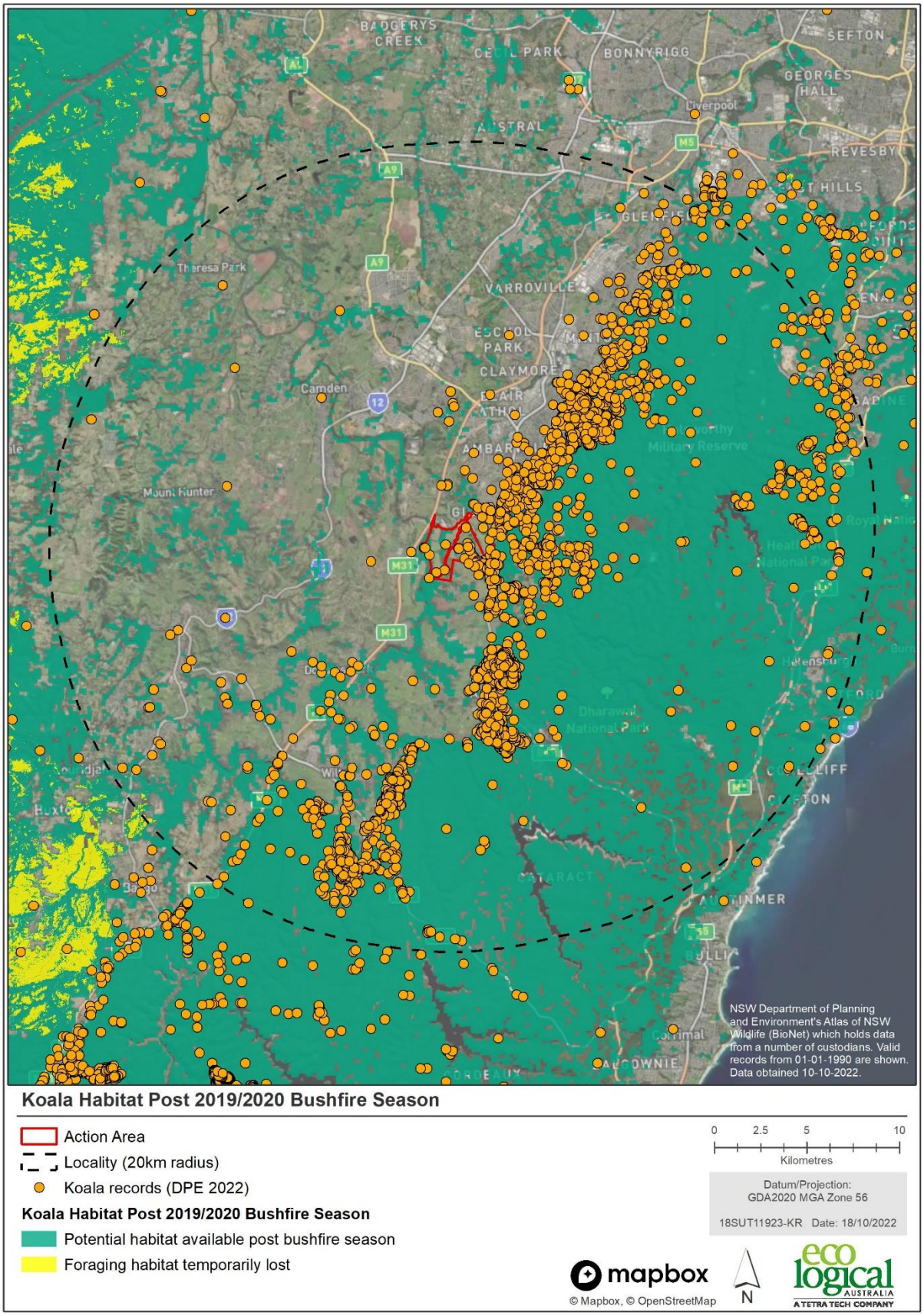


Figure 28: Impacts of the 2019 / 2020 bushfires in relation to Koala habitat in the locality

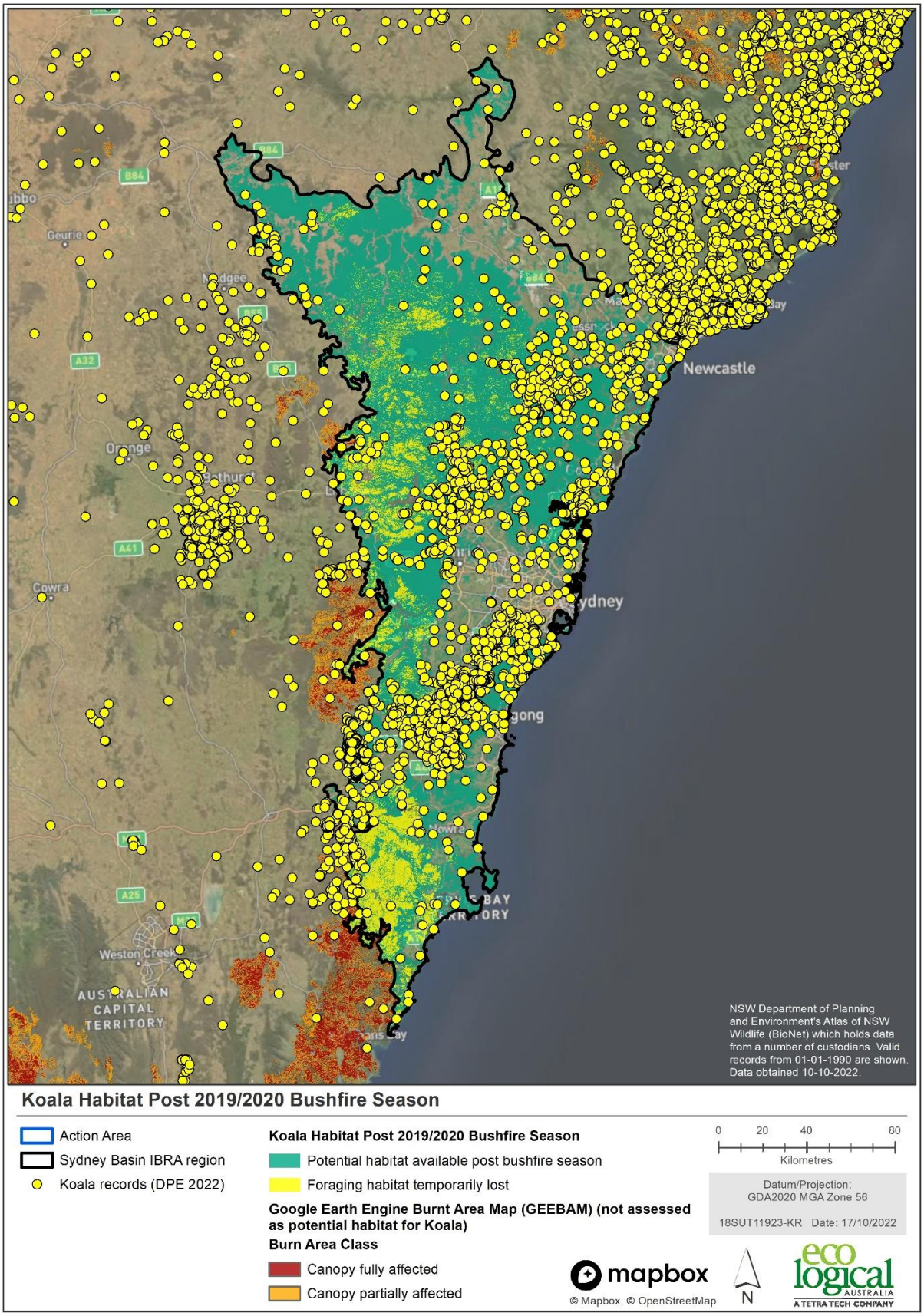


Figure 29: Impacts of the 2019 / 2020 bushfires in the IBRA region in relation to Koala preferred habitat and records

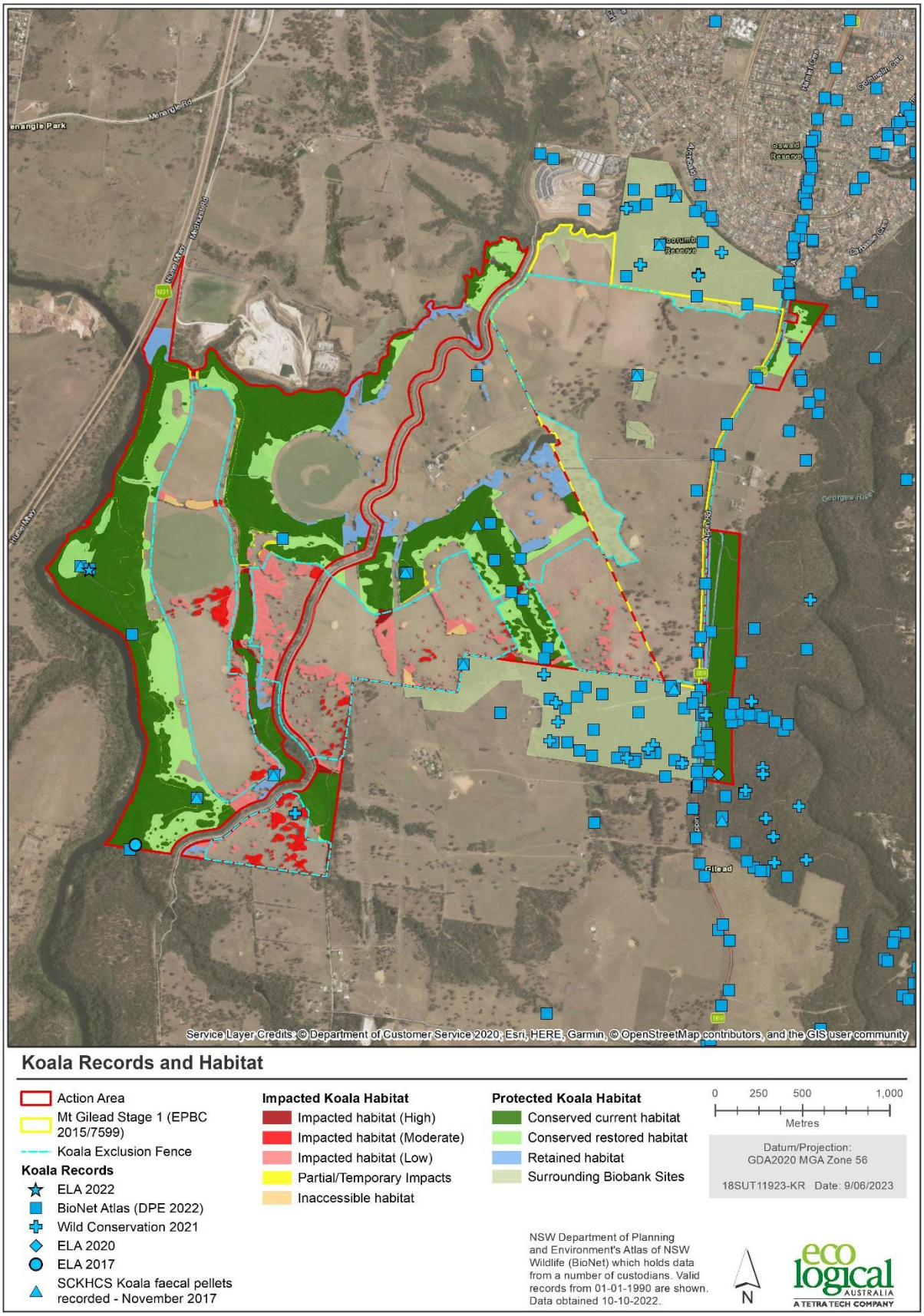


Figure 30: Koala habitat to be removed and conserved across the action area

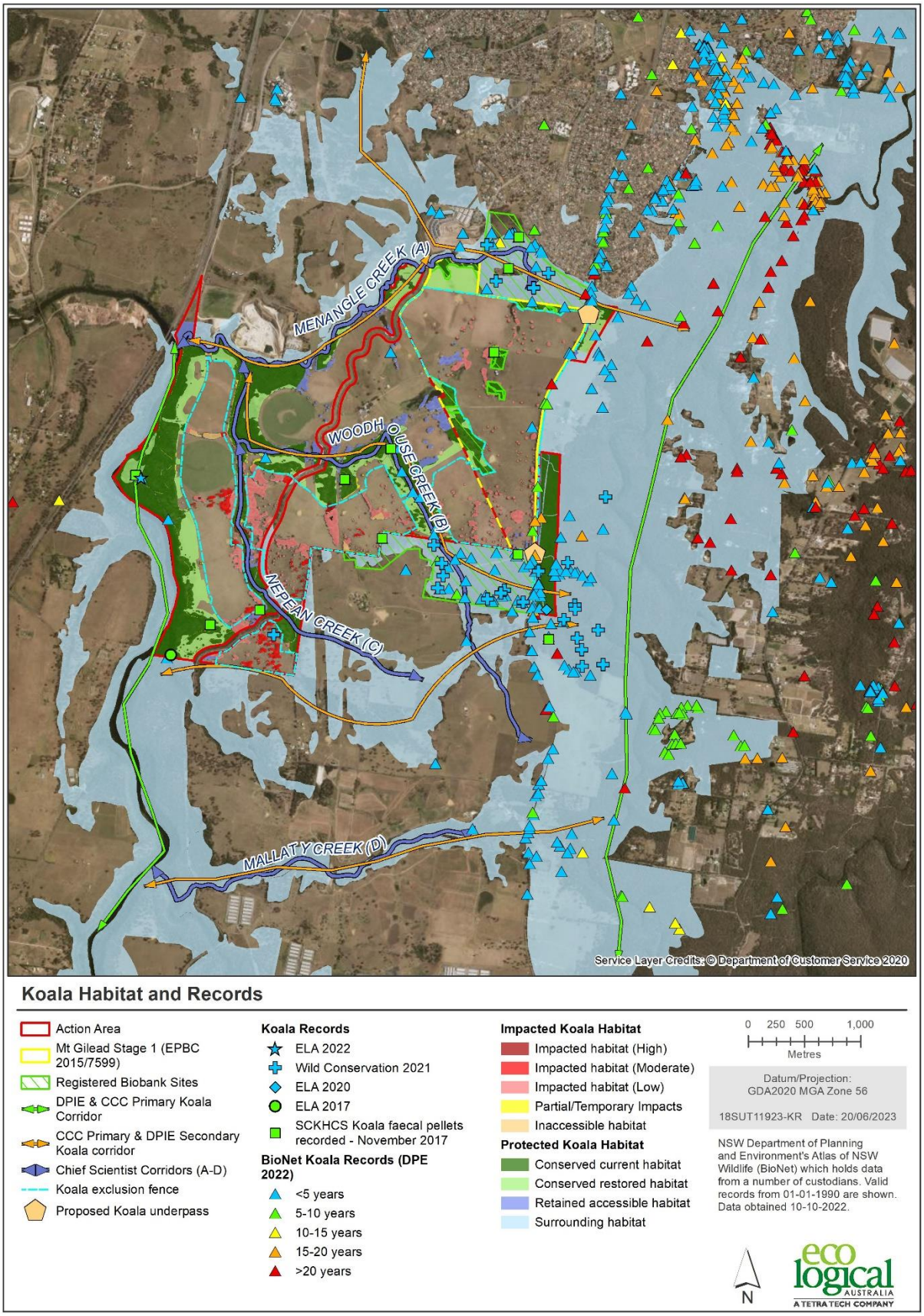


Figure 31: Koala corridors, registered Stewardship Agreement sites and Koala records in relation to the action area

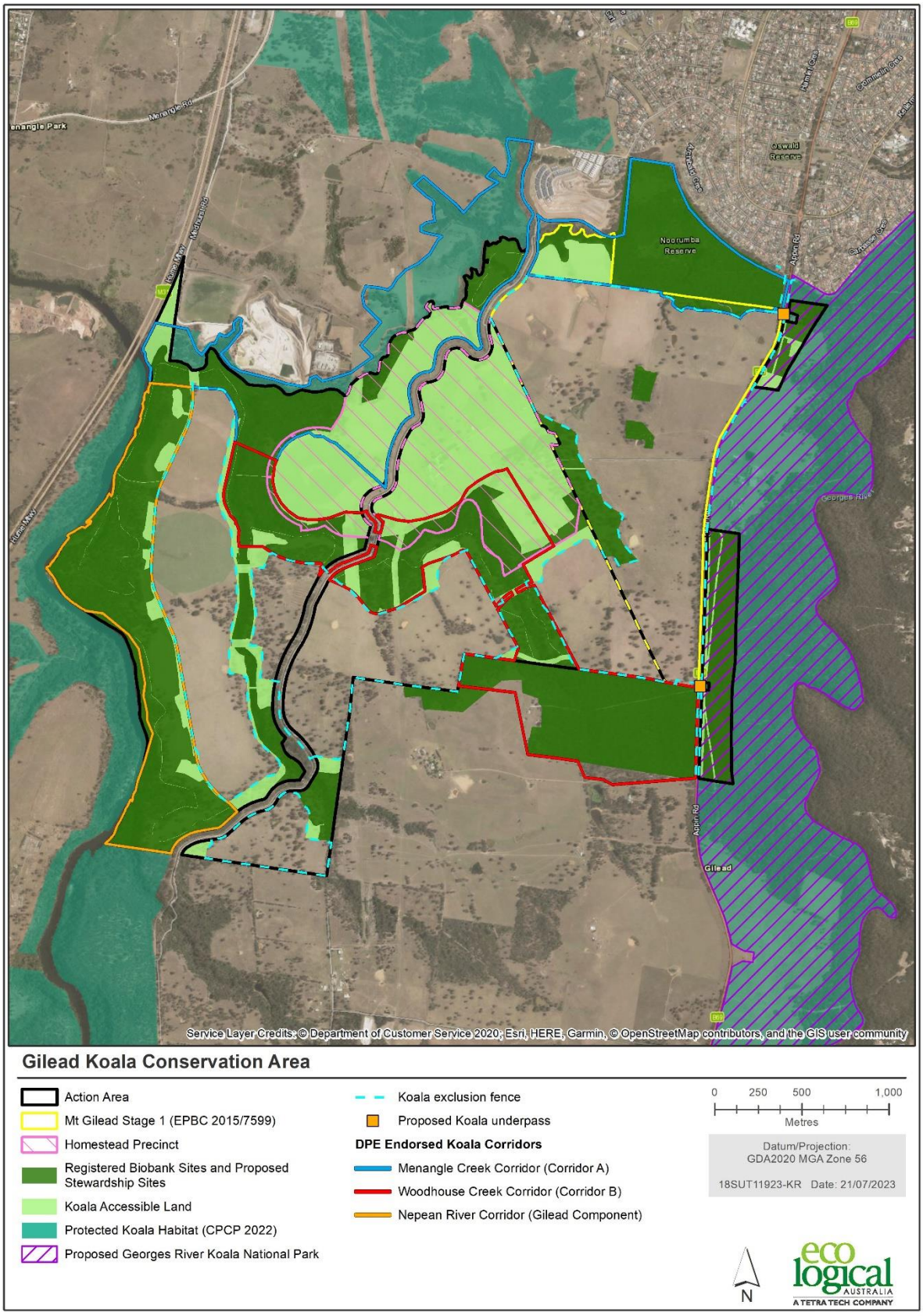


Figure 32: Proposed retained and protected Koala habitat in and adjacent to Mt Gilead including the fully fenced 300 ha Koala Conservation Area within MGS2

7.2 Greater Glider (*Petauroides volans*)

7.2.1 Species ecology

The Greater Glider was listed as a vulnerable species on the schedules of the EPBC Act on 5 May 2016 and was upgraded to an endangered species on 5 July 2022. However, in accordance with section 158A of the EPBC Act, as the species was listed as a vulnerable species at the time of the Controlled Action Decision, its upgraded conservation status is not taken into consideration in this PD report (i.e. it is assessed as a vulnerable species).

The Greater Glider is restricted to eastern Australia, from the Windsor Tableland in north Queensland down to central Victoria in areas from zero to 1,200 m above sea level, excluding alpine areas. The Greater Glider typically inhabits tall, montane, moist eucalypt forests with abundant tree hollows. Home ranges are typically small at approximately 1-4 ha but can be larger in areas of lower productivity forest. This species uses large hollows in large, old trees for denning and breeding habitat, and prefers areas where there are a diversity of *Eucalyptus* sp. in the canopy. Greater Gliders are particularly sensitive to forest clearing, fragmentation, intensive logging and wildfire. They typically do not disperse well across non-native vegetation and require native forest patches of at least 160 km^2 (16,000 ha) to maintain viable populations. As a result, this species has relatively low persistence in small forest fragments (TSSC 2016).

7.2.2 Distribution

Within the Sydney Region, records of the Greater Glider is widespread and more common in the west with greatest densities in the higher altitude tall forests of the Kanangra Boyd and Blue Mountains National Parks, with smaller populations occurring closer to the coast (DECC 2007).

There are 26 records for the Greater Glider within a 20 km radius of the action area, with a majority of records occurring within dense vegetation along major creek lines or gullies to the east of the study area i.e. the extensive areas of bushland protected in the Sydney water supply catchments, Dhawaral and Heathcote National Parks that include tall, most eucalypt forests (Hinterland Sandstone Gully Forest) (BioNet 2021; Figure 33). The nearest record to the study area was east of the proposed Browns Bush Stewardship Agreement site, in the south-eastern corner of the action area. The record is from a scat and was recorded in 1996 as part of the Urban Bushland Biodiversity Study (NPWS 1997). There was a spurius record from Noorumba Reserve in 2018 however this record has since been removed from the NSW BioNet database as a record in error (Figure 33).

The Greater Glider has not been identified in the action area despite extensive survey between 2016 and 2020 and is not expected to occur as the species preferred habitat is not present. Surveys were completed in good condition habitat within the deepest, most heavily vegetated gullies in the study area (Woodhouse and Nepean Creeks) where the species is most likely to occur, if present.

As the action area is not considered habitat for the Greater Glider, there are no anticipated direct and indirect impacts as a result of the proposed action. However, a precautionary approach has been taken, and the significant impact criteria have been applied to the Greater Glider.

7.2.3 Assessment of the 2019 / 2020 bushfires

The impact of the 2019 / 2020 bushfires was concentrated at the outer edge and to the west of the Sydney Basin IBRA region, with marginal areas of impact within the locality and no impacts to the action area (Figure 34 and Figure 35). The fires have not resulted in fragmentation of habitat or foraging resources within the locality, or the isolation of habitat or foraging resources within the locality. Figure 35 shows that large proportions of known habitat (evidenced through historical records) was not affected by the fires. Given that the bushfires did not affect any preferred habitat within the locality, it is unlikely that the resources throughout the locality have substantially declined, such that the action area has increased in importance for the Greater Glider.

7.2.4 Direct and indirect impacts

No direct or indirect impacts are expected to occur to the Greater Glider as it is not present within the action area.

7.2.5 Application of the Significant Impact Criteria

The application of the Criteria concluded that the proposed action will not constitute a significant impact to the Greater Glider (Table 22).

Table 22: Application of the Significant Impact Criteria with respect to the Greater Glider

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species (as it was at the time of the Controlled action Decision in February 2020) if there is a real chance or possibility that it will:		
1)	lead to a long-term decrease in the size of an important population of a species	The Greater Glider was not identified in the action area during extensive survey between 2016 and 2020 and is therefore considered highly unlikely to be present in the action area. There is very limited potential habitat for this species within the development footprint/action area, being the deeper gullies of Woodhouse and Nepean Creeks and the Nepean River corridor. The Greater Glider prefers large, continuous patches of native vegetation (16,000 ha or more) for dispersal, which is not present in the development footprint. The species is however present in the broader locality, with 26 records within a 20 km radius of the action area (The nearest record is located approximately 200 m south of the proposed Browns Bush BSA site from 2015). The 2016 Conservation Advice for the Greater Glider (TSSC 2016) does not define any important populations for the species. The 2022 Conservation Advice (DCCEEW 2022) states that as an endangered species, all populations of Greater Glider are considered important for the conservation of the species, across its range. As the species was not recorded within the action area, it is considered that a population of Greater Gliders is not present and by definition cannot represent an important population. Therefore, the loss of up to 41.95 ha of higher quality, potentially suitable habitat will not lead to a long-term decrease in the size of the local population.
2)	reduce the area of occupancy of an important population	The proposed development is unlikely to reduce the area of occupancy of this species, given that targeted survey did not identify any individuals in the action area.
3)	fragment an existing important population	The proposed action would not cause fragmentation of an important population into two or more populations as the Greater Glider was not identified in the action area during targeted survey and is considered highly unlikely to occur.

Criterion	Question	Response
	into two or more populations	
4)	adversely affect habitat critical to the survival of a species	Although the Greater Glider was not recorded during targeted surveys and it is highly unlikely that this species would utilise the action area for foraging or breeding purposes, DCCEEW (2022) defines 'habitat critical to the survival of the species" as being any habitat meeting any one of the following criteria, irrespective of the current abundance or density of Greater Gliders or the perceived quality of the site • large continuous areas of eucalypt forest which contain mature hollow bearing trees – yes • smaller or fragmented patches connected to larger patches – yes • cool microclimate forest/woodland areas (e.g. protected gullies) - Yes
5)	disrupt the breeding cycle of an important population	Targeted survey for the Greater Glider was completed across the action area (including offset areas) between 2016 and 2020 and the species was not recorded. There are no historic records for this species within the action area. The action area does not contain the preferred habitat for this species, in the form of tall, moist wet forest and is considered highly unlikely to be present. As such, the action area is highly unlikely to represent potential habitat for this species, and the proposed action is therefore, unlikely to disrupt the breeding cycle of an important population. Records for the Greater Glider in the locality are concentrated in areas where there are very large, continuous areas of native vegetation such as Dharawal National Park and the Upper Nepean State Conservation Area to the east and south-east of the action area (Figure 33).
6)	modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Targeted survey for the Greater Glider was completed across the action area and the species was not identified. There are no historic records for this species within the action area. Although the proposed action would remove up to 44.35 ha of forest/woodland native vegetation (in condition states ranging from intact to scattered trees), it is unlikely to support any Greater Gliders. There are historic records for the Greater Glider in the Dharawal National Park and the Upper Nepean State Conservation area which are very large, continuous areas of habitat. Considering the extensive habitat available in the locality and the absence of the Greater Glider in the action area, the removal of up to 44.35 ha of 'potential' habitat is unlikely to cause the species to decline.
7)	result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed action is unlikely to result in the establishment of an invasive species within Greater Glider habitat as no habitat is present in the action area.
8)	introduce disease that may cause the species to decline, or	The proposed action is unlikely to result in the introduction of a disease that would cause the Greater Glider population to decline as no habitat is present in the action area.
9)	interfere substantially with the recovery of the species.	The proposed action is unlikely to interfere with the recovery of the Greater Glider, given that the species was not identified in the action area during survey and there are no historic records in the action area. This species prefers tall, moist forests which are not present in the action area. The Greater Glider has been recorded in preferred habitat in the locality in areas of large, continuous habitat which are protected as a National Park and a State Conservation Area. Therefore,

Criterion	Question	Response
		the proposed action is highly unlikely to interfere with the recovery of the species.
Conclusion	Is there likely to be a significant impact?	No. The Greater Glider was not identified in the action area during survey and there are no historic records in the action area. This species prefers tall, moist forests which are not present in the action area. The Greater Glider has been recorded in preferred habitat in the locality in areas of large, continuous habitat which are protected as a National Park and a State Conservation Area. The proposed action will not lead to a significant impact on the Greater Glider.

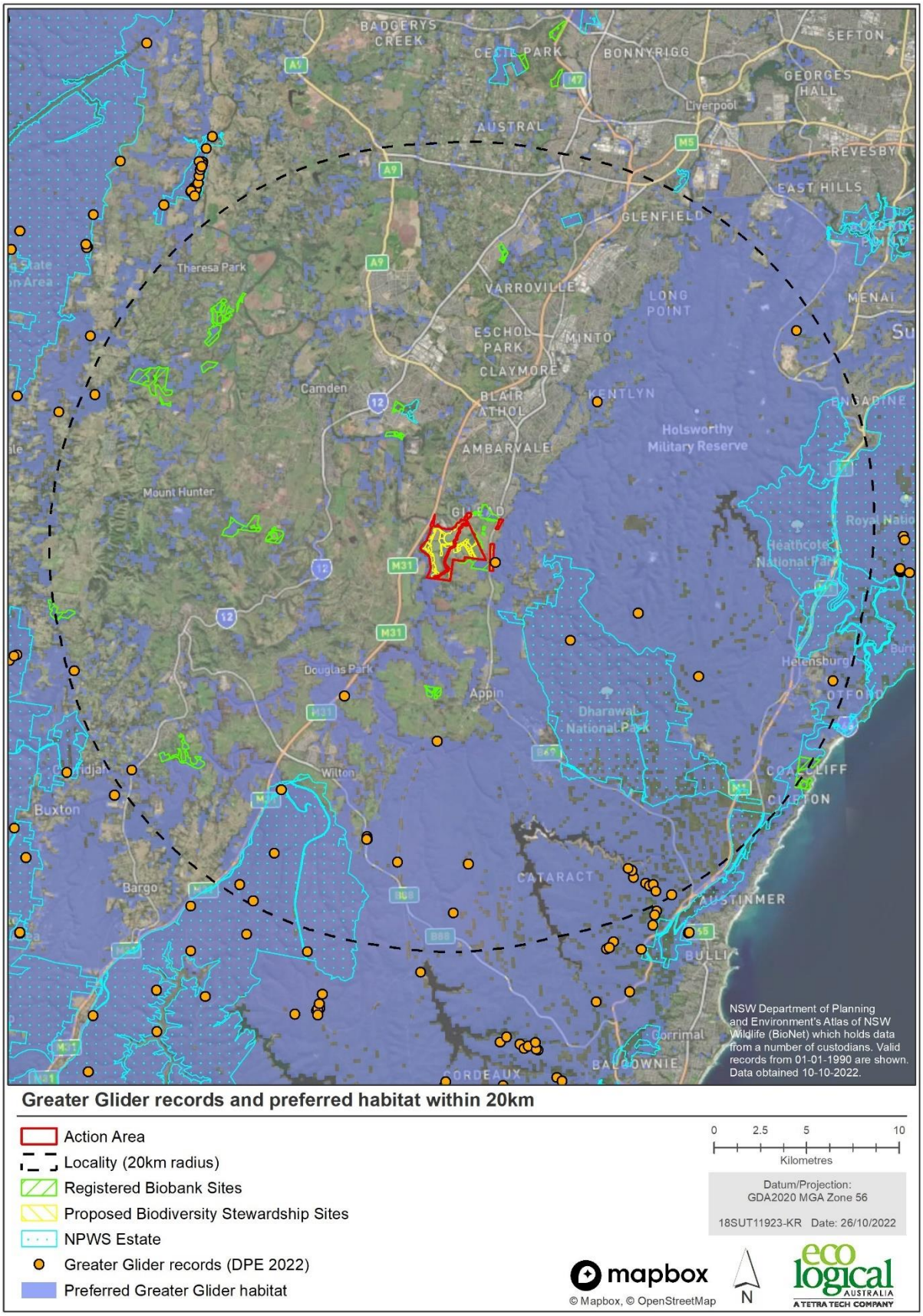


Figure 33: Records for the Greater Glider and preferred habitat within the locality

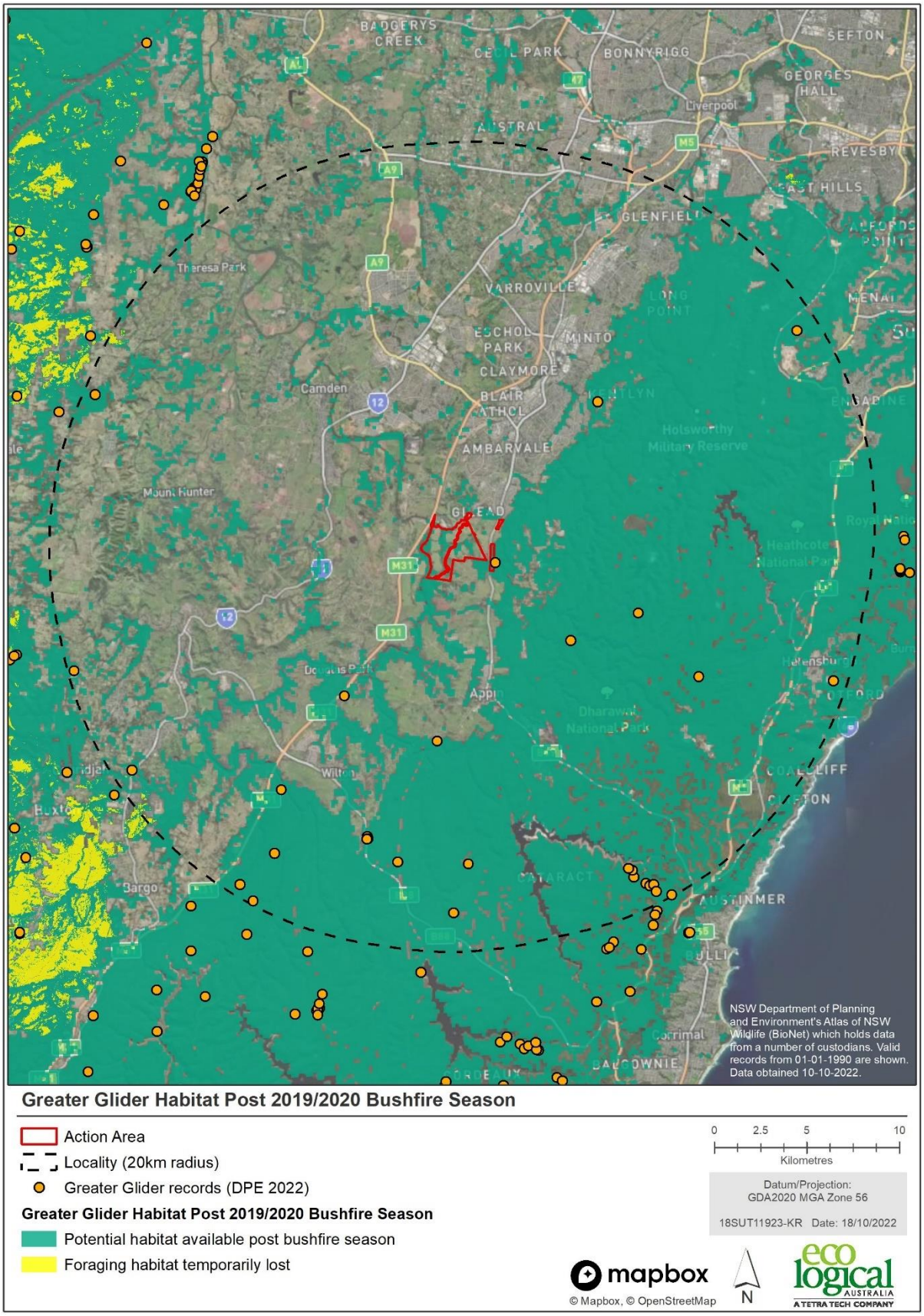


Figure 34: Greater Glider habitat and records in relation to the 2019 / 2020 bushfires within the locality

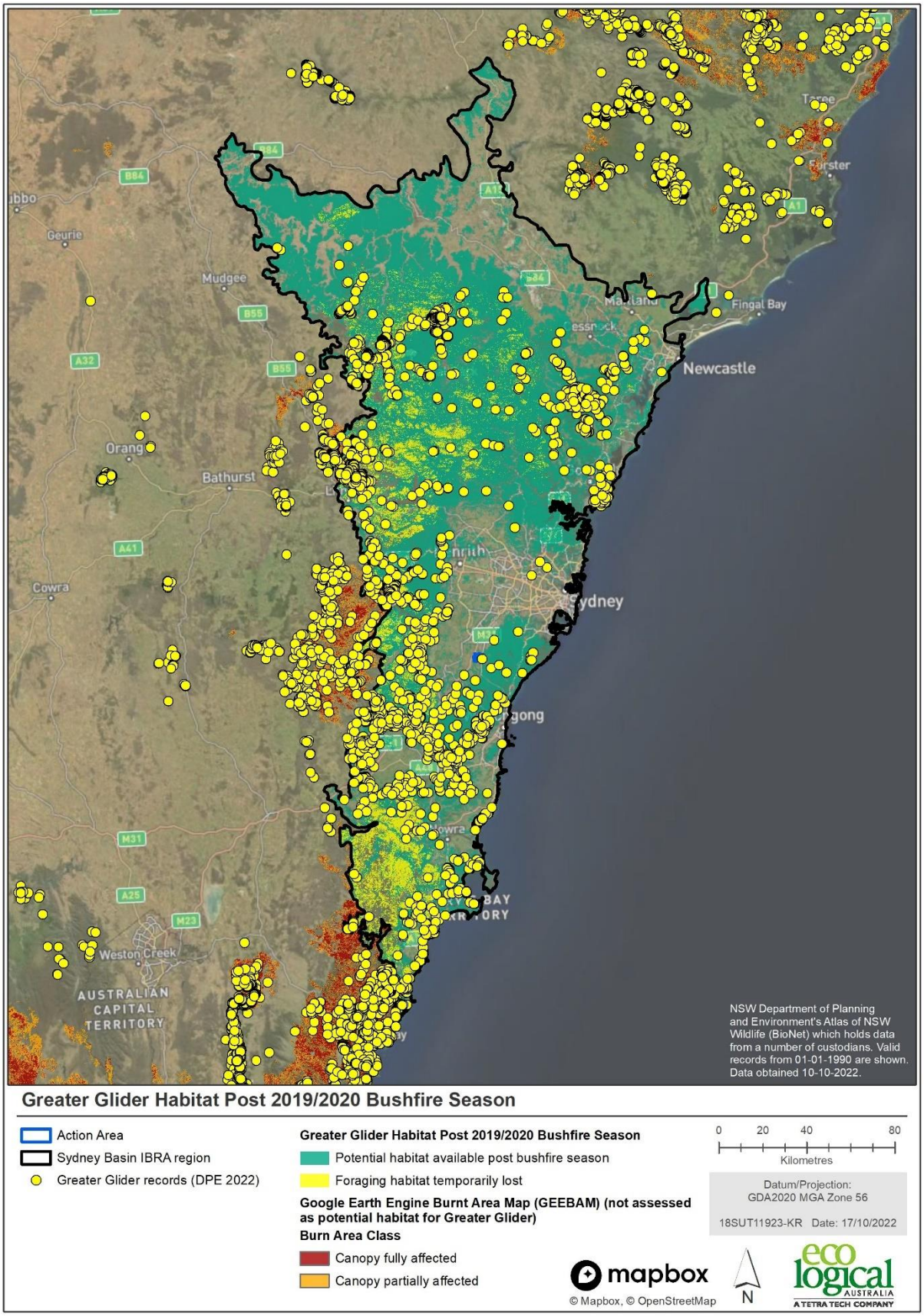


Figure 35: Greater Glider records, preferred habitat and impacts from the 2019 / 2020 bushfires in the IBRA region

7.3 Spot-tailed Quoll (*Dasyurus maculatus*) SE mainland population)

7.3.1 Species ecology

The Spot-tailed Quoll inhabits a variety of habitat types including rainforest, open forest woodland, coastal heath and inland riparian forest as well as beaches, grasslands and pastoral areas adjacent to forested habitat (DELWP 2016). The Spot-tailed Quoll typically occurs at low densities. Adults are solitary and occupy large home ranges while female home ranges generally don't overlap and are 88–1,515 ha in size (DELWP 2016). Male home ranges are 359 – 5,512 ha in size and overlap and encompass multiple female home ranges (DELWP 2016). The Spot-tailed Quoll can cover large distances in a short period of time, with animals recorded moving at least 8 km in a day and 19 km in a week (DELWP 2016). This species is carnivorous and hunts on the ground and in trees, feeding on a wide variety of prey including mammals, birds, reptiles and invertebrates.

Spot-tailed Quolls establish den sites in rock crevices, hollow logs, hollow-bearing trees, tree buttresses, windrows, clumps of vegetation, caves, boulder piles, under buildings and in burrows. They establish multiple den sites and move between them every 1-4 days, with preferred landscapes related to prey densities and den availability (DELWP 2016).

The Conservation Advice for the Spot-tailed Quoll (TSSC 2020) states that there is insufficient data to identify 'habitat critical to the survival' of the Spot-tailed Quoll, and that until such information is available, all habitat is considered 'habitat critical to the survival' of the species.

7.3.2 Distribution

Most records of the species in NSW are from the North Coast, Sydney Basin and South East corner bioregions with few recent sightings in the Sydney Basin Bioregion (DECC 2007). Recent sightings in the Sydney Bioregion include between Hornsby and the Central Coast, the Upper Blue Mountains and the Kangaroo Valley area, with a single record from the Woronora Plateau in 2005 (DECC 2007).

There are 73 records in BioNet for the Spot-tailed Quoll over the past 30 years within a 20 km radius of the action area with all records coming from areas of large, continuous patches of vegetation (Figure 36). The closest record to the action area is about 5 km to the east of the action area in Dharawal National Park. Records are confined to Dharawal National Park, Holsworthy Military Area and Yerranderie State Conservation Area (Figure 36).

The Spot-tailed Quoll is known to occur in Shale Sandstone Transition Forest and Cumberland Plain Woodland which are both present throughout the action area. The action area also contains hollow bearing trees and logs that could provide potential denning habitat for this species. However, the higher quality habitat available within the action area is fragmented with large portions of cleared land separating some areas of potential habitat.

Targeted survey was conducted across the action area between 2016 and 2020 and did not record any Spot-tailed Quoll individuals., however the species is known to be highly cryptic and can be difficult to detect during targeted survey.

7.3.3 Assessment of the 2019 / 2020 bushfires

The 2019 / 2020 bushfires affected a small portion of potential habitat for the Spot-tailed Quoll within a 20 km radius of the action area (Figure 37). The bushfires did not result in large scale fragmentation

or isolation of the action area from other areas of known or potential habitat. The action area remains directly connected to the Dharawal National Park to the east which is likely to provide habitat for this species (evidenced by records (BioNet 2021)). Across the IBRA region, there are larger patches of potential habitat that were affected by the 2019 / 2020 bushfires (Figure 38). Although these areas were large, the impacts are likely to be temporary and are unlikely to have directly affected any individuals that would utilise the action area.

7.3.4 Direct impacts

The Spot-tailed Quoll has not been previously recorded within the action area nor was it identified in the action area during targeted survey. The action area contains vegetated riparian corridors that provide connectivity to the broader landscape. However, the large portions of cleared land between the riparian corridors have caused localised fragmentation throughout the action area. Appin Road could be considered a minor fragmentation of the action area from large expanses of critical habitat in Dharawal National Park and the surrounding landscape. The action area could provide marginal habitat on the fringe of other areas that constitute critical habitat, such as Dharawal National Park. The action area may be used occasionally however is unlikely to be relied upon due to the fragmented nature of the vegetation and anthropogenic obstructions that would limit easy access between the action area and areas of suitable habitat.

7.3.5 Indirect impacts

Indirect impacts that could affect the Spot-tailed Quoll include fragmentation of movement corridors, increased collision with vehicles and competition with introduced predators such as cats and foxes. Indirect impacts are likely to occur if individuals were traversing between the proposed Stewardship Agreement sites and future residential areas. The Stewardship Agreement sites will be fenced and prohibit dogs. Perimeter roads adjacent to the conservation areas will have 50 kmph speed limits and traffic calming devices and signage will be used to slow traffic. Given that the Spot-tailed Quoll has not been identified in the action area and would only use the action area occasionally as part of a very large foraging range any indirect impacts are considered to be negligible.

7.3.6 Application of the Significant Impact Criteria

DAWE considered that there were 'likely to be significant residual impacts to Spot-tailed Quoll resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts that the proposed action is unlikely to constitute a significant impact to this species (Table 23) and this impact will be fully offset (meeting 214% of the EPBC offset requirements with the protection of existing habitat or 269% with additional restored habitat as per Table 29).

Table 23: Application of Significant Impact Criteria to the Spot-tailed Quoll

Criterion	Question	Response
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:		
1)	lead to a long-term decrease in the size of a population	Spot-tailed Quolls have a large home range (up to several hundred ha for females and several thousand ha for males). The proposed action would result in the loss of up to 48.04 ha of direct, partial and indirect impacts to potential habitat for this species, with a majority of potential habitat in poor condition existing as scattered paddock trees or canopy on pasture improved soils with areas of cleared land separating areas of canopy. No Spot-tailed Quolls were recorded during the survey, and none have been

Criterion	Question	Response
		previously recorded in the action area. The closest records are located about 5 km to the east of the action area in Dharawal National Park. Dharawal National Park. Given records of the species in the area and their high mobility, the action area is likely to be used occasionally by this species. Large areas of suitable habitat are available within the proposed Stewardship Agreement sites (208.11 ha) and other retained land (149.28 ha) and Dharawal National Park that are considered large enough to sustain the local population of Spot-tailed Quolls. The removal or modification of up to 48.04 ha of potential habitat, of which a majority is in poor condition is considered unlikely to lead to a long-term decrease in the size of an important population.
2)	reduce the area of occupancy of the species	The proposed action would remove or modify up to 48.04 ha of potential habitat for the Spot-tailed Quoll. The majority is in poor condition and is comprised of scattered paddock trees or canopy over pasture improved grass with areas of cleared land separating patches of canopy. The species was not identified in the action area during survey. The action area is likely to form 'supplementary' habitat for this species in the broader landscape and used from time to time by individuals dispersing in the broader area. The removal of up to 48.04 ha of potential habitat is unlikely to significantly reduce the area of occupancy of this species, given the ongoing availability of 208.11 ha of conserved habitat to be managed for conservation in-perpetuity, 149.28 ha of retained habitat and areas of habitat that form large, contiguous patches of in Dharawal National Park, Holsworthy Military Area and Yerranderie State Conservation Area. The Spot-tailed Quoll has a large home range and will utilise up to 10,000 ha to forage. In the context of the broader landscape, the removal of up to 48.04 ha of supporting habitat is unlikely to reduce the area of occupancy of the Spot-tailed Quoll.
3)	fragment an existing population into two or more populations	The proposed action would not result in fragmentation of habitat that would result in the fragmentation of the local population into two or more populations. The habitat to be affected is already highly fragmented throughout the action area and the areas proposed for restoration and conservation enhance connectivity in the broader landscape.
4)	adversely affect habitat critical to the survival of a species.	Critical habitat has not been defined for the Spot-tailed Quoll under section 207A of the EPBC Act, however as there is insufficient information available to identify 'habitat critical to the survival of the species', DCCEEW have advised that all habitat is considered 'habitat critical to the survival of the species'. The National Recovery Plan for the Spot-tailed Quoll (DELW, 2016) defines 'habitat critical to the survival of the species' as "*large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey*". The riparian corridors in the action area are well vegetated and provide some connectivity to other areas of vegetation outside of the action area however there are no historical records for this species within the action area. Critical habitat is likely present to the east of Appin Road in Dharawal National Park, Holsworthy Military Area and Yerranderie State Conservation Area. In this context, the removal of up to 48.04 ha of potential habitat is unlikely to reduce the area of occupancy of this species, given the availability of 208.11 ha of conserved habitat to be managed for conservation in-perpetuity, 149.28 ha of retained habitat and additional

Criterion	Question	Response
		areas of habitat that form large, contiguous patches of habitat in Dharawal National Park, Holsworthy Military Area and Yerranderie State Conservation Area. In the context of the broader landscape, the removal of up to 48.04 ha of marginal habitat is unlikely to disrupt: • the breeding cycle of the species • the long-term maintenance of the species or, • the genetic diversity of the species.
5)	disrupt the breeding cycle of a population	This species was not recorded during targeted survey, and therefore, the species is not known to be breeding within the site. The majority of the potential habitat available for this species within the action area that is being impacted is in poor condition and exists as scattered paddock trees or canopy over pasture improved paddocks. Due to the extensive history of disturbance associated with agriculture, potential denning resources are largely absent or limited. The removal of up to 48.04 ha of habitat containing potential breeding habitat may result in some disturbance to the breeding cycle of the local population, however, the proposed action is unlikely to significantly disrupt the breeding cycle of an important population that would lead to a long-term decline of the local population.
6)	modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The site would likely form part of a large home range of one or more individuals in the local population of the Spot-tailed Quoll. The removal of up to 48.04 ha of potential habitat would result in a loss of potential foraging habitat. The potential foraging habitat to be removed would not isolate or fragment other areas of foraging habitat throughout the action area or the locality. The foraging habitat to be removed is largely in poor condition (existing as isolated, scattered paddock trees) and would be used only occasionally by this species. Given the extensive areas of habitat in Dharawal National Park where there are previous records for the species, the removal of up to 48.04 ha of potential foraging habitat is unlikely to cause the species to decline. In addition, a majority of the continuous areas of vegetation in the action area will be conserved and managed in-perpetuity in the proposed Stewardship Agreement sites, which will conserve 208.11 ha of potential habitat for this species.
7)	result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	The proposed action is unlikely to result in the establishment of an invasive species in the habitat to be retained inside of the action area.
8)	introduce disease that may cause the species to decline, or	The proposed action is unlikely to introduce a disease that would cause the species to decline.
9)	interfere with the recovery of the species.	The recovery objectives relative to the proposed action are: *3. Reduce the rate of habitat loss and fragmentation on private land* – the proposed action will conflict with this recovery objective as it will result in the loss of up to 48.04 ha of potential habitat. Relative to the abundant areas of high quality habitat available within the locality at Dharawal National Park, Holsworthy Military Area and Yerranderie State Conservation Area, the increase rate of habitat loss resulting from the proposed action is considered unlikely to substantially interfere with the recovery of the Spot-tailed Quoll.

Criterion	Question	Response
		8. Reduce the frequency of Spot-tailed Quoll road mortality – the proposed action would result in more vehicles present adjacent to high quality Spot-tailed Quoll habitat which has the potential to result in road mortality, however proposed upgrades to Appin Road by the Roads and Maritime Services (RMS 2018) include provision of Koala exclusion fencing to restrict access to Appin Road and the action has proposed the provision of fauna underpasses at Beulah Biobank site and Noorumba Reserve (subject to NSW Government approval) to provide safe areas to cross that are linked to retained fauna movement corridors linking the Georges and Nepean Rivers. Further, the future residential use of the part of the action area will lead to additional traffic calming devices (traffic signals lights) on Appin Rd. Accordingly the risk of potential impacts associated with vehicle mortality are not likely to be significant and are likely to be reduced with lower speed limits and fauna crossing points.
Conclusion	Is there likely to be a significant impact?	The proposed action would result in the removal of up to 48.04 ha of potential habitat for Spot-tailed Quolls which would form part of a larger home range. Substantial areas of suitable habitat will be retained adjacent to the site and within the proposed Stewardship Agreement sites. Therefore, the proposed action is unlikely to constitute a significant impact on this species.

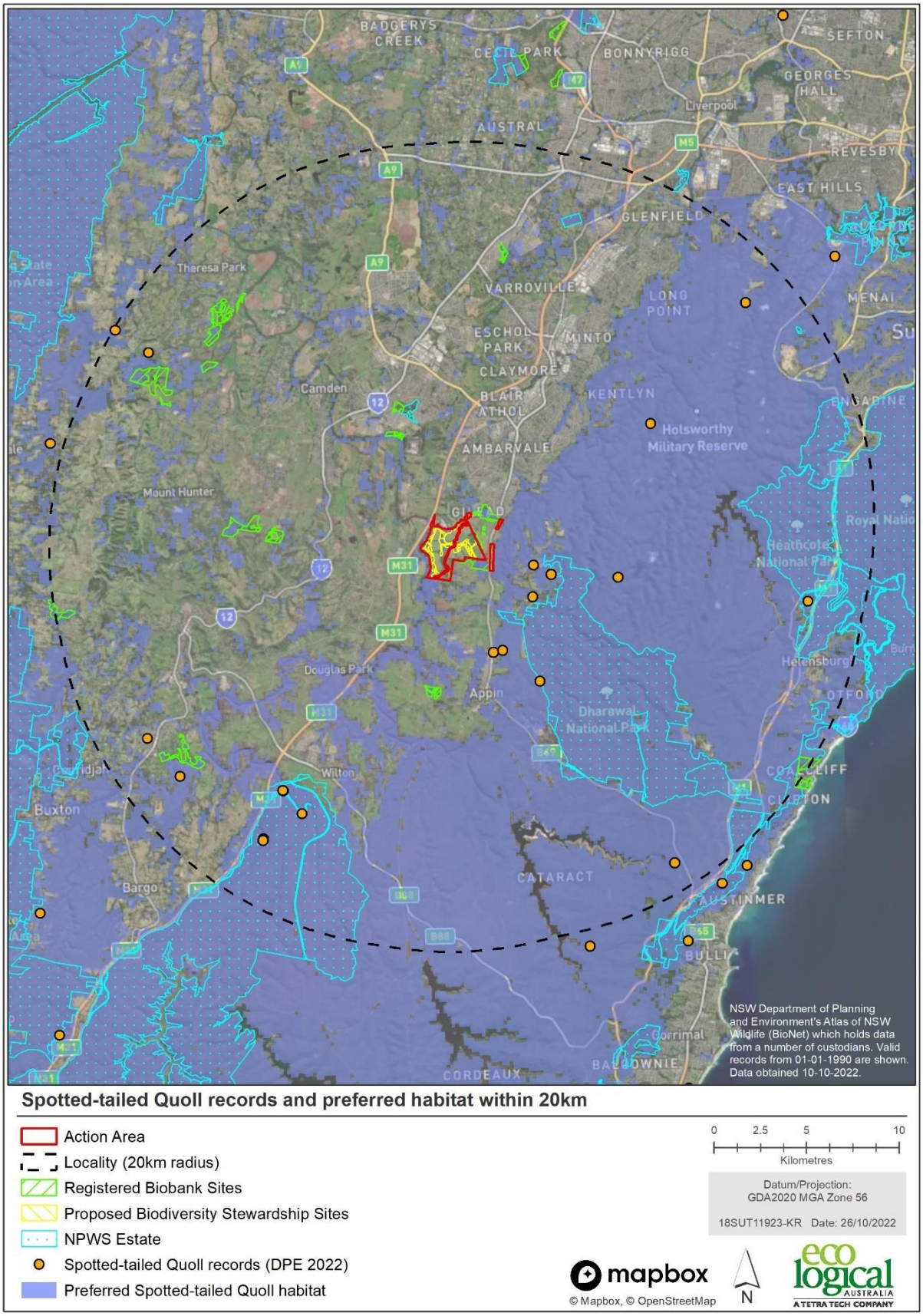


Figure 36: Spot-tailed Quoll records and preferred habitat within a 20 km radius of the action area

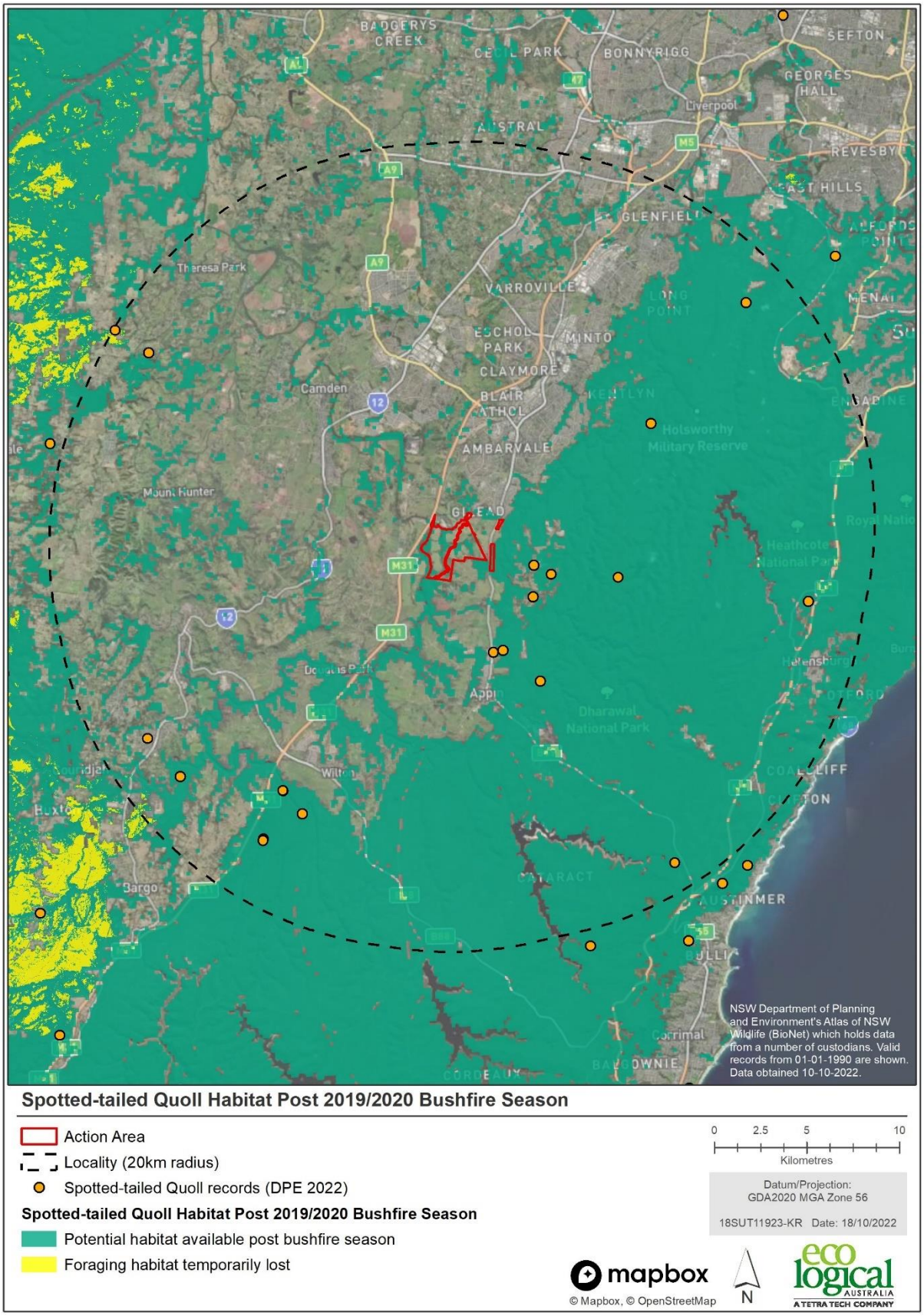


Figure 37: Impacts of the 2019 / 2020 bushfires on preferred Spot-tailed Quoll habitat within a 20 km radius of the action area

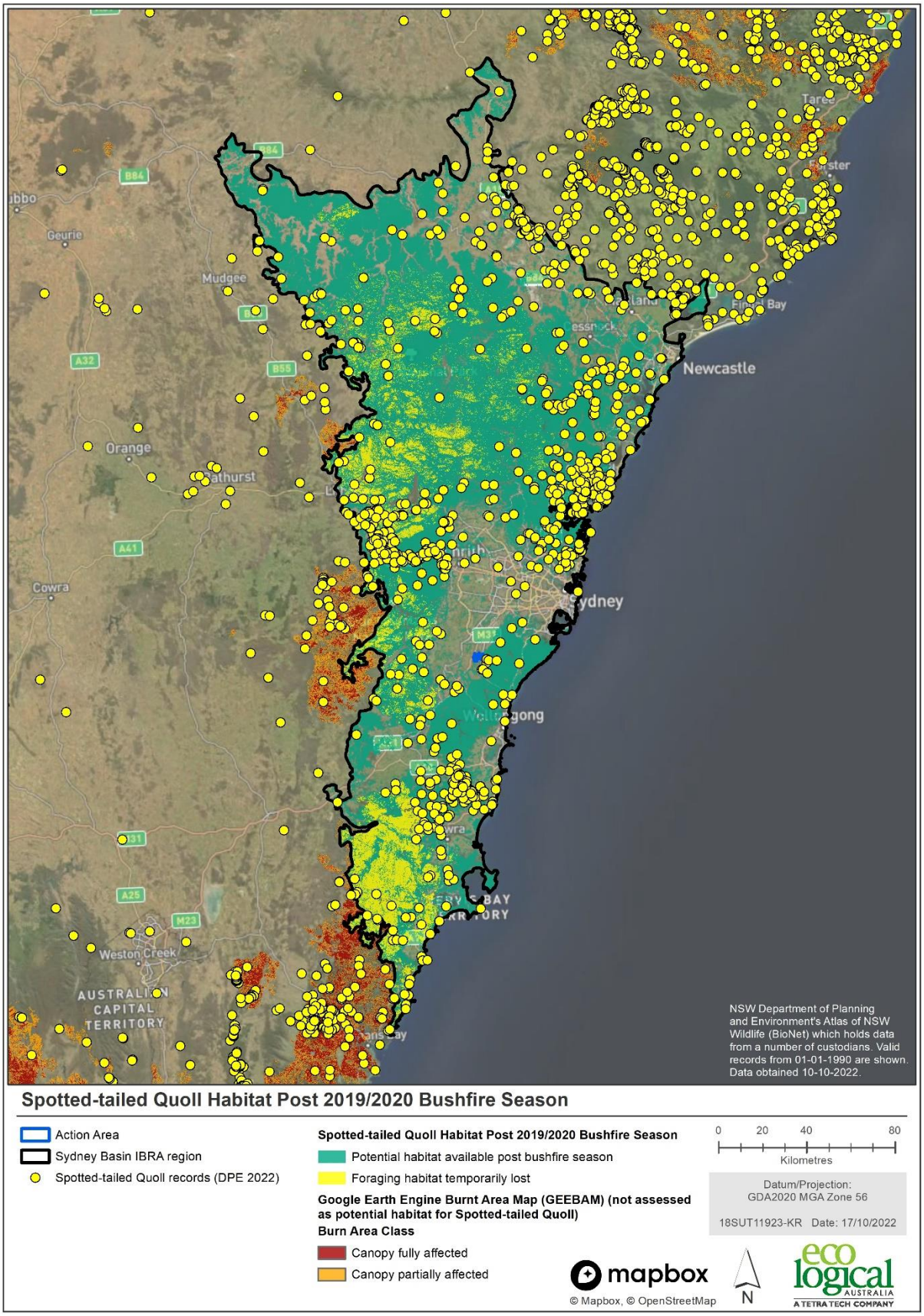


Figure 38: Spot-tailed Quoll habitat and records affected by the 2019 / 2020 bushfires in the Sydney Basin IBRA region

7.4 Grey-headed Flying-fox (*Pteropus poliocephalus*)

7.4.1 Species ecology and distribution nationally

Grey-headed Flying-foxes occur within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. The species is a nectarivore and fruitivore foraging in a wide range of habitats including rainforests, sclerophyll forests, woodlands, heaths, swamps, urban gardens and cultivated fruit crops.

Grey-headed Flying-foxes typically roost in camps which as used as a daytime refuge. Camps are generally stable sites, however numbers and occupation can vary over time, depending on the availability of foraging resources within the locality (DAWE 2021). An estimate of national population size, based on eleven counts between 1998 and 2005 is between 320,000 and 435, 000 individuals (DAWE 2021).

Roosting camps are generally located within 20 km of a regular food source and are commonly in gullies, close to water, and in vegetation with a dense canopy. Individual camps may have tens of thousands of animals, and are used for mating, birthing and rearing young. Mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century.

Grey-headed Flying-foxes are capable of travelling up to 50 km from the camp to forage; commuting distances are more often <20 km. This species will alter its roosting behaviour when foraging resources within the locality of their camp are low. A large camp will generally break up into smaller colonies and roost in small groups near the trees they are using for feeding. During winter, there is evidence to suggest that the population migrates to the north coast of NSW and southern Queensland (DotEE 2017). This is because these portions of the coast contain feed tree species that flower reliably during this period.

GHFF occupies most areas in their distribution in highly irregular patterns, and therefore surveys based on animal sightings are unlikely to be reliable. A more effective survey method, as endorsed by DAWE, is to search appropriate databases and other sources for the locations of camps, and to conduct vegetation surveys to identify feeding habitat.

The main threat to the survival of the species is habitat loss and disturbance through the clearing of foraging habitat and roosting locations for development and farming. Loss of important areas of habitat has also caused increased fragmentation of suitable habitat, resulting in the species having to travel greater distances for food or resorting to alternative sources such as food crops. Other threats to the species include unregulated shooting and electrocution on power lines.

Clearing of winter foraging habitat is a particular concern for the species (DECCW 2009). The vegetation communities that contain winter-flowering *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) have been substantially cleared, are poorly represented in conservation reserves, occur primarily on privately owned land and continue to be cleared at high rates (DECCW 2009).

The adopted national recovery plan for the Grey-headed Flying-fox (DAWE 2021) states that:

Where important winter and spring flowering vegetation communities are present, they are considered 'habitat critical to the survival' of the Grey-headed Flying-fox (Important winter and spring vegetation communities are those that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia* or *Syncarpia glomulifera* (Eby and Law 2008; Eby 2016; Eby et al., 2019).

The recovery plan also states that:-

'*Habitat critical to the survival'* of the Grey-headed Flying-fox may also be vegetation communities not containing the above tree species but which:

- contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May)
- contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or
- contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp1 as identified on the Department's interactive flying-fox web viewer.

Based on these criteria, foraging habitat for the GHFF that meets the recovery plans definition of '*habitat critical to the survival of the species*' occurs on site and should be the focus of protection and revegetation initiatives aimed to support the species.

7.4.2 Distribution in study area

The Grey-headed Flying-fox was recorded utilising habitat within the action area during field surveys. Potential foraging habitat that meets Criteria 1 of the recovery plans definition of '*habitat critical to the survival of the species'* occur on site in the form of native vegetation, comprised of Cumberland Plain Woodland, Shale Sandstone Transition Forest and River-flat Eucalypt Forest that includes important winter and spring flowering species such as *Eucalyptus tereticornis, E. crebra, E. fibrosa, E. paniculata, E. pilularis*.

There are no known camps in the action area. The two closest camps are Campbelltown, 5km north of the study area (2,500 – 9,999 individuals as of 2019) and Camden-Brownlow Hill, 8 km north-west of the study area – (2,500 – 9,999 individuals as of 2019) (Figure 39). The Camden Brownlow Hill camp has previously been listed as a Nationally Important Camp. The data on the interactive flying-fox web viewer suggests this is related to the camp containing >2,500 individuals for the last 10 years (DAWE 2021). The next closest Nationally Important camp is Parramatta Park (16,000 – 49,999 individuals as of 2019) and is 43 km to the north of the site.

7.4.3 Assessment of the 2019 / 2020 bushfires

The 2019 / 2020 bushfires did not affect any Grey-headed Flying-fox habitat within the action area. Impacts were limited to the western extent of the locality and were minor in nature (Figure 39). Impacts across the Sydney IBRA region are concentrated in the southern and western portions (Figure 40). The Grey-headed Flying-fox is one large, interbreeding population that migrates along the east coast. Any camps, or foraging resources within the foraging range of camps that were affected are likely to have temporarily changed the foraging and roosting behaviour of this species. Where there were substantial

reductions to camp extents or primary foraging resources adjacent to camps, individuals occupying these camps are likely to have migrated to other unaffected camps along the coast. There are no camps within the action area, however, the foraging habitat available within the action area may have temporarily supported an increased number of Grey-headed Flying-foxes immediately after the fires. It is unlikely that the action area has permanently increased in importance for the survival of the species given that the loss of foraging habitat was not permanent.

7.4.4 Direct impacts

The proposed development will result in the removal or modification of up to 46.06 ha of foraging habitat with 155.18 ha of existing foraging habitat to be conserved in perpetuity as part of the proposed Biodiversity Stewardship Agreement sites (Figure 41). An additional 55.90 ha of cleared land will be restored and conserved which will provide habitat in the future for the Grey-headed Flying-fox (i.e. the conservation measures across the action area will include the conservation of 208.11 ha of current and future habitat. A further 48.76 ha of existing woodland vegetation will be retained in the action area within open space, easements and rural land and up to a further 19 ha will be revegetated in the detention basins.

The landscape of the study area has been extensively modified by past agricultural uses. The site does not currently contain a camp for this species. The foraging habitat to be affected either directly, partially or indirectly (46.06 ha) is mostly comprised of scattered paddock trees (41.76 ha) which, although still representing foraging habitat, is sub-optimal for this species. The habitat to be conserved within the proposed conservation areas forms part of large, continuous patches of better condition foraging habitat.

7.4.5 Indirect impacts

Indirect impacts to the Grey-headed Flying-fox that may result from the proposed action include electrocution from overhead powerlines and heat stress. The proponent is proposing to run all powerlines underground which will remove the risk of electrocution from overhead powerlines (other than existing high voltage lines that traverse the study area). It is difficult to quantify how the proposed action would contribute to mortality due to heat stress, the large areas of retained habitat that will likely be used by GHFF, will maintain lower temperatures.

7.4.6 Application of Significant Impact Criteria

DAWE considered that there were 'likely to be significant residual impacts to Grey-headed Flying-fox resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts, that the proposed action is unlikely to constitute a significant impact to this species (Table 24). Despite this conclusion, significant offsets to protect and enhance GHFF habitat in the action area are provided which 97% of the EPBC offset target with the protection of existing habitat, increasing to 307% with the addition of restored habitat (Table 29).

Table 24: Significant Impact Assessment for Grey-headed Flying -fox

Significant Impact Criteria	Assessment
Lead to a long term decrease in the size of an important population of a species	There is one single interbreeding population of the Grey-headed Flying-fox in eastern Australia. No known roosting or breeding habitat in the form of camps would be affected by the proposed action. The two closest camps are Campbelltown (2,500 – 9,999 individuals as of 2019, 8 km north) and Camden-Brownlow Hill – (2,500 – 9,999 individuals as of 2019, 5

Significant Impact Criteria	Assessment
	km north). The Camden Brownlow Hill camp has previously been listed as a Nationally Important Camp. The data on the interactive flying-fox web viewer suggests this is related to the camp containing >2,500 individuals for the last 10 years (DAWE 2021). The next closest Nationally Important camp is Parramatta Park (16,000 – 49,999 individuals as of 2019) and is 43 km to the north of the site. The proposed action would impact directly, partial or temporarily, up to 46.06 ha of foraging habitat in the site. The action area would be used occasionally for foraging and would form part of a mosaic of foraging resources throughout the region, used primarily by the individuals within the 20 km foraging range of camps. For any individuals within foraging range of the action area, there are an abundance of foraging resources that would be conserved within the action area. This includes the permanent protection and management of 155.18 ha of existing foraging habitat in a dedicated conservation area, restoration of a further 53.90 ha and retention of an additional 25.19 ha of native vegetation that would provide foraging habitat for this species. This is in addition to the foraging habitat present within Dharawal National Park to the east and Nattai National Park to the west. Therefore, the loss and/or modification of up to 46.06 ha of foraging habitat and no direct impacts to camps is unlikely to lead to a long-term decrease in the size of the important population.
Reduce the area of occupancy of an important population	The Grey-headed Flying-fox is one, single interbreeding population and occupies the coastal belt from Rockhampton to Melbourne. No known roosting or breeding habitat in the form of camps would be affected. The proposed action would remove or modify up to 46.06 ha of potential foraging habitat for this species. A reduction in the area of occupancy could result from a substantial reduction in foraging habitat within the foraging range of a Grey-headed Flying-fox camp, such that suitable resources are not available to sustain the individuals in the camp. The proposed action would remove or modify up to 46.06 ha of potential foraging habitat within the foraging range of two camps containing between 2,500 – 9,999 individuals in each camp. The habitat to be removed forms part of a mosaic of resources within the foraging range that the Grey-headed Flying-fox would rely upon. Although the proposed action would remove foraging habitat, 208.11 ha of foraging habitat would be permanently conserved, restored and retained in the action area, with an abundance of foraging resources available within Nattai National Park and Dharawal National Park. As such, the proposed action would not remove all, or a substantial proportion of, the foraging habitat available such that the foraging behaviour of any individuals was significantly affected. The proposed action is unlikely to reduce the area of occupancy of this species.
Fragment an existing important population into two or more populations	There is a single inter-breeding population of the Grey-headed Flying-fox in Australia. The proposed action would remove or modify up to 46.06 ha of foraging habitat within the foraging range (20 km) of two camps; Camden – Brownlow Hill and Campbelltown. The foraging resources to be removed form part of a larger network of foraging resources within the foraging range for any individuals within these camps. The proposed action will conserve, restore and retain 208.11 ha of foraging habitat within the action area. Extensive foraging habitat is also available within the Dharawal National Park and Nattai National Park which are both within the foraging range of the Camden – Brownlow Hill and Campbelltown Camps. Given the conservation, restoration and retention of 208.11 ha of foraging habitat within the action area, the removal or modification of up to 46.06 ha of foraging habitat would not result in a substantial loss of foraging habitat or cause fragmentation or isolation of foraging resources, or camps from foraging resources, such that the existing population would be fragmented into two or more populations.
Adversely affect habitat critical to the survival of a species	Yes. The adopted national recovery plan for the Grey-headed Flying-fox (DAWE 2021) states that: '*where important winter and spring flowering vegetation communities are present, they are considered 'habitat critical to the survival' of the Grey-headed Flying-fox*' (Important winter and spring vegetation communities are those that contain *Eucalyptus*

Significant Impact Criteria	Assessment
	tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia or *Syncarpia glomulifera* (Eby and Law 2008; Eby 2016; Eby et al., 2019). The proposed action would remove or modify up to 46.06 ha of habitat critical to the survival of the species, although more than 90% of this habitat (41.76 ha) is of low quality as scattered paddock trees. The proposed action will permanently protect and manage 155.18 ha of critical habitat, restore and conserve 53.90 ha of habitat that will become critical habitat and retain an additional 25.19 ha of critical habitat for the Grey-headed Flying-fox. The habitat to be conserved and restored will form part of proposed Biodiversity Stewardship Agreement sites which will be managed for conservation in-perpetuity. The areas to be conserved form part of connected corridors of good condition habitat that extend beyond the action area. The Grey-headed Flying-fox is highly mobile and known to utilise a range of foraging resources within its foraging range. The habitat within the action area to be conserved would be available for any individuals in nearby camps who are foraging. The proposed action is unlikely to significantly adversely affect habitat critical to the survival of the Grey-headed Flying-fox.
Disrupt the breeding cycle of an important population	Actions that may impact the breeding cycle of an important population are direct impacts to a camp or substantial reductions in the availability of foraging habitat within the average nightly foraging range of a camp that may affect breeding success. No known camps would be affected by the proposed action. The closest camp is located 5 km north west of the action area in Camden-Brownlow Hill. The proposed action would remove 46.06 ha of potential foraging habitat for the Grey-headed Flying-fox, however this does not comprise a substantial proportion of the habitat within the action area. 155.18ha of good condition habitat will be conserved in-perpetuity and an additional 53.90 ha of habitat will be restored and conserved. The proposed action would not fragment or isolate a camp from foraging habitat or on a camp. There are substantial resources within the foraging range that would remain available in-perpetuity for individuals in nearby camps. The proposed action would not disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No camps were identified within the action area. The proposed action would remove or modify up to 46.06 ha of potential foraging habitat for the Grey-headed Flying-fox which would result in a decrease in foraging habitat, of which more than 90% is low quality foraging habitat (scattered paddock trees). However, the decrease in foraging habitat is unlikely to impact the Grey-headed Flying-fox such that it is likely to decline. The proposed action would permanently conserve 155.18 ha of good condition foraging habitat and a further 53.90 ha of habitat will be restored and conserved within the action area. In addition, 25.19ha of potential foraging habitat would also be retained. Any individuals in nearby camps would rely on the conserved, restored and retained amongst other resources within the locality. As such, the proposed action is unlikely to impact habitat such that the species declines.
Result in an invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	*Pteropus alecto* (Black Flying-fox) can outcompete the Grey-headed Flying-fox when foraging resources are low. The availability of foraging resource is unlikely to decline to an extent that competition would substantially increase with the Black Flying-fox.
Introduce disease that may cause the species to decline	Grey-headed Flying-foxes are known natural reservoirs for the Australian Bat Lyssavirus (ABL) which can spread when the population is under stress. The incidence of the ABL is low within the Grey-headed Flying-fox (DotEE 2017). The removal or modification of up to 46.06

Significant Impact Criteria	Assessment
	ha of foraging habitat and no impacts to camps is unlikely to cause stress such that the ABL spreads.
Interfere substantially with the recovery of the species	The proposed action is unlikely to substantially interfere with the recovery of the species because: • no camps would be affected • up to 46.06 ha of potential foraging habitat would be affected (of which more than 90% is of low quality • 155.18 ha of good condition foraging habitat will be conserved in-perpetuity • 53.90ha of habitat will be restored and conserved in-perpetuity • 25.19ha of potential habitat will be retained • The proposed action will not fragment or isolate any areas of foraging habitat or any areas of foraging habitat and camps • The species is highly mobile and would utilise a range of foraging resources in the locality.

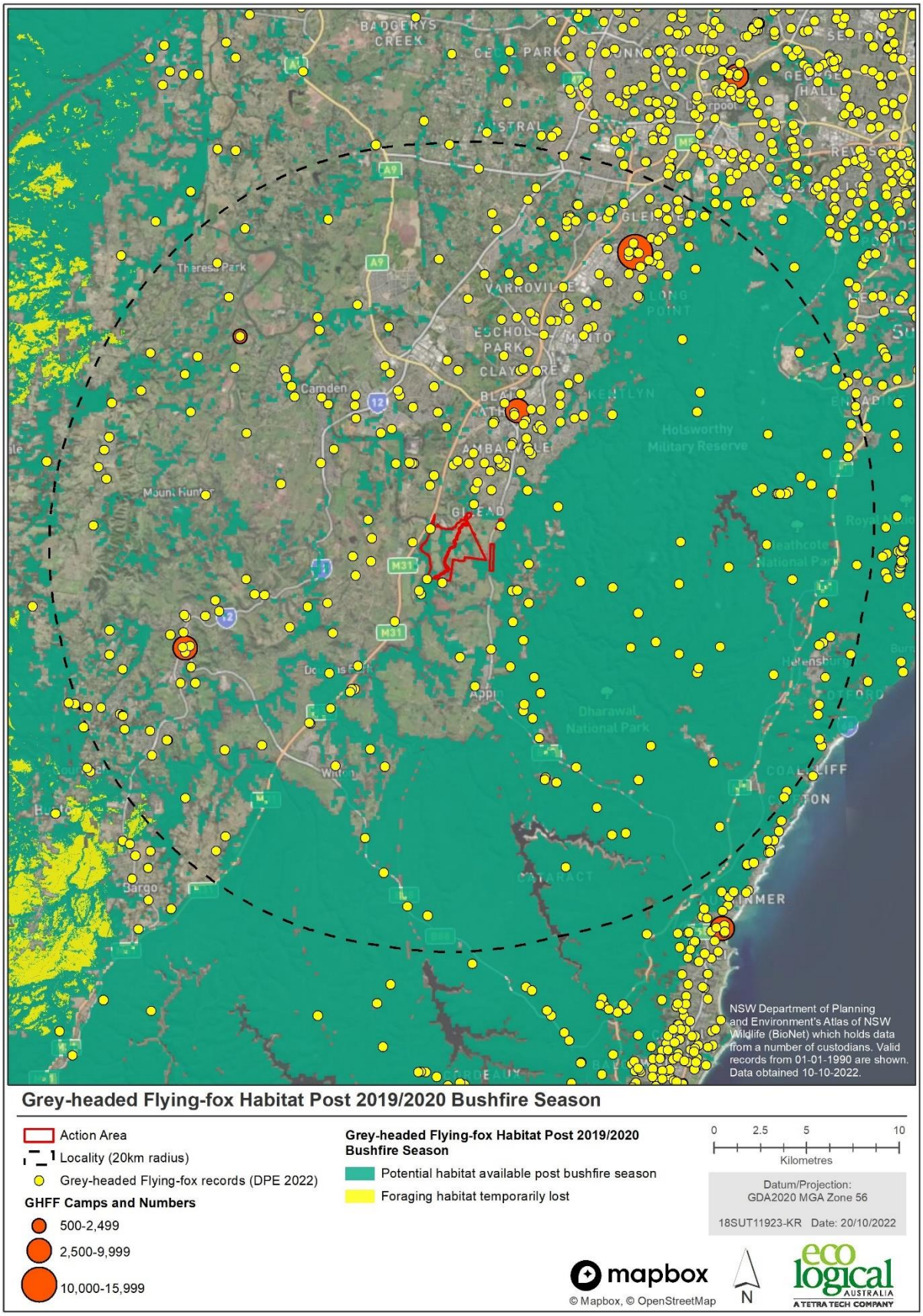


Figure 39: Grey-headed Flying-fox preferred habitat and impacts of the 2019 / 2020 bushfires within the locality

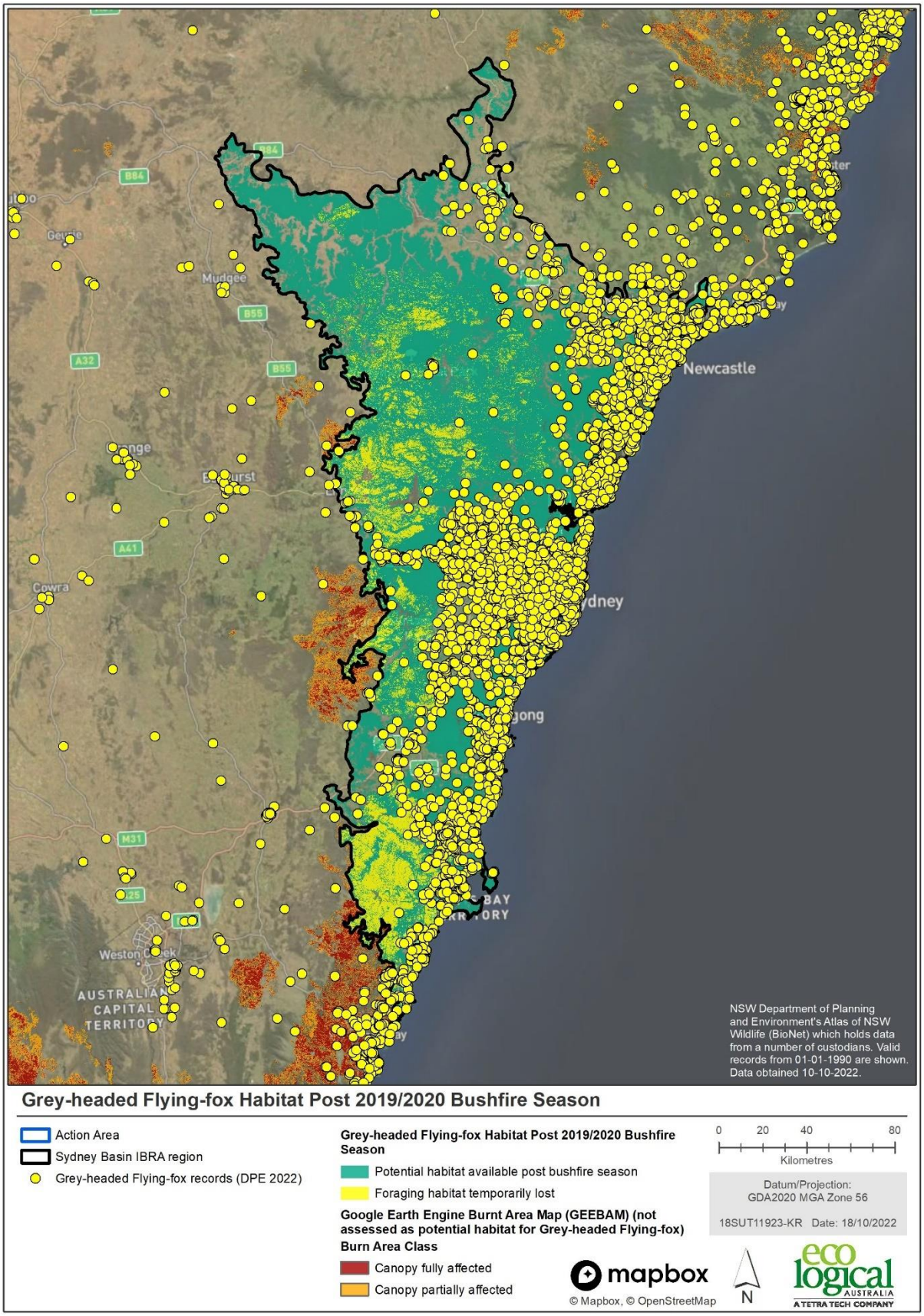


Figure 40: Grey-headed Flying-fox records, preferred habitat and impacts of the 2019 / 2020 bushfires in the IBRA subregion

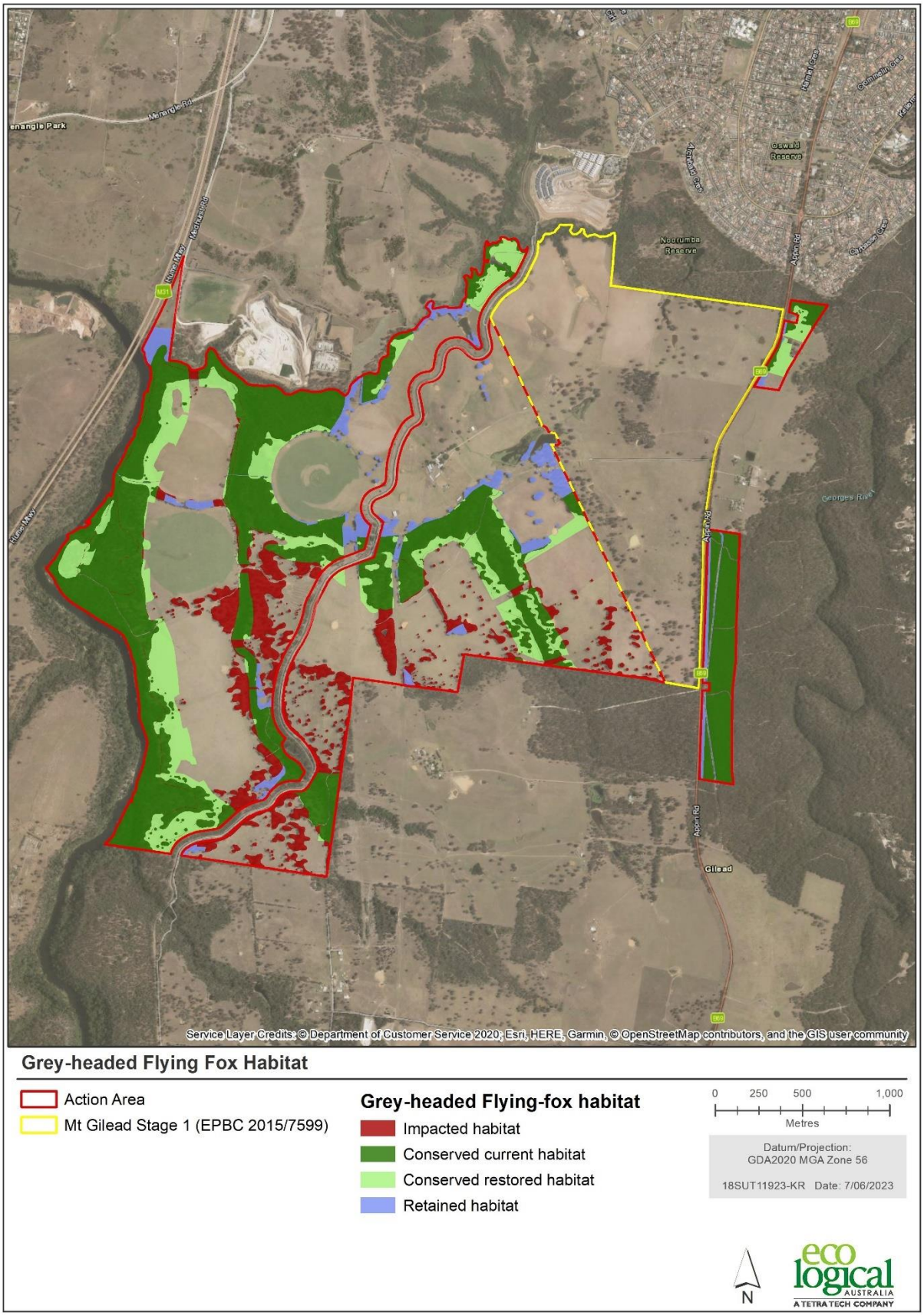


Figure 41: Grey-headed Flying-fox foraging habitat to be affected, protected and retained

7.5 Large-eared Pied Bat (*Chalinolobus dwyeri*)

7.5.1 Species ecology

The Large-eared Pied Bat is an insectivorous bat with a distribution from Shoalwater Bay in Queensland through to around Ulladulla in NSW. The species is largely restricted to the interface of sandstone escarpment for roosting habitat, and relatively fertile forests supporting woodlands and forests for foraging habitat. The species forages for insects in and around forest canopies across a range of vegetation types including dry and wet sclerophyll forest, grassy woodland, Callitris dominated forest, tall open forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country. However, the species utilisation of these habitats is highly dependent on the presence of sandstone caves or escarpments which this species uses for breeding. This is reflected by a vast majority of records within several kilometres of cliff lines and rocky terrain (DERM 2011; DAWE 2021).

The Conservation Advice for the Large-eared Pied Bat (DAWE 2021) states that it is not practical to describe/define habitat critical to the survival of the species as large areas of potential habitat for the species are unsurveyed. Accordingly no critical habitat has been defined under section 207A of the EPBC Act or included in the Register of Critical Habitat.

Similarly the Conservation Advice also states that at this point in time there is insufficient information available to be able to describe important populations of the species and that until such information is available, all populations of the species shod be considered important (DAWE 2021).

7.5.2 Distribution locally and in action area

Across its known range, the Large-eared Pied Bat has an estimated extent of occurrence of 280,000 km^2, of which 1,500 km^2 is the estimated area of occupancy (DAWE 2021) with a heavy reliance of native vegetation within proximity to sandstone caves and escarpments. Within the locality of the proposed action, there are over 1,500 records for the Large-eared Pied Bat mostly within large, continuous patches of native vegetation, including in Dharawal National Park, Upper Nepean Nature Reserve and Heathcote National Park (Figure 42).

Within the action area, the Large-eared Pied Bat was detected via echolocation survey (Figure 42). Within the proposed development footprint, there are no sandstone caves or escarpments. There are numerous riparian corridors that run through the action area which, although having sandstone features present, are generally low lying, are not steep and have limited fissures and crevices or caves suitable for roosting or breeding. Some of the riparian corridors and escarpment / cave systems to the east of the action area in the Georges River catchment may have suitable roosting and breeding resources. The habitat within the development footprint is limited to foraging habitat. As such, the Large-eared Pied Bat would be using the action area for foraging purposes only.

7.5.3 Assessment of the 2019 / 2020 bushfires

The 2019 / 2020 bushfires did not affect any Large-eared Pied Bat habitat within the action area. Impacts were limited to the western extent of the locality and were minor in nature (Figure 43). Impacts across the Sydney IBRA region are concentrated in the southern and western portions (Figure 44). The Large-eared Pied Bat is comprised of numerous, important populations that span the eastern coastal range from QLD to NSW with structurally complex native vegetation in proximity to breeding sites (sandstone caves and escarpments) considered critical habitat for this species. Any foraging resources within the

foraging range of breeding sites that were affected may have temporarily changed the roosting and foraging behaviour of this species. Within the Sydney Basin IBRA region, the records, location of preferred habitat and extent of the fires suggest that at the western and southern extents of the region, foraging habitat within proximity to caves may have been affected by the 2019 / 2020 bushfires. In areas where the canopy was partially affected, some foraging resources may have remained available within proximity to roosting / breeding habitat. Where the canopy was fully affected, it is likely that this foraging habitat was temporarily lost, which may have increased the importance of other roosting / breeding sites and foraging habitat in proximity to the affected area.

Given that the Large-eared Pied Bat occupies several smaller, important populations and generally utilises a small home range for foraging purposes, the action area is unlikely to have increased in importance for the Large-eared Pied Bat which form other populations.

7.5.4 Direct impacts

The proposed action will impact directly or indirectly up to 46.06 ha of Large-eared Pied Bat foraging habitat, more than 90% of which is of poor quality (scattered paddock trees, given the preference of the species to forage in areas of continuous canopy). No breeding or roosting habitat will be affected as part of the proposed action. The proposed action will permanently conserve 155.18 ha of existing foraging habitat in perpetuity as part of the Biodiversity Stewardship Agreement sites. An additional 53.90 ha of cleared land will be restored and conserved which will provide habitat in the future for the Large-eared Pied Bat. The proposed action will also retain 25.19 ha of foraging habitat across the action area. The conservation measures across the action area will include the conservation of 208.11 ha of current and future habitat.

The landscape of the action area has been extensively modified by past agricultural uses. The foraging habitat to be affected is mostly (41.76 ha) comprised of scattered paddock trees and thinned/pasture improved woodland which, although still representing foraging habitat, is sub-optimal for this species as it prefers structurally complex vegetation. The habitat to be conserved within the proposed conservation areas forms part of large, continuous patches of better condition foraging habitat.

7.5.5 Indirect impacts

Indirect impacts likely to affect the Large-eared Pied Bat include disturbance to primary nursery sites by human recreational activities (caving) and feral animals (goats), predation by introduced predators and disturbance to habitat from livestock (DAWE 2021). There are no primary nursery sites known in the action area and grazing will be excluded from the proposed offset areas

7.5.6 Application of the Significant Impact Criteria

DAWE considered that there were 'likely to be significant residual impacts to Large-eared Pied Bat resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts, that the proposed action is unlikely to constitute a significant impact to this species (Table 25). Despite this conclusion, significant offsets to protect and enhance LEPB habitat in the action area are provided which 97% of the EPBC offset target with the protection of existing habitat, increasing to 307% with the addition of restored habitat (Table 29).

Table 25: Significant Impact Assessment for Large-eared Pied Bat

Criteria	Significant Impact?
An action is likely to have a significant impact on an vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	The Sydney Basin is recognised as an important population of the Large-eared Pied Bat. The proposed action would remove or modify up to 46.06 ha of foraging habitat within the action area. The foraging habitat to be affected is mostly located in the areas that have been previously grazed and extensively cleared for agricultural purposes. The foraging habitat in these areas is sub-optimal due to the lack of structural complexity, and is furthest away from potential breeding / roosting sites along the Nepean and Georges Rivers. Where there is habitat adjacent to riparian corridors or rocky, sandstone areas, the foraging habitat is in good condition and will be conserved in-perpetuity as part of the proposed Biodiversity Stewardship Agreement sites (BSAs). The proposed action will conserve and restore 208.11 ha of foraging habitat for this species. Given that no breeding or roosting habitat will be affected and the impacts to foraging habitat are concentrated in poorer condition areas away from potential breeding features, the action is unlikely to lead to a long-term decrease in the size of an important population.
reduce the area of occupancy of an important population	The estimated area of occupancy is 1,500 km^2 across the distribution of the Large-eared Pied Bat (Extent of Occurrence 280,000 km^2). The proposed action will remove or modify up to 46.06 ha of foraging habitat within the area of occupancy (0.031%). However, the habitat to be removed is sub-optimal and in poor condition, and does not directly join any areas that could be used for breeding or roosting purposes. The best condition foraging habitat along riparian corridors and close to rocky, sandstone areas will be conserved in-perpetuity. Therefore, the reduction in area of occupancy would only be marginal in comparison the substantial area of foraging habitat to be restored and conserved in-perpetuity.
fragment an existing important population into two or more populations	The proposed action will remove or modify up to 46.06 ha of foraging habitat mostly within areas previously cleared or grazed for agricultural purposes, with no roosting or breeding areas to be affected. The foraging habitat to be removed will not result in the fragmentation of foraging habitat within the action area. The areas proposed for conservation will maintain connected corridors of vegetation throughout the action area and throughout the broader landscape and will not result in the isolation or fragmentation of foraging habitat from breeding / roosting habitat.
adversely affect habitat critical to the survival of a species.	The Conservation Advice for the Large-eared Pied Bat Habitat states that it is not practical to describe 'habitat critical to the survival' of this species and suggests that all habitat is critical to the survival of the species (DAWE 2021). The 2011 recovery plan (DERM 2011) states that habitat critical to the survival of the species includes maternity roosts and sandstone cliffs and fertile wooded valley habitat within close proximity of each other. The proposed action would remove or modify up to 46.06 ha of foraging habitat within the action area. This habitat is sub-optimal for this species and is located furthest away from sandstone features that could form breeding or roosting sites. The areas of foraging habitat that best fit the definition of critical habitat are along the riparian corridors that are being protected in BSA sites. This is comprised of 155.18ha of existing higher quality foraging habitat that will be conserved in-perpetuity and a further 53.90 ha of habitat that will be restored and conserved. The proposed action is unlikely to adversely affect habitat critical to the survival of the Large-eared Pied Bat as defined by DERM (2011) but will as defined by DAWE (2021).

Criteria	Significant Impact?
disrupt the breeding cycle of an important population	The proposed action will not impact any breeding or roosting sites and would not remove substantial portions of foraging habitat immediately adjacent to breeding or roosting habitat. The proposed action will conserve in-perpetuity 155.18 ha of existing higher quality foraging habitat immediately adjacent to rocky sandstone features, which would remain available for any breeding individuals within the vicinity. Further, the foraging habitat available will form part of connected corridors that run through the action area and provide connectivity to the locality.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No. Whilst up to 46.06ha of foraging habitat would be removed or modified, over 80% of this impact (41.76 ha) is to low quality foraging habitat and does not function as the primary or sole foraging resource for any nearby breeding or roosting individuals. The habitat to be removed is in poor condition and would function as a sub-optimal foraging resource due to the lack of structural complexity within the patch. The proposed action will not impact any breeding or roosting sites within the action area. A total of 224.75 ha of foraging habitat, comprised of 169.58 ha in moderate-good condition and 55.17 ha to be restored, will be conserved in perpetuity in the proposed BSAs. This habitat is located close to rocky sandstone areas and forms continuous corridors throughout the action area. Although the proposed action would decrease the availability of foraging habitat by up to 46.06 ha, this impact is unlikely to result in a decline of the species given its position in the landscape and quality, and the conservation measures that will be implemented as part of the proposed action.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species that could impact the Large-eared Pied Bat include domestic cats. The prevalence of domestic cats would likely increase a result of the action, given that the action is a residential subdivision. However, they would be unlikely to impact on any primary nursery sites.
introduce disease that may cause the species to decline	No. There are no known diseases that are fatal to the Large-eared Pied Bat.
interfere with the recovery of the species.	The proposed action is unlikely to interfere with the recovery to the Large-eared Pied Bat because: • No breeding or roosting sites will be affected • The foraging habitat to be removed is furthest away from rocky, sandstone areas that are preferred foraging habitat of the species • The up to 46.06 ha of foraging habitat to be removed is sub-optimal foraging habitat and is generally in poor condition • The proposed action would not fragment or isolate any breeding habitat from foraging habitat or fragment patches of foraging habitat • The proposed action will conserve in-perpetuity 208.11 ha of foraging habitat, comprised of 155.18ha of existing habitat and 53.90 ha to be restored • The conserved habitat is in good condition and is in proximity to rocky sandstone areas, forms part of connected corridors throughout the action area, increases connectivity with the surrounding landscape and is along riparian corridors (which LEPB is known to use for foraging purposes).

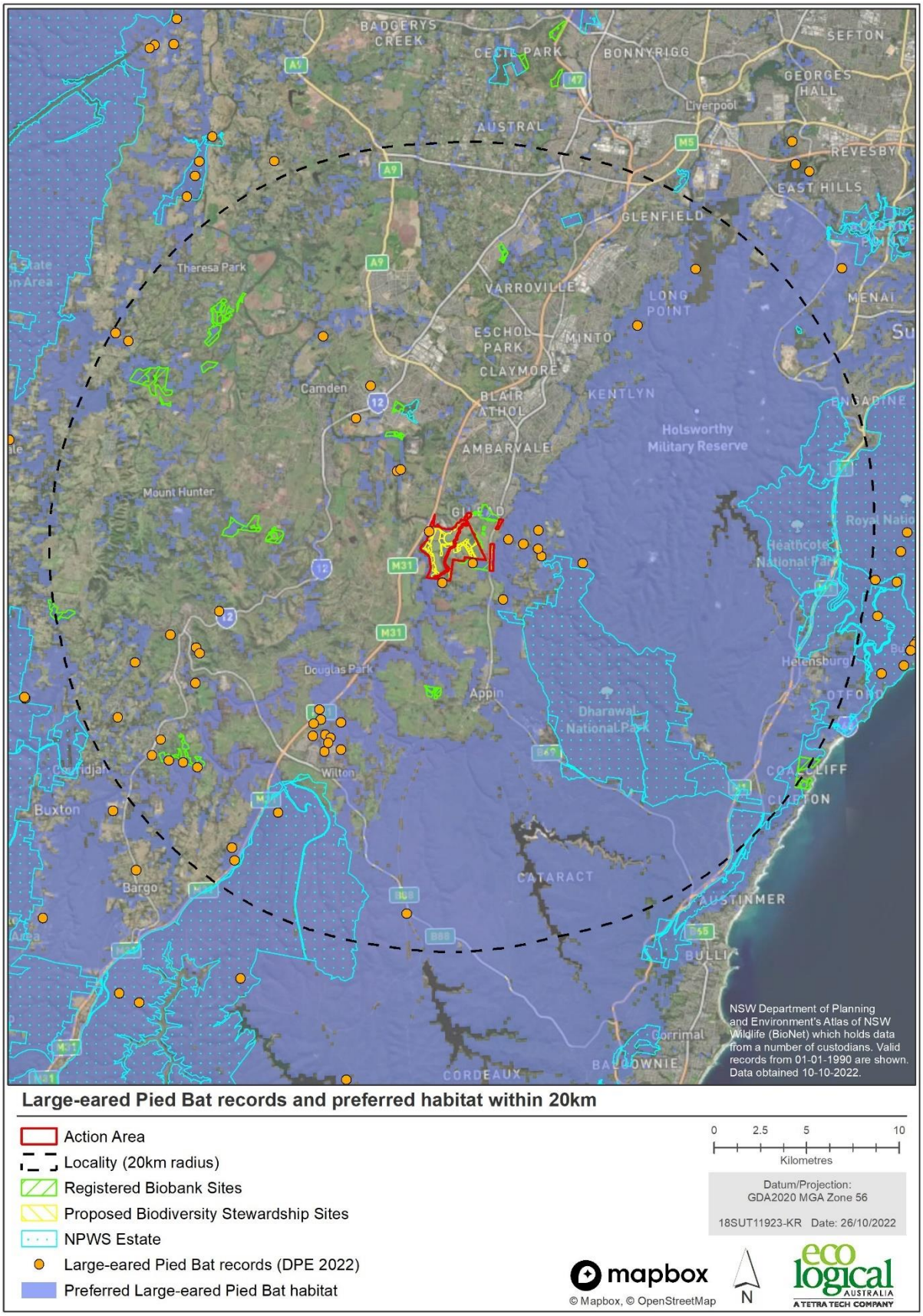


Figure 42: Large-eared Pied Bat records and preferred habitat within the locality

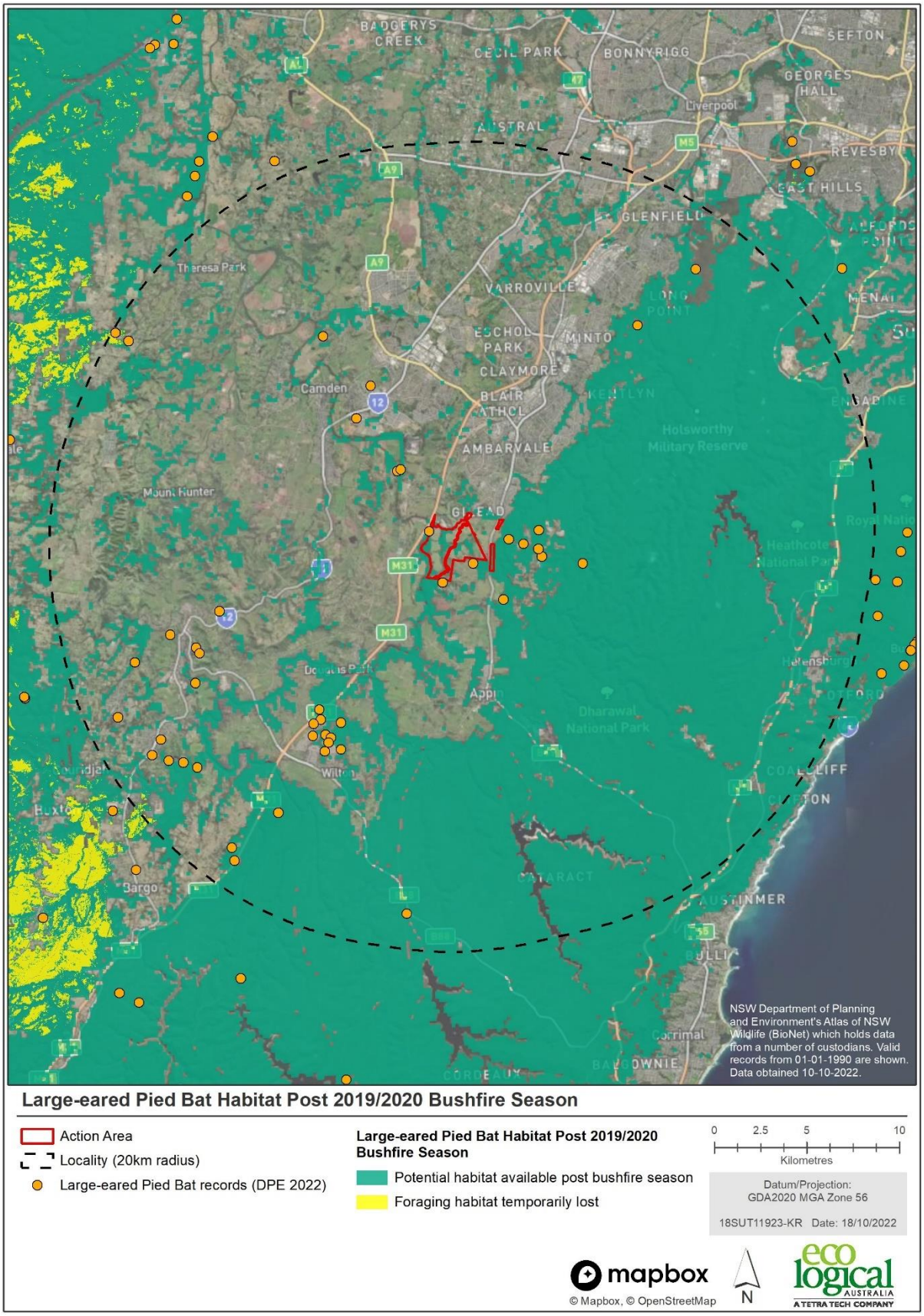


Figure 43: Impact of the 2019 / 2020 bushfires in relation to Large-eared Pied Bat preferred habitat in the locality

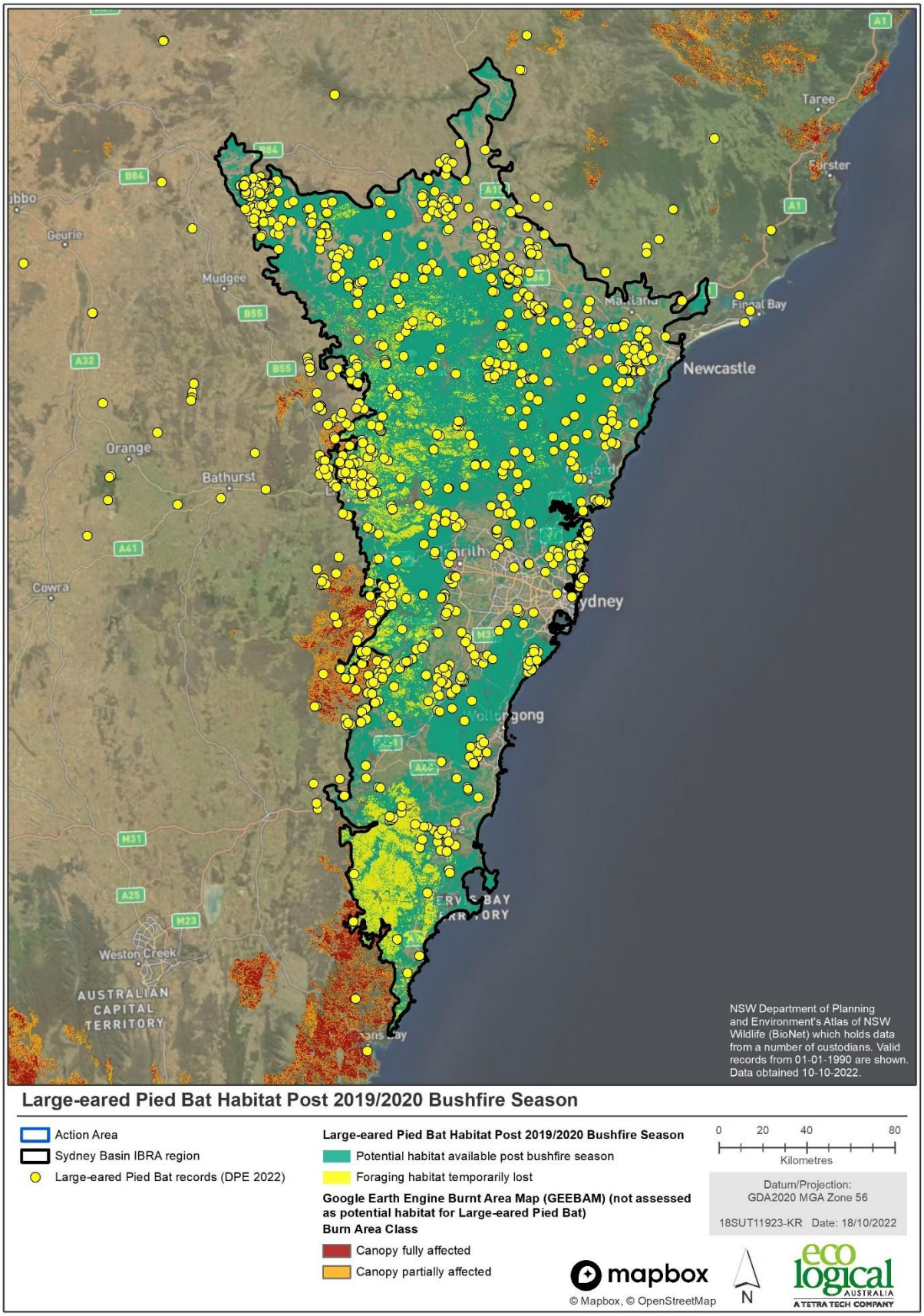


Figure 44**: Impacts of the 2019 / 2020 bushfires in relation to preferred Large-eared Pied Bat in the Sydney Basin IBRA region**

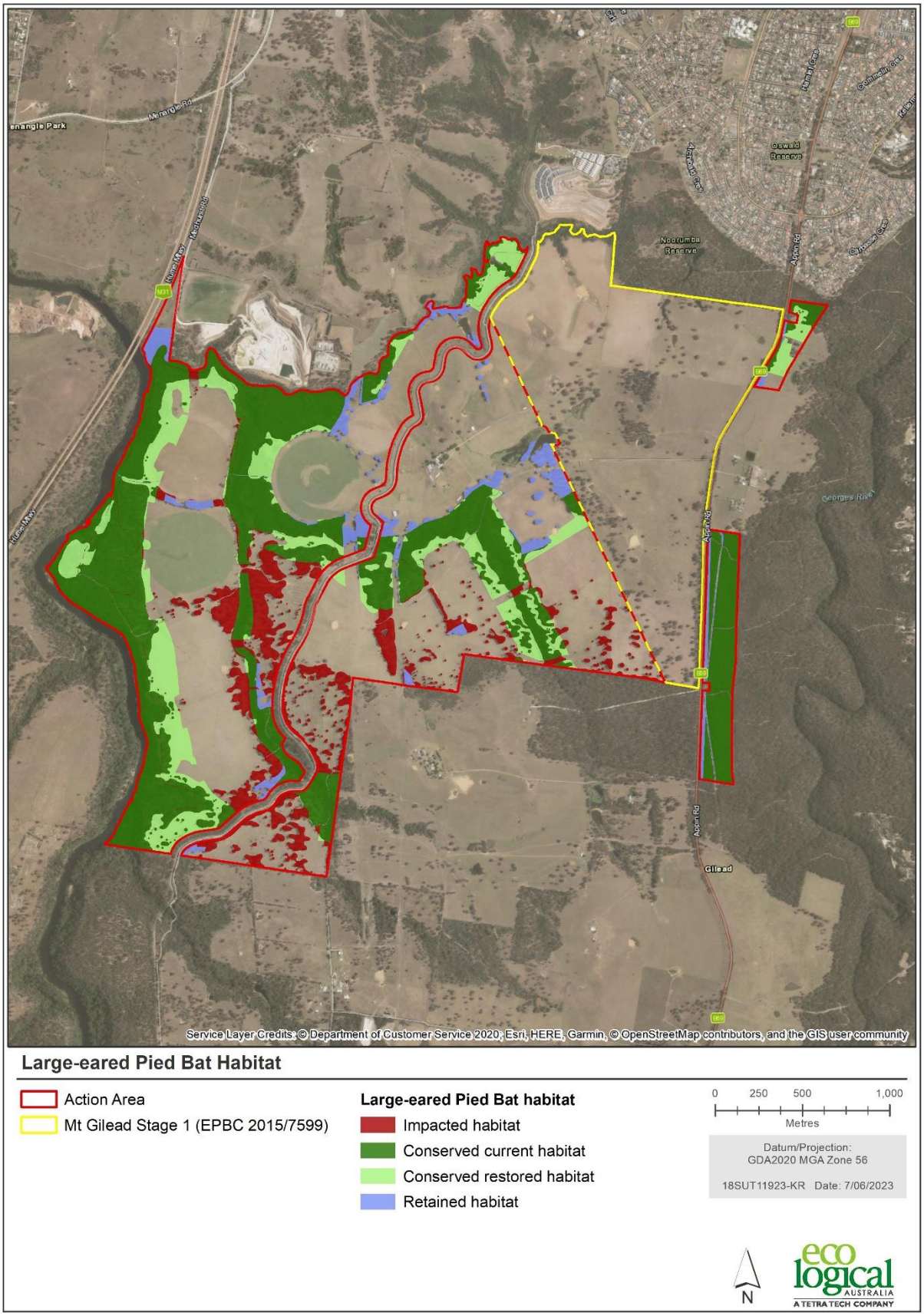


Figure 45: Large-eared Pied Bat foraging habitat to be affected, protected and retained

7.6 Swift Parrot (*Lathamus discolour*)

7.6.1 Species ecology

The Swift Parrot is a fast-moving and distinctive bird and is generally conspicuous where present.

The Swift Parrot breeds in Tasmania during the Australian summer and migrates north as a single population to mainland Australia (NSW, ACT and VIC) during winter. In NSW the Swift Parrot typically forages in forests and woodlands and tends to prefer mature trees. When on mainland Australia the Swift Parrot feeds on flowers and lerps in *Eucalyptus* spp. and will often forage widely. It is a highly mobile species able to utilise a variety of nectar sources over large areas (Saunders *and Tzaros* 2011).

In NSW, Swift Parrots forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought. Favoured feed trees including winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum)*, C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark), and *E. albens* (White Box). Key habitat for Swift Parrots on the coast and coastal plains of NSW include *Corymbia maculata*, *Eucalyptus robusta* and *E. tereticornis* forests.

Swift Parrots tend to feed on the largest, most mature trees available, when in flower. Their distribution fluctuates in response to food availability.

The Swift Parrot Recovery Plan (Saunders and Tzaros 2011) defines habitat critical to the survival of the species as:

> *those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot, or are otherwise identified by the recovery team (DotEE (Bird Life Australia) 2011).*

Priority habitat includes areas:

- used for nesting
- used by large proportions of the Swift Parrot population,
- used repeatedly between seasons (site fidelity), or
- used for prolonged periods of time (site persistence).

7.6.2 Distribution

Within the locality, records for the Swift Parrot are spread along coastal areas and within smaller patches of habitat to the west (Figure 46).

The Swift Parrot was not recorded in the action area during survey, which may be a result of its highly nomadic and irregular visitation to south-west Sydney, but the action area does support suitable habitat in the form of RFEF, CPW and SSTF which include several tree species used for foraging purposes: *Corymbia maculata* (Spotted Gum) and *E. tereticornis* (Forest Red Gum). There are a number of historical records of the species from the Camden area and reports of foraging birds in the Beulah homestead property to the south of the action area some 30 or so years ago (unpublished data in submissions to Mt Gilead Stage 1 (ELA 2018)). More recently the species has been recorded east of Browns Bush (two birds in May 2018 and seven birds in August 2021), St Helens Park (5km north-east of Gilead) in 2021 and the Mount Annan Botanic Gardens, 5km north-west of Gilead, in September 2021 (four birds).

BioNet also includes a number of records near Appin, south of the referral area and what is now the Dharawal National Park from the 1990's and 2015.

The Gilead area has not been mapped by DPIE as 'important habitat' for the Swift Parrot in the NSW BAM and Biodiversity Offset Scheme (BOS) . Important habitat is defined as '*areas with sightings of five (or more birds) recorded over any two or more consecutive years, or single sightings of 40 or more birds'* reflecting the criteria used to define areas critical to the survival of the species in the National Recovery Plan.

7.6.3 Assessment of the 2019 / 2020 bushfires

The 2019 / 2020 bushfires did not affect any Swift Parrot habitat within the action area. Impacts were limited to the western extent of the locality and were minor in nature (Figure 47). Impacts across the Sydney IBRA region are concentrated in the southern and western portions (Figure 48). The Swift Parrot breeds in Tasmania and utilises a wide variety of habitats in NSW for foraging purposes. Where substantial portions of foraging habitat were affected by the fires and where those impacts were estimated to have fully affected the canopy, this would have led to a reduction in the availability of foraging habitat in the winter of 2020 and 2021. Areas where the canopy was partially affected would still support foraging although to a lesser extent than unburnt areas. The importance of the action area for foraging habitat may have increased temporarily after the fires where large areas did not contain any intact canopy (supporting the number of 2021 sightings around Sydney, however there were still significant flocks seen in the Port Macquarie Area in 2021, despite extensive impacts of fire in that region). It is unlikely that the action area has permanently increased in importance for the survival of the species given that the loss of foraging habitat for Swift Parrot is not permanent.

7.6.4 Direct impacts

The proposed action will impact directly and indirectly up to 45.76 ha of potential Swift Parrot foraging habitat (Figure 50). No breeding habitat will be affected as part of the proposed action (as breeding habitat is restricted to Tasmania). The proposed action will conserve 143.80 ha of potential foraging habitat in perpetuity as part of the proposed Biodiversity Stewardship Agreement sites. An additional 48.70 ha of cleared land will be restored and conserved which will provide habitat in the future for the Swift Parrot. The proposed action will also retain 25.19 ha of potential foraging habitat across the action area. The conservation measures across the action area will include the conservation of 192.50 ha of current and future habitat.

Whilst the habitat to be affected includes a proportion of 'key' coastal feed trees identified in the recovery plan, the proposed action will not impact on habitat considered to be 'important' or 'critical' to the survival of Swift Parrot as it does not support a large proportion of the overwintering population and there is little evidence to suggest that Swift Parrot use the site on a regular basis or for prolonged periods of time i.e. there is a low level of site fidelity.

7.6.5 Indirect impacts

Indirect impacts listed in the recovery plan and conservation listing advice (TSSC 2016) that may impact the Swift Parrot are predation by introduced Sugar Gliders (at breeding sites) and competition for resources. Competition for breeding sites by Sugar Gliders is only relevant to breeding sites in Tasmania that will not be impacted by the proposed action. Competition for resources would only be likely to occur in situations where a significant reduction in foraging habitat occurs. The proposed action will conserve and manage in-perpetuity 143.80 ha of foraging habitat and restore and conserve at additional

48.70 ha of habitat. The habitat to be conserved and restored will form part of three proposed Biodiversity Stewardship Agreement site. In addition, 25.19 ha of foraging habitat will be retained within open space areas.

7.6.6 Application of the significant Impact Criteria

DAWE considered that there were 'likely to be significant residual impacts to Swift Parrot resulting from the action, however, we are of the view, taking into account the measures to avoid and minimise impacts, that the proposed action is unlikely to constitute a significant impact to this species (Table 26). Despite this conclusion, significant offsets to protect and enhance Swift Parrot habitat in the action area are provided which meet 112% of the EPB offset target using the protection and management of existing habitat only, increasing to 155% with the addition of restoration areas (Table 29).

Table 26: Significant Impact Assessment for the Swift Parrot

Criteria	Application
An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
lead to a long term decrease in the size of a population	The Swift Parrot breeds in Tasmania and migrates to NSW and Victoria to forage outside of the breeding season. Actions that may lead to a long-term decrease in the size of the population would be impacts to breeding habitat and substantial reductions in foraging resources on the mainland. The proposed action would remove *or modify* up to 45.76 ha of potential foraging habitat for the Swift Parrot. No breeding habitat would be affected. The foraging habitat to be removed forms part of a mosaic of foraging resources throughout the species foraging range, and would not solely be relied upon. The proposed action will permanently conserve and enhance 143.80 ha of better condition foraging habitat, restore and conserve a further 48.70 ha of land that will become foraging habitat and retain a further 25.19 ha of foraging habitat in open space and recreational areas. The loss of up to 45.76 ha of foraging habitat in this context is considered unlikely to lead to a long-term decrease in the Swift Parrot population given the very wide ranging and variable foraging activity of the species on mainland Australia.
reduce the area of occupancy of the species.	The estimates for the area of occupancy for the Swift Parrot vary year to year, as this species changes its foraging behaviour each year in response to flowering events. The area of occupancy has been estimated at an average of 425 km^2 (TSSC 2016). The proposed action would reduce the area of occupancy of the Swift Parrot by approximately 0.46 km^2 (45.76 ha). It is difficult to determine the relative importance of this habitat given that the species only relies on this habitat when the canopy is in flower and may not visit all flowering habitat areas every season. The proposed action will conserve and manage in-perpetuity 1.92 km^2 of foraging habitat. When compared to area of foraging habitat to be conserved and managed in-perpetuity, the reduction in area of occupancy of 0.46 km^2 is unlikely to adversely affect the Swift Parrot.

Criteria	Application
fragment an existing population into two or more populations	The proposed action would not fragment an existing population into two or more populations. . The Swift Parrot has a very large foraging range along the eastern coastal regions of NSW and Victoria and is highly mobile, visiting multiple foraging areas each season. The removal or modification of up to 45.76 ha of foraging habitat would not fragment the foraging resources network to such an extent such that the population would be fragmented into two or more populations, each using foraging areas independently. The proposed action will conserve, manage and enhance in-perpetuity 143.80 ha of foraging habitat and restore and conserve an additional 48.70 ha of foraging habitat. An additional 25.19 ha will be retained. The conservation measures across the action area secure foraging habitat and contribute to broader connectivity throughout the landscape.
adversely affect habitat critical to the survival of a species.	No. There the action area does not meet the definition of 'habitat critical to the survival of the species' and the recovery plan does not identify the area as critical habitat.
disrupt the breeding cycle of a population	No. The species does not breed in NSW and the impacts to a relatively small proportion of the available foraging habitat are unlikely to disrupt the breeding cycle of the population. The proposed action will conserve and manage in-perpetuity 143.80 ha of foraging habitat and restore and conserve an additional 48.70 ha of foraging habitat. An additional 25.19 ha will be retained. The conservation measures across the action area secure foraging habitat and contribute to broader connectivity throughout the landscape.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No. The species forages widely in NSW and Victoria and is highly mobile. The loss or modification of up to 45.76 ha of potential foraging habitat is unlikely to lead to a decline in the species.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Invasive species that could present a threat to the Swift Parrot include the European Honeybee and *Sturnus vulgaris* (European Starlings) which can compete for hollows in breeding areas. There is no breeding habitat in the action area.
introduce disease that may cause the species to decline, or interfere with the recovery of the species.	The Swift Parrot is susceptible to the Psittacine Beak and Feather Disease (PBFD). The disease can be spread when birds are under period of environmental stress. The proposed action would remove or modify up to 45.76 ha of potential foraging habitat, however, given the foraging behaviour of the species and its very high mobility, this is unlikely to contribute to stress levels in the species. In addition, the proposed action would conserve 192.50 ha of foraging habitat in-perpetuity as part of the proposed Biodiversity Stewardship Agreement sites and retain an additional 25.19ha of foraging habitat in a connected network.

Criteria	Application
interfere with the recovery of the species.	No. The proposed action is unlikely to interfere with the recovery of the species because: • No breeding habitat would be affected • The proposed action would not isolate or fragment two areas of foraging habitat or breeding habitat from foraging habitat *given the high mobility of the species* • The proposed action would remove or modify up to 45.76 ha of potential foraging habitat which is a minor impact to the extent of foraging habitat for the Swift Parrot, given their wide foraging range and reliance on multiple foraging resources • The proposed action will conserve, in-perpetuity, 143.80 ha of foraging habitat and conserve and restore 48.70 ha of foraging habitat as part of a Biodiversity Stewardship Agreement sites. An additional 25.19 ha of foraging habitat would be retained in the action area.

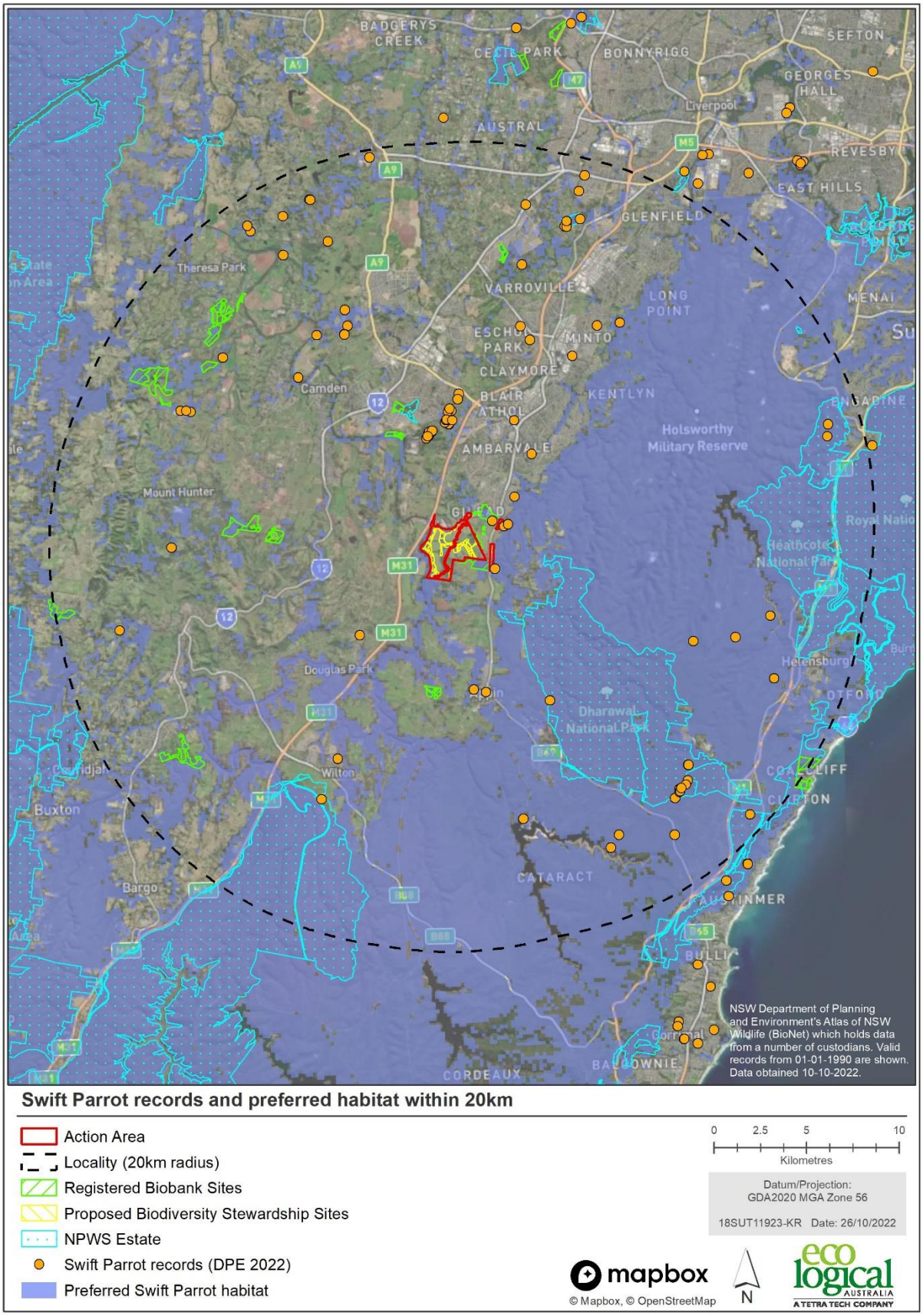


Figure 46: Swift Parrot records and preferred habitat throughout the locality

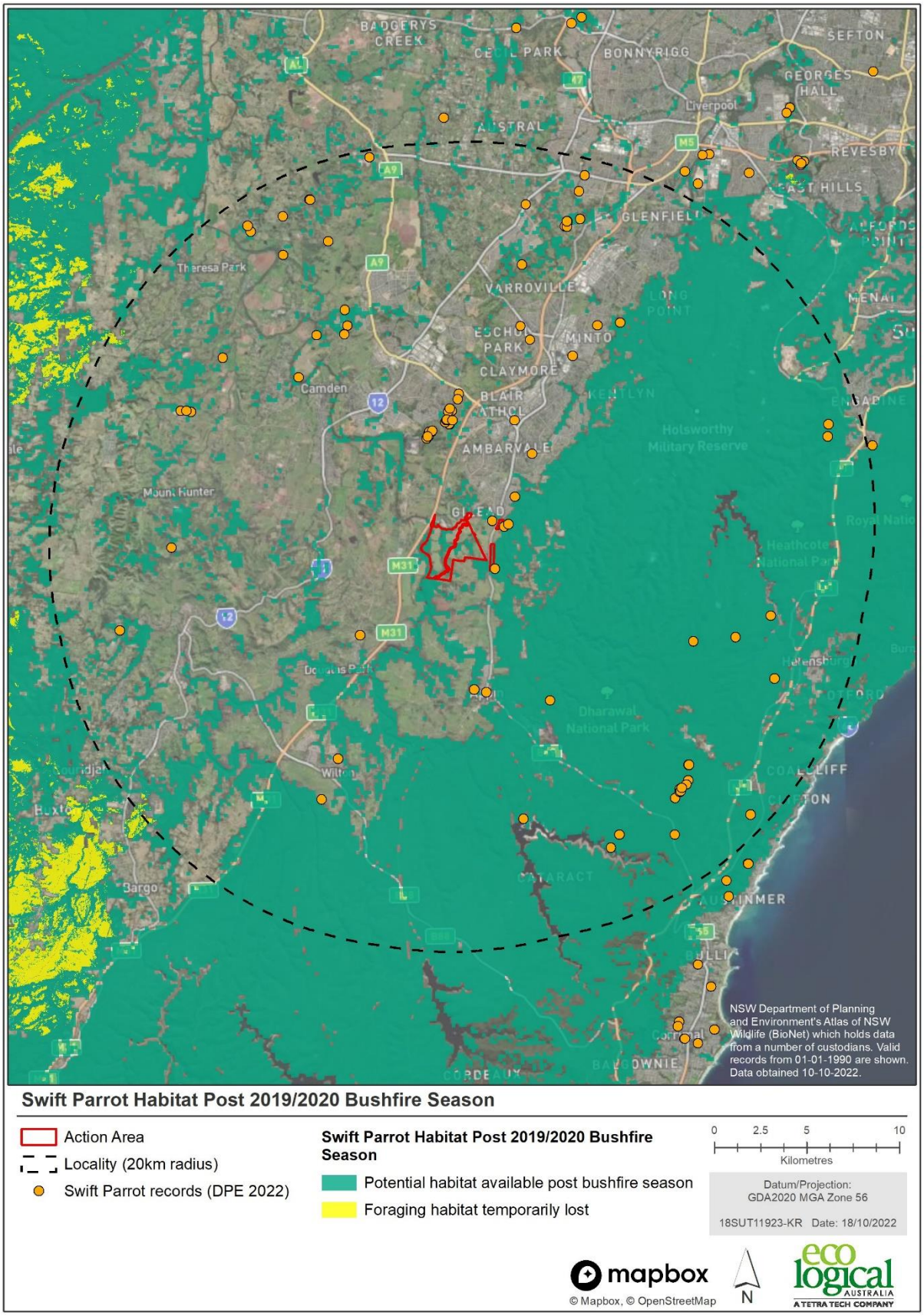


Figure 47: Impacts of the 2019/2020 bushfires on preferred Swift Parrot habitat and the action area

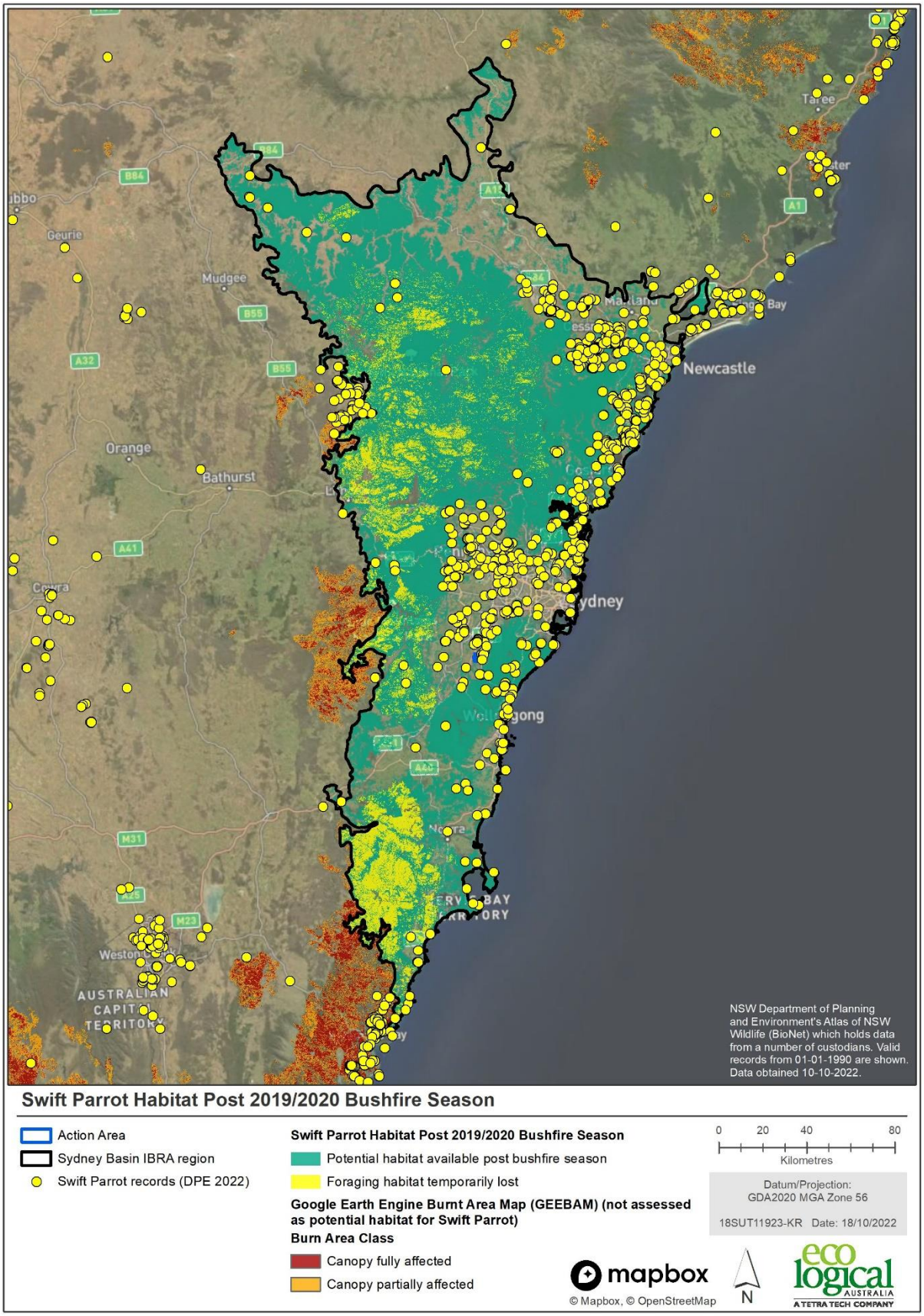


Figure 48: Impacts of the 2019 / 2020 bushfires on preferred Swift Parrot habitat in the Sydney IBRA region

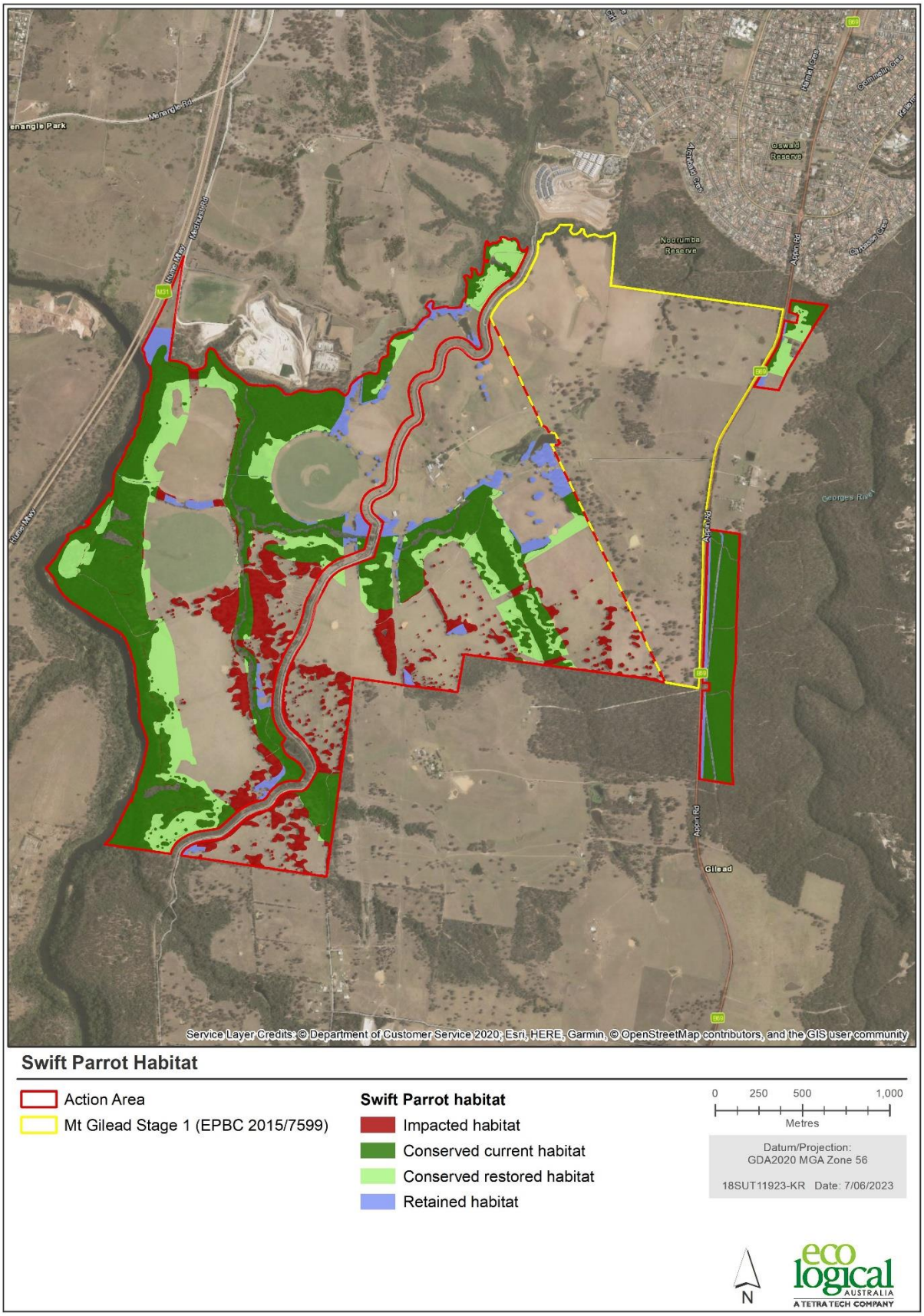


Figure 49: Swift Parrot foraging habitat to be affected, protected and retained

8. Proposed avoidance, minimisation and mitigation / management measures

A range of safeguards and mitigation measures will accompany the proposed action. The goal of these actions is to firstly minimise the direct impact introduced by the development and secondly to ensure that indirect impacts do not eventuate, so all proposed on-site offset areas are adequately protected and managed alongside the development.

8.1 General Avoidance and minimisation

The design of the proposed action has followed the Significant Impact Guidelines for MNES (DotE 2013), which identifies important factors that must be considered when assessing the potential impacts on threatened species, populations, or ecological communities, or their habitats; namely to avoid, mitigate and finally to offset any residual impacts.

The land within the action area has been identified by the former DPE as a Priority Precinct in the Greater Macarthur Growth Area (DPE 2015, 2018 & 2020). Following an assessment of the biodiversity values of the action area and surrounding lands between 2015 and 2017, the proponent developed a Masterplan that is consistent with the Greater Macarthur Structure Plan and is sympathetic to biodiversity values.

The Masterplan (Figure 3) has been developed through numerous iterations to avoid the EPBC Act vegetation and retain and enhance wildlife corridors, particularly for the Koala. Following the submission of the referral in 2019 (Appendix A), further modifications to the footprint were made to further reduce impacts to the MNES across the action area.

The principles used to avoid, minimise and mitigate impacts in the development footprint include:

- the layout design selection process considered the biodiversity constraints of the proposed action
- the proposed action was located predominantly in areas that did not have native vegetation, avoiding CPW and SSTF
- where impacts to threatened ecological communities was unavoidable, impacts were concentrated in the poorer condition patches of the communities (thus avoiding and/or minimising impacts CPW and SSTF that met EPBC Act condition thresholds
- where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition (avoiding and/or minimising impacts to Koala, GHFF, LEPB)
- where possible the amount of habitat loss was minimised and concentrated in areas of poorer habitat that were already fragmented or isolated from other vegetation across the action area.

The calculation of all direct impacts has been based on a worst-case scenario – i.e. on the assumption of complete loss of all biodiversity values including where these losses are likely to be only partial e.g. creation of bush walking paths 1.2 m that will avoid impacting trees), establishment and maintenance of bushfire asset protection zones (which allow for the retention of canopy with crown separation and

ground cover), retention of trees in open space areas; or temporary e.g. detention basins (which will be revegetated after establishment)

8.2 Management of potential indirect impacts

Activities within the development site have the potential to indirectly impact avoided or retained native vegetation over both the short and the long term. These potential impacts, often referred to as 'indirect' and/or 'edge effects', may include:

- the introduction of weeds and exotic species
- the spread of litter and rubbish
- introduction of domestic animals (cats and dogs)
- increased disturbance from pedestrian access
- runoff from construction containing nutrients, sediments and other pollutants
- inappropriate water, sewer and stormwater management leading to erosion
- recreational use of open space adjacent to offset areas

The lot layout for Stage 2 has been designed to avoid and/or minimise, to the maximum extent possible, indirect impacts to native vegetation including indirect impacts to the proposed conservation areas. The outer perimeter of the proposed residential footprint is a perimeter road. As such, there will be no residential blocks directly adjacent to protected bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by future residents, thus minimising the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals
- allows for the required Bushfire Asset Protection Zones (APZs) to be absorbed, where possible, (i.e. overlap with) the perimeter roads and the dwelling setback within the individual lots. Therefore, the only impacts from APZs is the partial impacts caused by the establishment and maintenance of the outer protection zones which are able to retain a degree of canopy cover, as long as a 2m separation between canopies is provided (PBP 2019) and managed ground cover, and
- allows for a managed 30 m TEC buffer zone to be established between the residential lots and protected bushland areas as required by the EPBC Act Conservation Listing Advice (TSSC 2014a), see below.

8.2.1 Flooding, stormwater and water quality

Inappropriate water, sewer and stormwater management presents potential risks to the integrity of the conservation areas. Water sensitive urban design (WSUD) features will be incorporated in the development. The preferred strategy option for water cycle management includes:

- Vegetated bioretention systems incorporated into select streetscapes
- Rainwater harvesting tanks on homes
- Vegetated filter strips located within open areas/parks adjacent and upslope of riparian corridors
- Gross Pollutant Traps (GPTs) strategically located at outlet of stormwater drainage systems

- Naturalised stormwater improvement basins ('naturalised basins'), incorporating both treatment and on-site detention function, located downstream of GPTs and off-line from existing waterways, in cleared land outside of riparian buffers.
- Rehabilitated natural drainage channels

The naturalised basins are located within land currently clear of any significant native vegetation due to previous agricultural uses and outside of riparian buffers (24.15 ha of the land to be certified containing 3.42 ha of native vegetation). Naturalised basins incorporate ephemeral wetland and bioretention features to filter stormwater and reduce water-borne pollutants such as nutrients and fine suspended solids before being discharged to the streams. They also slow the discharge rates during small but frequent rainfall events, those which have greater impact on stream erosion, as well as detain larger storm flows for flood detention.

The naturalised basins will support native ground covers, shrubs and trees consistent with local PCTs (Cumberland Plain Woodland and Shale Sandstone Transition Forest) to provide for fauna movement and connectivity, including arboreal mammals (e.g. Koala). Habitat enhancements, such as ephemeral or permanent watering holes/pools (receiving treated stormwater only), rock piles, fallen wood and hollow logs, provide a range of habitat opportunities for birds, frogs and foraging/nesting resources for bats and birds. They are designed to support long functional life spans, aligned to the tree species growing within, and provide access for regular low impact (non-mechanical) maintenance.

Examples of constructed naturalised basins are depicted in Figure 50. The water captured in the basins will only be retained for as long as required for it to be released at pre-development flow rates, once discharged (shortly after a rainfall event), the areas quickly dry out emulating ephemeral floodplain wetlands. The quantity and quality of the water flowing out of the naturalised basins into receiving watercourses, including through proposed offset areas, will be of a higher standard than pre development rural run-off and at flow rates no different to the current high and low flow events.

Examples of rehabilitated naturalised detention basins with up to 16 years of vegetation growth are detailed in **Appendix U** and Figure 50. These examples show the level of biodiversity values that can be established in these basins after construction whilst still operating efficiently for storm water management and requiring little if any maintenance after the plant establishment phase (Years 0-2). These naturalised basins will provide a strong buffer area between the urban development interface and the proposed conservation areas.

As a result of the above measures, no stormwater run-off is expected to enter conservation areas other than periodic discharges of high quality water into existing waterways as described above. Further, the CEMP will include measures to ensure that any impacts during the construction phase of the bio-retention basins is confined to the development footprint and will not extend into proposed conservation areas.

The outlet pool of an ephemeral stormwater treatment wetland

Vegetated detention basin providing species diversity and habitat values.

A maintenance access track between a naturalised basin (right) and remnant natural forest (left)

Design and landscaping examples of stormwater basins (photo credits: E2Designlab)

Photos of a treed stormwater biofiltration basin, 16 years post construction (E2 Designlab, 2023)

Figure 50: Examples of naturalised detention basins at Wakerley, Brisbane, showing fauna habitat values 16 years after establishment.

8.3 Measures to avoid and minimise impacts to each MNES

8.3.1 Threatened Ecological Communities (CPW and SSTF)

8.3.1.1 Avoidance

The layout design selection process considered the biodiversity constraints of the proposed action. The resulting action was located predominantly in areas that did not have native vegetation, of vegetation in poor condition, avoiding significant impacts to CPW and SSTF. Where impacts to threatened ecological communities was unavoidable, impacts were concentrated in the poorer condition patches of the communities (thus avoiding and/or minimising impacts CPW and SSTF that met EPBC Act condition thresholds. Finally areas where vegetation was avoided have been provided with buffers as described below.

8.3.1.2 TEC buffer zones

The conservation advice for SSTF (TSSC 2014a) recommends that a 30 m vegetated buffer is provided between the development zone and the edge of the EPBC SSTF to mitigate against indirect impacts to retained or conserved areas of SSTF. Whilst not specifically required for CPW (TSSC 2008), the DAWE recommends that similar buffers are provided for retained patches of CPW.

As shown in Figures 52 and 53, 30 m buffers comprising inner and outer zones have been provided to all retained SSTF and CPW in the action area as described in Section 5. The buffers have been created from the outer edge of the perimeter road and extend for 30m and in in some parts include the outer APZ or parts of the proposed Biodiversity Stewardship sites. Impacts have been calculated for all APZ areas as a 40% reduction in biodiversity values as shown in Table 14 and Table 16 (i.e. 60% of the original biodiversity values remains). Where the buffers extend into the proposed conservation areas, indirect impacts will be mitigated by the fully funded in perpetuity active conservation management and restoration of the proposed conservation areas as described in Section 9. Accordingly any indirect impacts to CPW and SST within the outer and inner buffer zones are fully managed and mitigated. An allowance of a 20% and 5% reduction (i.e. 80% and 95% of the original biodiversity values remaining respectively), in the quality of these vegetation types has been included in the impact assessment in Section 5 on the basis of these mitigation measures, consistent with Stage 1, as shown in Table 14 and Table 16.

All proposed conservation areas, including portions of the inner and outer 15 m of the 30 m buffer zones, will be permanently fenced (Koala exclusion fencing) and actively managed for fully funded conservation in-perpetuity under registered Biodiversity Stewardship Agreements. This fully funded management will minimise and mitigate any potential indirect impacts including weed establishment and growth, rubbish dumping, illegal tree removal and will improve the existing condition of all vegetation within the Stewardship Agreement sites ultimately meeting EPBC Act condition criteria (discussed further in Section 9).

Any changes to surface runoff from the development site will be managed through the proposed stormwater infrastructure and stormwater management strategy which will generally direct surface flows away from the offset sites and to specifically designed stormwater detention basins. The basins will filter water and ultimately return the water to the original creek lines. The stormwater management strategy aims to ensure that post development peak discharges are equal to or less than pre-development discharges. Recreational use of conservation areas will be prohibited and discouraged

through fencing and signage other than via proposed management trails / walking paths and managed in accordance with the BSA management plan). Large areas of passive and active open space have been provided in the development design to cater for the recreational needs of the community as shown in Figure 3.

Despite these mitigation measures and active conservation management, potential indirect impacts to EPBC CPW and SSTF in the buffer zones have been assessed and calculated as partial impacts as described in Section 5 and shown in in Table 14 and Table 16.

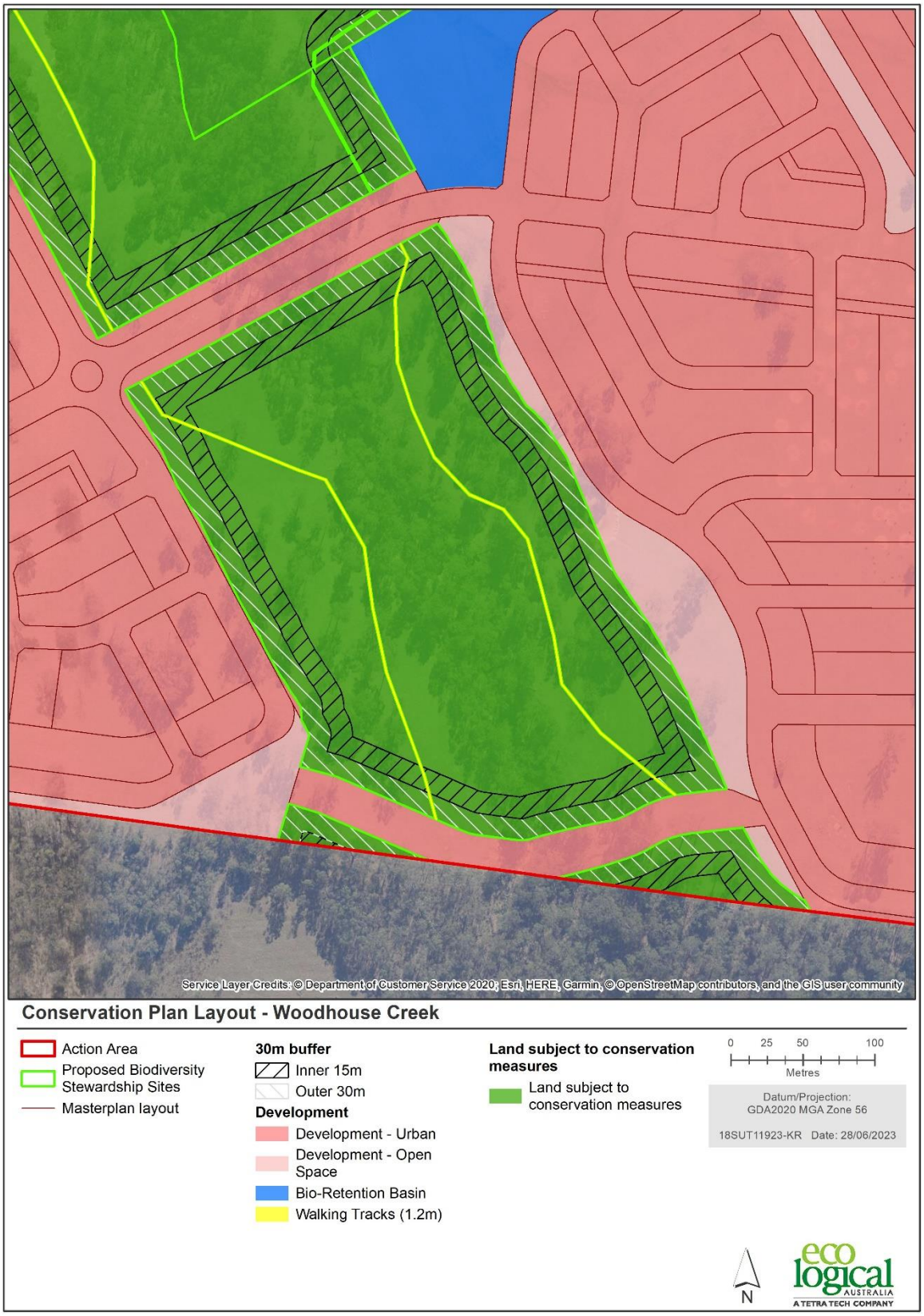


Figure 51: Example of assessment of indirect impacts to SSTF and CPW by APZs and edge effects (30m buffers along Woodhouse Creek)

Figure 52: Example of assessment of indirect impacts to SSTF and CPW by APZs and edge effects (30m buffers along Nepean Creek)

8.3.2 Threatened Species specific avoidance and mitigation measures

Where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition (thus avoiding and/or minimising impacts to Koala, GHFF, LEPB, GHFF and Swift Parrot). The following specific measures were implemented for each threatened species:-

8.3.2.1 Pomaderris

Area where Pomaderris brunnea was recorded were avoided and prosed as conservation areas. The majority of recorded Pomaderris plants were found in or near to riparian areas. Creek crossings were modified to avoid impacts to Pomaderris plants in these creek crossing areas.

As a result of these measures, only two plants will be impacted out of a total of 252 in the study area and 249 will be conserved in conservation areas.

8.3.2.2 Koala

The proposed action was located predominantly in areas that did not have native vegetation (only 46.23 ha of mapped vegetation, the majority of which is in low condition comprising scattered paddock trees in the 259.02 ha development/impact footprint), avoiding impacts to Koala and Koala habitat.

Where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition, in small, isolated patches, avoiding impacts to high quality habitat. For Koala, this meant that of the 47.87 ha of direct, indirect and not accessible habitat impacts to Koala habitat, the majority (33.39 ha out of 47.87 ha (or 70%) was in low condition vegetation comprising scattered paddock trees, with a low proportion of preferred browse species over pasture improved, grazed paddocks, and a further 11.41 ha (or 24%) in moderate quality habitat (thinned areas of woodland, with moderate proportion of preferred browse species.

As a result of these measures, the majority of high quality habitat (151.58 ha) in the largest, well connected patches have been retained and proposed as conservation areas providing landscape scale connectivity between the Georges and Nepean Rivers. Further, the provision of Koala exclusion fencing and fauna underpasses along Appin Rd, increase the protection of Koala within these corridors and reduces a significant existing threat to the local population being road mortality along Appin Rd.

8.3.2.3 Koala movement corridors

There is potential for some indirect impacts resulting from the fragmentation and/or reduction in width of movement corridors or cumulative loss of foraging opportunities for some threatened fauna species. For example, removal of vegetation, including scattered paddock trees, and their replacement with residential housing, could impede the movements / access of the Koala throughout the action area.

The NSW Chief Scientist and Engineer (CS&E) tabled a report titled “Advice on the protection of the Campbelltown Koala population” in April 2020. The report outlines four potential mitigation options for the protection of the Campbelltown koala population, only one of the four options (Pathway 4) would result in the increase of koala population numbers.

When reviewing the CS&E report against the proposed conservation outcomes the action would implement all recommendations of pathway four and actively support an increase in koala numbers.

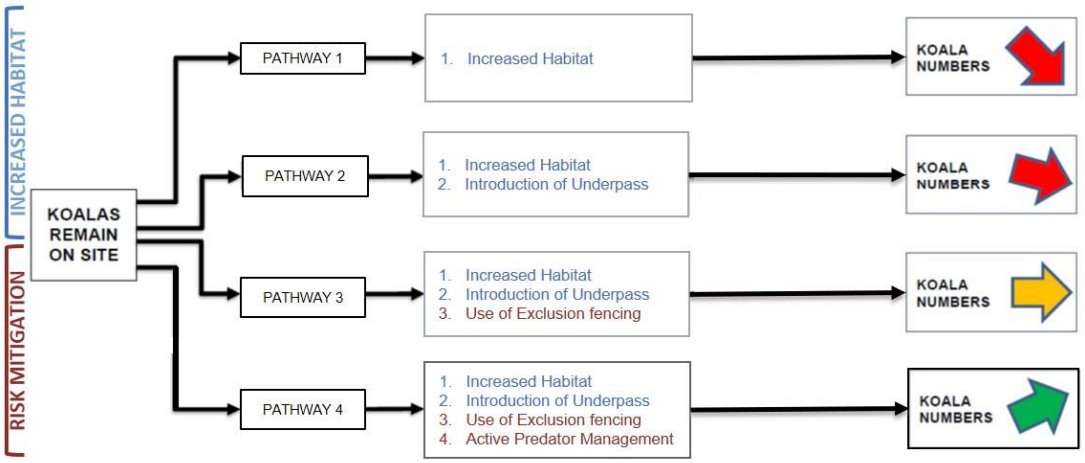


Figure 53: NSW CS&E Report April 2020

The NSW CS&E Report also influenced amendments to the Biocertification Assessment Report (BCAR) prepared under Threatened Species Conservation (TSC) Act for the action area (ELA 2023a), the amendments to the BCAR are consistent with actions and conservation outcomes contained in this report, which in turn adopts reductions to impacts and increases to conservation outcomes from those reviewed in the referral documentation presented to the Department in November 2019.

In December 2020, Campbelltown City Council noted that "The amendments to the Biocertification Assessment report requested by the Minister are consistent with the requirements of the Chief Scientist and Engineers Report and address the updated findings of Dr Steve Phillips, whose peer review was presented to Council." Accordingly the application for biocertification was endorsed for public exhibition in accordance with the TSC Act requirements.

The provision of the following conservation and management outcomes is consistent with State and Local policies for the mitigation of impacts to the Campbelltown koala population:

Key Conservation Outcomes:

1. Increased habitat

- 56.54 ha of additional koala habitat (cleared land/pasture fully restored to high quality habitat)
- 45.25 ha of Low and moderate quality habitat (scattered paddock trees and thinned woodland with non-browse species) to be enhanced with selective Koala feed tree plantings and re-connected to high quality habitat) to create high quality habitat
- 106.33 ha High quality habitat improved and maintained

3. Use of exclusion fencing

- Provision of 25 km of Koala exclusion fencing to on-site conservation areas

4. Active Predator management

- Vertebrate pest (fox and wild dog) management programs

5. Other Conservation Measures:

- Koala monitoring program
- Community awareness programs
- Community training programs

The methodology that DPE used to calculate the average width of Koala corridors, consistent with the CS&E advice, is provided in **Appendix J**, with the resulting corridors in and adjacent to the Mt Gilead action area shown in **Appendix K** and overlaid on Figure 32.

Whilst not part of this action, Lendlease will also provide Koala underpasses and exclusion fencing between Beulah and Noorumba Biobank sites on both sides of Appin Road to retain connectivity between the Georges and Nepean River corridors and reduce an existing Koala road kill hotspot as described in RMS (2023). This will be a permanent underpass at Noorumba Reserve and an interim underpass as Browns Bush as part of the initial phase of the Appin Road upgrade works. Detailed designs for these underpasses have been submitted to the NSW Government for approval. These underpasses have been incorporated into an amended Koala Management Plan prepared under EPBC 2015/7599, which was approved on 30 May 2023. Lendlease have also made an irrevocable Letter of Offer to the NSW Government to modify the Mt Gilead Voluntary Planning Agreement to provide a permanent Koala underpass at Beulah).

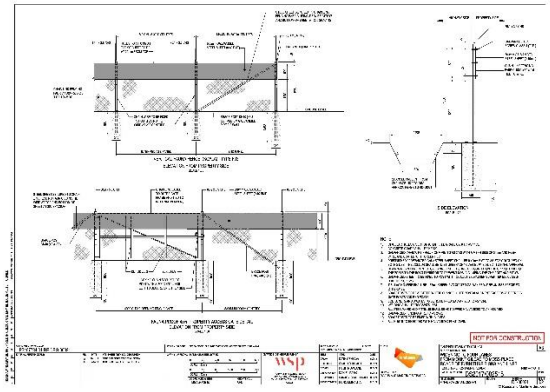
The proposed mitigation measures reduce impacts of the proposed action and are consistent with state and local government policies by adopting Pathway 4 outcomes as recommended by the NSW CS&E including the endorsement of Campbelltown City Council noting consistency with the findings of Dr Steve Phillips the author of the Campbelltown Council Comprehensive Koala Plan on Management.

8.3.2.4 Mt Gilead Koala Conservation Plan

The proponent has also prepared a 'Gilead Koala Conservation Plan' (**Appendix L** - Lendlease 2022) to serve as a comprehensive conservation management framework to guide the design, planning, construction, habitation, monitoring and adaptive management of Koalas in the study area.

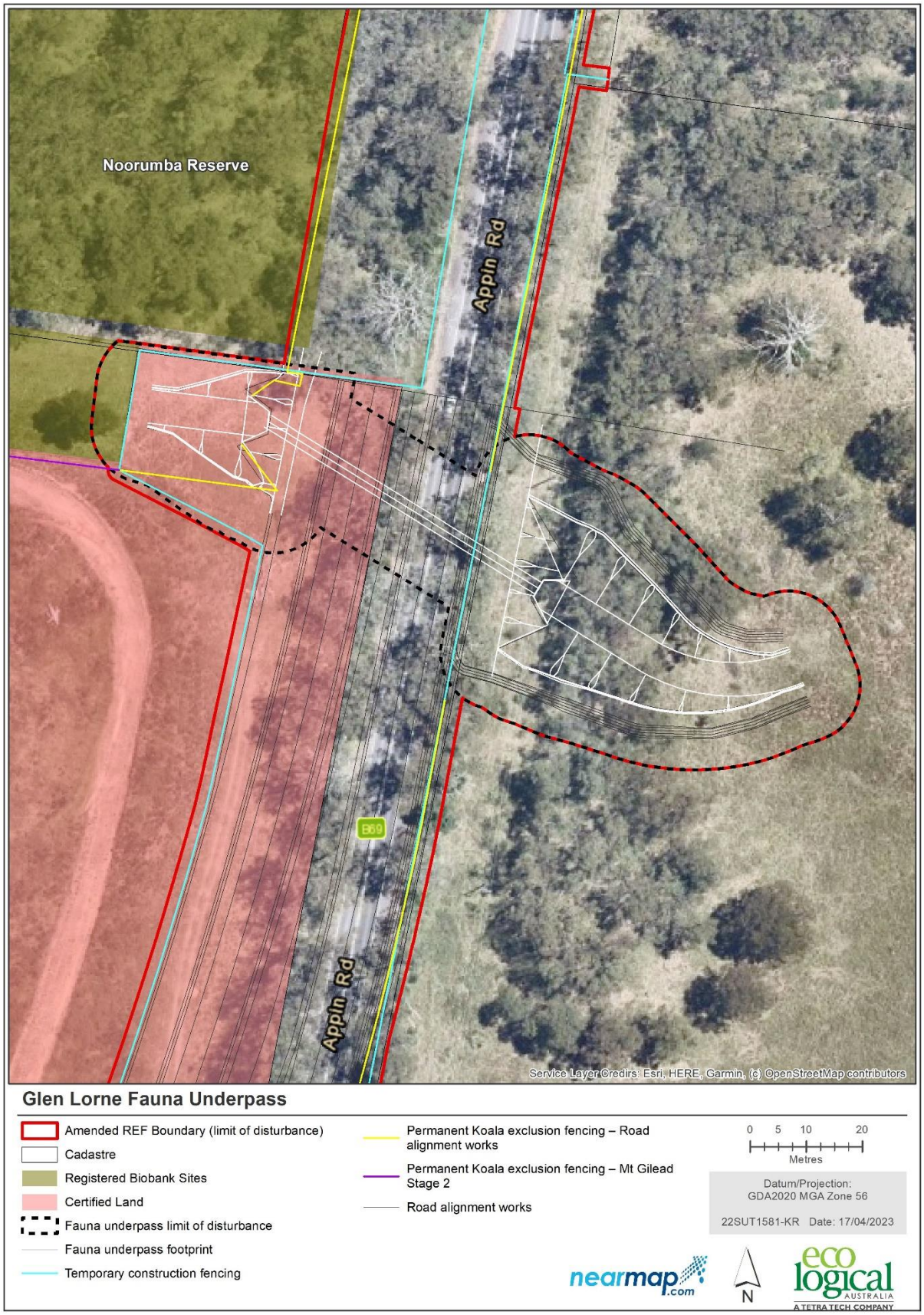
Traditional floppy-top Koala Exclusion Fence – RMS Picton Road

New Design Koala Exclusion Fence – RMS Picton Road

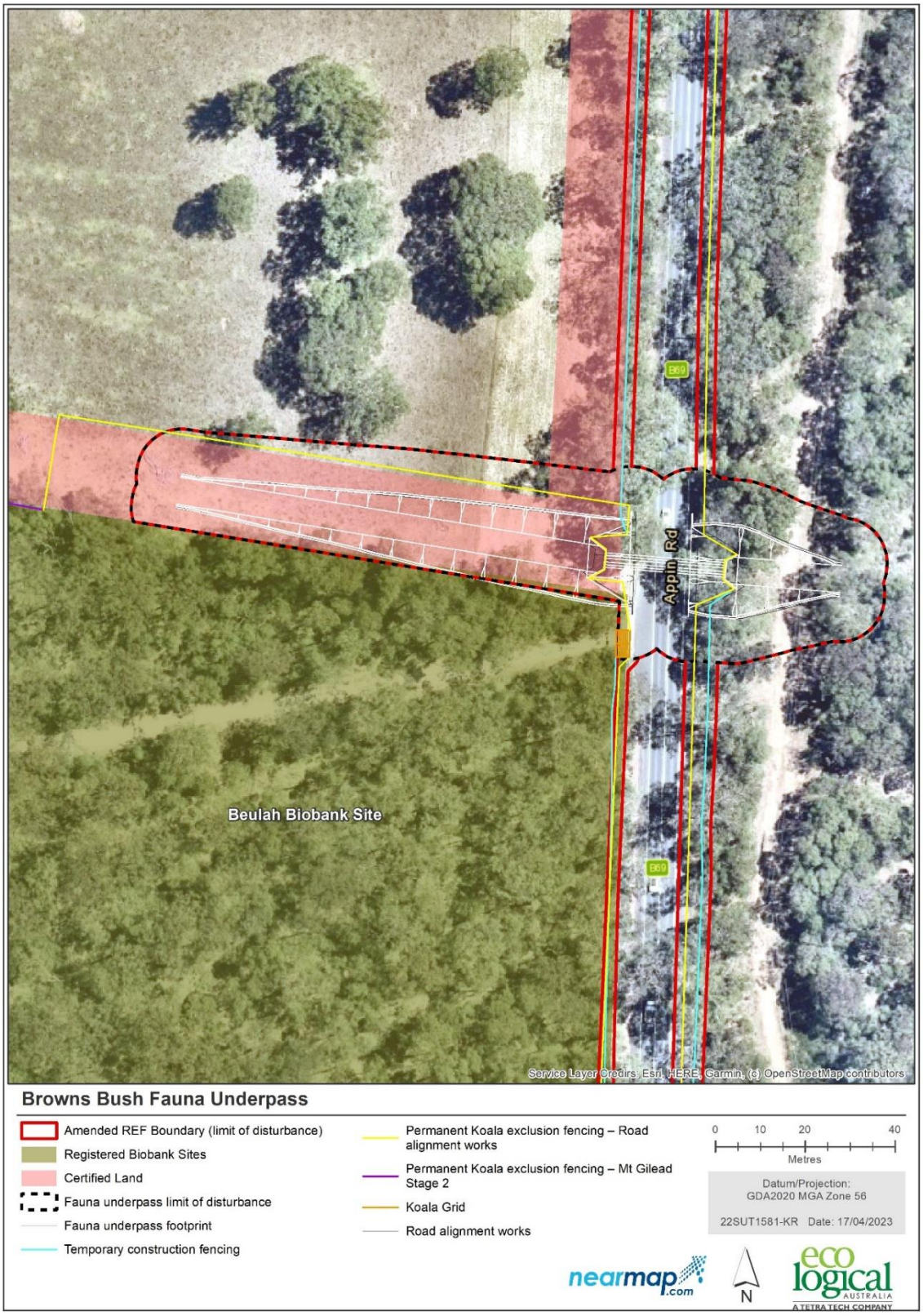


Gilead fence 1500mm high with 600mm panel

Figure 54: Gilead Koala exclusion Fence Design



Design of Koala underpass at Glen Lorne / Noorumba Reserve (part of Menangle Creek corridor) submitted to NSW Government as part of Appin Road upgrade.



Design of Koala underpass at Browns Bush / Beulah Biobank site (part of Woodhouse Creek corridor) submitted to NSW Government as part of Appin Road upgrade.

Figure 55: Appin Road Koala Underpass (Subject to Stage Government approval)

8.3.2.5 Spot-tailed Quoll

The proposed action was located predominantly in areas that did not have native vegetation (only 46.23 ha of mapped vegetation, the majority of which is in low condition comprising scattered paddock trees, in the 259.02 ha development/impact footprint), avoiding impacts to STQ and STQ habitat.

Where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition, in small, isolated patches, avoiding impacts to high quality habitat. For STQ this meant that of the 48.04 ha of direct, indirect and not accessible habitat impacts, the majority (41.91 ha) was in low to moderate condition vegetation comprising scattered paddock trees or thinned areas of woodland over grazed pasture.

As a result of these measures, the majority of high quality, structurally diverse habitat (162.54 ha) in the largest, well connected patches have been retained and proposed as conservation areas.

8.3.2.6 GHFF and LEPB

The proposed action was located predominantly in areas that did not have native vegetation (only 46.23 ha of mapped vegetation in the 259.02 ha development/impact footprint), the majority of which is in low condition comprising scattered paddock trees, avoiding impacts to GHFF/LEPB habitat.

Where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition, in small, isolated patches, avoiding impacts to high quality habitat. For GHFF and LEPB, this meant that of the 46.06 ha of impacts, the majority (41.76 ha) was in low to moderate condition vegetation comprising scattered paddock trees or thinned areas of woodland over grazed pasture.

As a result of these measures, the majority of high quality, structurally diverse habitat (155.18 ha) in the largest, well connected patches have been retained and proposed as conservation areas.

8.3.2.7 Swift Parrot

The proposed action was located predominantly in areas that did not have native vegetation (only 46.23 ha of mapped vegetation in the 259.02 ha development/impact footprint), avoiding impacts to Swift Parrot habitat.

Where possible the project was located in areas where the native vegetation and threatened species habitat was in the poorest condition, in small, isolated patches, avoiding impacts to high quality habitat. For Swift Parrot, this meant that of the 45.76 ha of direct and indirect impacts, the majority (37.76 ha) was in low to moderate condition vegetation comprising scattered paddock trees or thinned areas of woodland over grazed pasture with a low abundance of preferred foraging trees (Spotted Gum, Forest Red Gum and Blackbutt).

As a result of these measures, the majority of high quality, structurally diverse habitat (143.80 ha) in the largest, well connected patches, with higher proportions of preferred foraging trees (Spotted Gum, Forest Red Gum and Blackbutt) have been retained and proposed as conservation areas.

8.4 Construction Environment Management Plan (Mitigation Measures)

Lendlease Communities (Figtree Hill) Pty Limited (the proponent) has prepared and will implement a Construction Environment Management Plan (CEMP) to the satisfaction of DAWE, for vegetation clearing within the action area to guide the development outlined in this report and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off etc) are contained within the development footprint and appropriate mitigation measures are put in place to minimise indirect impacts to threatened fauna including Koala, Squirrel Glider and microbats (**Appendix N** – ELA 2023b). Specifically, this will address the management of the land proposed for conservation measures and their buffers such that surrounding roads will be fully curbed and guttered with no stormwater being discharged into the conservation areas (treated water from the detention basins within the development footprint will flow into existing riparian areas).

The CEMP includes, but is not limited to:

- temporary and permanent protective fencing will be erected around all areas identified for conservation prior to clearing activities commencing in relevant stages to minimise any inadvertent damage
- any impacted hollow-bearing trees within the proposed development footprint that potentially contain roosting and breeding habitat for threatened fauna will be identified and hollows relocated to offset areas
- any trees, or parts thereof, that would be appropriate for use as fauna habitat in the Mt Gilead Homestead, Gilead or Brown's Bush Stewardship Agreement sites, will be identified and salvaged in accordance with the BSAs management plans.
- roads surrounding each part of the Conservation Areas will be fully curbed and guttered with piped stormwater management infrastructure to ensure that stormwater will not flow directly into the Conservation Areas
- a de-watering plan will be prepared for any farm dams that are removed from the proposed development footprint
- a fauna pre-clearance protocol will be prepared for the removal of all trees within the proposed development footprint
- lighting around conservation areas designed to minimise impacts to fauna
- monitoring of performance measures and non-compliance.

A draft of the CEMP is provided as **Appendix N** and includes a draft Koala Management Plan (**Appendix M** of this PD report).

8.4.1 Preconstruction measures

The main preconstruction measures include fencing and erosion and sediment controls. Additional controls for managing the removal of native vegetation and fauna habitat and weed invasion have been included in the preconstruction measures, noting that these particular controls may be repeated during the life of the construction period.

Fencing conservation areas

24 km of Koala exclusion fencing will be installed along the perimeter of all conservation areas and other retained vegetation (Figure 32).

. Signage will be provided to increase community awareness of the importance of the conservation areas. Gates (with grids) will be included within the fence-lines to allow operational/management access and emergency services access as indicated in the Stewardship Agreement site management plans.

Fencing will be monitored and maintained as part of the Stewardship site reporting requirements to ensure their integrity remains intact. The fence lines will be regularly checked for weeds, particularly prior to any mowing to ensure propagules are not dispersed into the conservation areas, with any weeds surrounding these areas to be removed during regular landscaping.

Sediment and erosion control measures

The erosion and sediment controls will include the following measures:

- construction of temporary diversion drains or provision of staked straw bales on the high side of the disturbed areas to direct upstream runoff around the areas.
- the use of silt fencing on the downstream side of the area of works to retain soils.
- provision of a stabilised site access at appropriate points where construction vehicles will enter and leave the site to reduce the likelihood of vehicles tracking soil materials onto public roads.
- topsoil stockpile located adjacent to the areas of disturbance and to have an earth bank on the upslope side to divert runoff around the stockpile with a sediment fence located 1 to 2 metres downslope of the stockpile.
- rock wrapped in geofabric or straw bales will be installed in or around any stormwater drainage inlet.

The CEMP (**Appendix N**) includes requirements for ensuring the required controls are in place prior to construction, marking/fencing vegetation for retention and pre-clearance ecological surveys.

Vegetation and habitat clearance

Vegetation clearance will be undertaken in a manner which is sensitive to the ecological values of the area. Strict clearing limits will be established and delineated to ensure that no over clearing occurs.

Hollow bearing trees (HBTs) will be cleared in a progressive manner in accordance with the hollow bearing tree clearance protocol in the CEMP to minimise potential impacts to hollow dependant fauna and stress to any Koalas resident during the construction phase. A suitably qualified ecologist will be on site during any vegetation clearance in ecologically sensitive areas (including areas containing MNES) as well as during the clearance of HBTs.

The pre-clearing protocol in the CEMP (Appendix B of the CEMP) and Koala tree clearing protocol (**Appendix M** of this PD report) includes:

- threatened fauna searches one week prior to tree removal;
- protocols for hollow-bearing tree removal (including the use of drones to search trees for the presence of Koala's prior to felling;
- addition of fallen logs to conservation areas

- supervision by an ecologist;

Woody material and hollow logs will be relocated to offset areas to supplement habitat features for fauna as described in the Biodiversity Stewardship site management plans. Surplus material will be mulched on site, piled into unobtrusive piles or disposed of at a facility licensed to receive green waste. All weed propagules especially noxious will be bagged and disposed of as directed by legislation at a facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

Dead timber and hollows from the development areas will also be salvaged and relocated to the dedicated conservation areas.

Weed and pest management

Weeds and control of pests including rabbits and foxes will be managed and reported on as part of the BSA Management Plans.

8.4.2 Construction and operation controls

Litter/sediment control

Local drainage from the urban areas will be filtered (using in-line filter pit inserts or equivalent) prior to discharge to water detention basins and to downstream ecosystems. This will allow for protection of the storages from gross pollutants and for the easy interception and collection of this pollutant material. The filtering system will remove nutrients and other pollutants to the agreed standards.

Lighting controls

The potential for added light impacts will be addressed through a range of control measures on the lighting to be used within the residential area, including;

- ensuring the development complies with the Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting, which provides recommended limits for lighting.
- incorporating a lighting strategy which prescribes limits on lights for various areas, such as;
    - Post top overhead street lighting to be used facing down with minimal spill into adjacent areas, in particular, offset areas.
    - Lighting to be set on timers where appropriate, and/or set on sensor switches.
    - Position and directional lighting to be located near the conservation area where deemed necessary but oriented away from the conservation area and back into the development where suitable.

Waste management controls

All reasonable steps will be taken by the developer to remove waste deposited by others within the study area during the development stages. Construction waste management measures are included as a component of the CEMP (See Appendix N).

To deter any waste dumping within the Offset Sites in the longer term, koala exclusion fencing will be installed along the permitter of existing vegetation remnants and the surrounds of the conservation areas (as described above). Additionally, signage will be erected along the boundary to deter dumping.

As a result of further reductions to the development footprint, and the proposed mitigation measures, residual impacts associated with the proposed action include:

As a result of the avoidance and impact minimisation measures incorporated into the planning of the action, the final areas of impact to MNES are as follows:-

- 7.59 ha of direct impact to EPBC Act listed Category C and A CPW within the action, no partial impacts in asset protection zones (APZs) and up to 0.98 ha of indirect impacts in 30 m buffer areas around proposed conservation areas (Stewardship Agreement sites) within the action area.
- 26.29 ha of direct impacts to EPBC Act listed Category D, B and D SSTF within the action area, partial impacts to 1.63 ha in asset protection zones (APZs) and up to a further 13.33 ha of indirect impacts in 30 m EEC buffer areas around proposed conservation areas.
- Impacts to two *Pomaderris brunnea* across the action area (down from 23).
- up to 47.87 ha of impacts to Koala habitat comprising 30.71 ha of permanent impacts (20.63 ha of low condition, non-browse species scattered paddock trees), up to 11.50 ha of partial impacts in APZ's and open space areas (where some Koala feed trees can be retained), 3.85 ha of temporary impacts (detention basins and creek crossings that will be revegetated to Koala habitat after construction and 1.81 ha of excluded access to existing habitat (as a result of Koala exclusion fencing to prevent Koalas entering urban areas and the associated risks of vehicles and domestic dog attack)
- Up to 44.52 ha of impacts to Spot-tail Quoll habitat (mainly loss of 41.91 ha of thinned/pasture improved woodland, scattered paddock trees and derived grassland/shrubland across action area), 1.71 ha of partial impacts (managed bushfire APZs) and exclusion from 1.81 ha of habitat as a result of koala exclusion fencing.
- Up to 44.35 ha of impacts to potential Grey-headed Flying-fox and Large-eared Pied-bat habitat (mainly loss of 41.76 ha of thinned/pasture improved woodland, scattered paddock trees and derived grassland/shrubland across action area) and 1.71 ha of partial impacts (managed bushfire APZs where some trees will be retained).
- Up to 44.13 ha of impacts to potential Swift Parrot foraging habitat (mainly loss of 37.76 ha thinned/pasture improved woodland, scattered paddock trees across action area) and 1.63 ha of partial impacts (managed bushfire APZs where some trees will be retained and the establishment of a walking track that will not impact any trees).

The conservation measures include:

Registration of three Biodiversity Stewardship Agreement under the NSW *Biodiversity Conservation Act* 2016 to legally secure the conservation areas :-

- A 189.09 ha Gilead Stewardship Agreement site
- A 19.99 ha Mt Gilead-Homestead Stewardship Agreement site; and
- a 26.89 ha Browns Bush Stewardship Agreement site (although this site will not be used to meet the offset requirements for the project).

The total offset area proposed for the Action (not including the Browns Bush BSA site) is 209.08 ha which includes 162.54 ha of existing vegetation, 45.57 ha of vegetation to be restored (commencing in Year 1) and 0.97 ha of existing management trails and water bodies. There are a further 1.25 ha of proposed bush walking tracks within the proposed offset areas that will not impact any trees (and that are included in the impact assessment).

Collectively the proposed Gilead and Mt Gilead Homestead Biodiversity Stewardship sites will permanently protect and manage:-

- 11.47 ha of EPBC Act condition A and C CPW within the offset areas and a further 9.89 ha to be restored to EPBC condition CPW outside of the buffer zones, and an additional 0.98 ha of EPBC CPW and 3.68 ha of non- EPBC CPW in the buffer zones to be managed and enhanced within the offset area (Total CPW in offset area of 25.04 ha and 26.02 ha of CPW being managed)
- 96.83 ha of EPBC Act condition SSTF within offset areas and 24.42 ha to be restored to EPBC condition SSTF outside of the buffer zones, and an additional 13.33 ha of EPBC SSTF and 13.39 ha of non-EPBC SSTF in the buffer zones to be managed and enhanced area within the offset area (Total offset area of 134.63 ha with 147.97 ha of SSTF managed)
- 21.60 ha of EPBC Act condition RFEF within offset areas and 4.17 ha to be restored to EPBC condition, and an additional 0.28 ha of EPBC RFEF in the buffer zones to be managed and enhanced within the offset area (Total area of managed RFEF being 26.05 ha)
- 249 *Pomaderris brunnea* recorded plants
- 151.58 ha of existing and 56.54 ha of restored (derived grassland/shrublands and cleared areas) Koala habitat
- 155.18 ha of existing and 53.90 ha of restored (derived grassland/shrublands and cleared areas) Grey-headed Flying-fox and Large-eared Pied-bat foraging habitat
- 162.54 ha of existing and 45.57 ha of restored (derived grassland/shrublands and cleared areas) Spot-tailed Quoll habitat, and
- 143.80 ha of existing and 48.70 ha of restored Swift Parrot foraging habitat.

These offsets will be legally 'secured' by the registration of in perpetuity, fully funded, Biodiversity Stewardship Agreements with the area of offset required for each impacted MNES calculated using the EPBC Act Offset Calculator and secured via the retirement of Biodiversity credits of an equivalent area from the registered BSAs.

Retention of 25.19 ha of foraging habitat for the Swift Parrot, Koala, Large-eared Pied Bat and Grey-headed Flying-fox as part of open space and easement management.

8.5 Parties responsible for implementation

Lendlease Communities (Figtree Hill) Pty Ltd will ensure that all mitigation measures are undertaken until the completion of the development. On completion of the development, the responsibility for management of open space will be transferred to Campbelltown City Council who will continue to manage the open space areas in accordance with management plans prepared under the Local Government Act 1993.

The current landowners, Mt Gilead Pty Ltd (proposed Mt Gilead Homestead and Gilead BSAs) will be responsible for the permanent fencing of the conservation areas (Koala exclusion fencing), establishment of walking paths/management trails, initial weed and feral animals control, revegetation and supplementary planting, bringing in of fallen timber and hollows from the development area within 30 days of approval being granted, and be responsible for the ongoing implementation of the BSA management plans once the BSAs are registered (BSAs will be submitted for registration within 12 months of project approval.

Where necessary, suitable environmental, conservation, and engineering contractors experienced in bushland conservation and management will be employed. The contractors will be chosen through a tender process which will likely take into account each tenderer's:

- experience with bushland conservation and management (previous environmental records)
- sustainability and efficiency
- cost
- availability of equipment.

A Project Ecologist will be engaged for the duration of the on-site works.

The Project Ecologist will ensure that all conditions relating to the biodiversity management of the site are fully implemented and complied with including:-

- Vegetation not authorised to be removed shall be protected during construction to ensure the natural vegetation and topography is not unnecessarily disturbed.
- Exclusion fencing will be installed prior to site works commencing, exclusion fencing will delineate the limit of areas impacted by the works and provide protection for trees being retained within the works areas.
- Erosion and sedimentation controls will be in place prior to the commencement of site works and maintained throughout construction activities until the site is suitably revegetated.
- Earthworks will be minimised and generally limited to the foot print area of the drainage structure.
- Stockpiling is to be located within the development areas and not within buffer zones.
- The design performance requirements and maintenance strategies of the drainage structure will ensure that there is no increase in water quantity exiting the structure relative to predevelopment conditions and there is no diminishing of water quality exiting the drainage structure relative to pre development conditions.
- Areas requiring ecological restoration / rehabilitation will be actively regenerated via bush regeneration principles and, where needed, planted with a diversity of plant species from the existing vegetation community. Works will be in keeping with Best Practice Guidelines of OEH and the Commonwealth.

The project ecologists will recommend and approve plant species selections and ensure the timing of material collection will result in the required plants being available at the time of on-ground restoration works.

9. Biodiversity Offset Strategy

9.1 Offsets summary

The proposed development has implemented measures to avoid and minimise impacts to MNES as outlined in Section 8, however it was not possible to completely avoid all impacts and some residual impacts to MNES remain, that have been determined to be significant for CPW, SSTF and likely for Koala, Grey-headed Flying-fox, Large-eared Pied Bat and Swift Parrot (But not Spot-tailed Quoll, Greater Glider or Rufous Pomaderris). Lendlease is committed to offsetting these impacts in accordance the EPBC Act Offset Policy (DSEWPaC 2012) and has also provided the calculations via the NSW Biobanking Scheme which is an EPBC Act endorsed offsetting framework (i.e. established under the now repealed TSC Act).

The EPBC Act Offset Policy requires residual significant impacts to MNES to be offset, namely the impact to:

- 26.29 ha of direct impacts to EPBC Act listed Category D, B and A SSTF within the action area, a further 1.63 ha of partial impacts to EPBC Act listed SSTF in the APZ and 13.33 ha of EPBC Act SSTF in the offset area buffers (which after mitigation measures for the management of the offset areas results in a total mitigated impact of 28.78 ha (Refer to Table 14).
- 7.59 ha of direct impact to EPBC Act listed Category A and C CPW within the action area and a further 0.98 ha of potential indirect impacts within the 30 m buffer areas around proposed conservation areas to protect CPW within the action area (which after mitigation measures for the management of the offset areas results in a total mitigated impact of 7.72 ha (Refer to Table 16)
- Loss of 2 individual Rufous Pomaderris plants
- Up to 47.87 ha of direct, partial and indirect impacts to Koala habitat, over 50% of which is the loss of low quality individual scattered paddock trees across the action area (Refer to Table 19)
- Up to 48.04 ha of direct, partial and indirect impacts to Spot-tailed Quoll habitat (over 50% of which is the loss of low quality individual scattered paddock trees across the action area
- Up to 46.06 ha of direct, partial and indirect impacts to Grey-headed Flying-fox and Large-eared Pied Bat habitat (mainly loss of individual scattered paddock trees across the action area); and
- Up to 45.76 ha of direct, partial and indirect impacts to potential Swift Parrot habitat (mainly loss of individual scattered paddock trees across the action area

9.1.1 NSW Biocertification and Biobanking Offset Calculations

The NSW Biocertification assessment and application (ELA 2022) includes a Statement of Commitments and offset requirements calculated in accordance with the Biocertification Assessment Methodology (BCAM). The Biocertification assessment concluded that all offset requirements for endangered ecological communities (i.e. CPW, SSTF and RFEF) and species credit threatened species could be met by the proposed on-site offset commitments.

However, as the BCAM is not an EPBC Act endorsed offsetting framework, the offset calculations have been also been calculated using the Biobanking Assessment Methodology (BBAM), which is an EPBC Act endorsed policy. The Biobanking impact and offset credit reports are provided in **Appendix V** and **W** and summarised in Table 28.

There are two main components to the Mt Gilead Stage 2 PD Report offset strategy that are consistent with meeting all NSW offset requirements. These components are:

- on-site conservation areas (registration of two Biodiversity Stewardship Agreement sites (not including Browns Bush) with a total area of 209.08 ha (162.54 ha of existing vegetation, 45.57 ha to be restored) and 0.97 ha of existing tracks and water bodies (dams). A summary of the BBAM credits 'required' for impacts in this PD Report and 'generated' by the proposed offset measures with the credit balances is provided in Table 28.
- Under the BBAM, these offsets account for
    - all impacts to SSTF, CPW and RFEF (noting a surplus of 924 SSTF, 45 CPW and 307 RFEF ecosystem credits – all of which will be retired)
    - all impacts for Koala (noting a 233 credit surplus)
    - all impacts to *Pomaderris brunnea* (noting a 1,738 credit surplus)
        - It is noted that the equations used in the BBAM methodology differ to those in the BCAM methodology hence the difference in the credit deficit versus surplus for Koalas between these calculation methods.
- Commitment to submit applications to register three Biodiversity Stewardship Agreement sites (BSAs) within 12 months of certification being conferred (ELA 2023a) noting that applications to register three Biobank sites (Gilead, Homestead and Browns Bush) were prepared and submitted to the DPIE in August 2020 under the now repealed TSC Act. These reports and management plans will be updated to reflect the revised areas and comply with the now BC Act (BAM) requirements.

In addition to SSTF, CPW, *Pomaderris brunnea* and Koala, conservation outcomes are also being provided (whether residual impacts are significant or not) for the following MNES: Swift Parrot, Grey-headed Flying-fox, Large-eared Pied Bat and Spot-tailed Quoll (although it is noted that the BBAM does not calculate offsets for Swift Parrot, Grey-headed Flying-fox, Large-eared Pied Bat or Spot-tailed Quoll as these species are classified as 'ecosystem credit species' and are considered as part of the overall impacts to vegetation (habitat surrogate)). They are thus addressed by the 209.08 ha of suitable habitat protected and managed for conservation in the two Biodiversity Stewardship sites.

The conservation measures provide conservation and in-perpetuity management of:

- 11.47 ha of EPBC Act condition A and C CPW within the offset areas and a further 9.89 ha to be restored to EPBC condition CPW outside of the buffer zones, and an additional 0.98 ha of EPBC CPW and 3.68 ha of non- EPBC CPW in the buffer zones to be managed and enhanced within the offset area (Total CPW in offset area of 25.04 ha and 26.02 ha of CPW being managed)
- 96.83 ha of EPBC Act condition SSTF within offset areas and 24.42 ha to be restored to EPBC condition SSTF outside of the buffer zones, and an additional 13.33 ha of EPBC SSTF and 13.39 ha of non-EPBC SSTF in the buffer zones to be managed and enhanced area within the offset area (Total offset area of 134.63 ha with 147.97 ha of SSTF managed)
- 21.60 ha of EPBC Act condition RFEF within offset areas and 4.17 ha to be restored to EPBC condition, and an additional 0.28 ha of EPBC RFEF in the buffer zones to be managed and enhanced within the offset area (Total area of managed RFEF being 26.05 ha)
- 249 *Pomaderris brunnea* recorded plants

- 151.58 ha of existing and 56.54 ha of restored (derived grassland/shrublands and cleared areas) Koala habitat
- 155.18 ha of existing and 53.90 ha of restored (derived grassland/shrublands and cleared areas) Grey-headed Flying-fox and Large-eared Pied-bat foraging habitat
- 162.54 ha of existing and 45.57 ha of restored (derived grassland/shrublands and cleared areas) Spot-tailed Quoll habitat, and
- 143.80 ha of existing and 48.70 ha of restored Swift Parrot foraging habitat.

These conservation commitments do not include the avoidance and mitigation measures outlined in Section 8 (i.e. the 30m TEC buffers). Potential indirect impacts to vegetation in these buffers has been included in the impact calculations and has not been included in offset area calculations).

In addition, a further 25.19 ha of foraging habitat for the Swift Parrot, Koala, Large-eared Pied Bat and Grey-headed Flying-fox will be retained in the study area as part of open space and easement management.

The offset strategy is consistent with the principles in the Commonwealth Offsets Policy. The proponent proposes to:

- deliver an overall conservation outcome that improves or maintains the viability of the aspects of the environment that are protected by the EPBC Act and affected by the proposed action.
- offset at a size and scale proportionate to the residual impacts on the protected matter.
- be efficient, effective, timely, transparent, scientifically robust and reasonable with their offsets.
- have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

9.1.2 EPBC Act Offset Policy Calculations

This PD Report has concluded that the residual impacts to SSTF, CPW and Koala have the potential to have significant impacts at the local and regional level and thus require offsets. Whilst not considered to have significant impacts as a result of the proposed action, impacts to *Pomaderris brunnea,* the Grey-headed Flying-fox, Large-eared Pied Bat, Spot-tailed Quoll and the Swift Parrot will also be offset by the proposed on-site offset areas.

9.1.2.1 Habitat quality scoring

The EPBC Offset calculator relies on the use of scores for 'habitat quality' (scored from 1-10) for both the impact and offset areas. These scores are determined through the consideration of 'site condition',' site context' and 'species stocking rates'.

Site condition is broadly an understanding of the condition of a site in relation to the ecological requirements of the relevant ecological community and species. This includes considerations such as vegetation health and structure, the diversity of characteristic species present, and the number of the relevant habitat features present for each MNES.

Site context is the relative importance of a site in terms of its position in the landscape, considering the connectivity needs of the MNES. This includes considerations such as the proximity of the site in relation to other areas of suitable habitat, threats that may occur nearby, increase of threats as a result of the

proposed action and the role of the site in relation to the overall population or extent of habitat available. Habitat quality needs to be assessed consistently on both the impact and offset calculators and a score out of ten is required for each area as input in the offset calculator.

The final quality score has been determined to be different for the area of habitat to be removed and conserved for each MNES as in general, the quality of habitat to be impacted is lower (poor condition, isolated, fragmented patches of habitat compared to the offset areas which are in better condition (larger, connected patches).

9.1.2.2 Quantification of impact

The Offsets calculator moderates the area of impact based on the quality of habitat or number of individuals. The 'quantum of impact, on which the assessment of offset adequacy is based, decreases with decreasing quality.

9.1.2.3 Time till conservation gain

The offset areas proposed to be registered and active management commenced before the commencement of the development which will progress in stages over an approximate 10 year timeframe. Accordingly it is anticipated that conservation gains will be achieved for TECs and all threatened species for areas in better condition following the removal of grazing and active weed control over the short term (5-10 years) and significant improvements to the condition of TECs and their value as threatened species habitat in the longer term (15-> 20 years) for areas in poorer condition or that will be restored (as planted trees will need to survive and mature and start providing foraging habitat for Koala, bats and Swift Parrot). There are a number of research papers showing 'use' of replanted habitat by Koalas after four to seven years, particularly when this planted or restored habitat is adjacent to retained, intact areas (see Kavanagh & Stanton 2012, Rhind et al. 2014) and others have suggested Koala's will not use replanted habitat until after 10 years (Smith 1992).

The most significant gains are estimated to be made in the first 5-10 years of the stewardship site management plan actions being implemented as part of the BSA (i.e. active commencement of weed control and feral animals control programs from Year 1 of project commencement that historically have not existed for the area). The ecological benefits of management are expected to continue throughout the life of the BSA until the full ecological benefit is realised.

Table 27: Timing and management actions to achieve a conservation gain

Timing	Conservation Gain
Short Term (within 5 -10 years)	Grazing managed/removed all sites
	Fencing, exclusion zones and signage established
	Weeds reduced to maintenance levels across 90% of site by end year 10.
	Revegetation management (tree, shrub, and ground cover planting and seeding, where required/specified in BSA Management Plans)
	Increased species diversity, biomass, and resources
	Decreased native species competition with weeds for light and space
	Decreased risk of loss of SSTF/CPW community
	Improved surface hydrology

Timing	Conservation Gain
	Increased community awareness of the significance of SSTF/CPW conservation
Medium to long Term (15->20 years)	In perpetuity funding, management and security
	Increase in SSTF/CPW in the conservation area through gradual regrowth
	Weeds reduced to less than 10% cover across site by end year 20 and ongoing
	Maintenance of suitable fire regimes

9.1.2.4 Level of certainty of conservation gain

Offsets that involve the restoration or regeneration of habitat are subject to uncertainty when considering the gains that can be achieved. However, when consideration is given to the likelihood of degradation to a site that is placed under restricted use and a management regime, the introduction of funded management will result in a conservation gain. To increase the gain, the management prescription for the offsets will be based on best practice assisted regeneration.

Assisted regeneration is successful when continued over extended periods of time, often over five to ten years. The protection and long term security of the MGS2 BSA Agreements will ensure 'maintain and improvement' outcomes are achieved and that management of the site is continued in-perpetuity. In addition, the offsets will be monitored as part of the BSA to ensure that the predicted gains are being achieved on-site. This will also allow the management actions to be adaptive to ensure that the best ecological and conservation outcome is achieved.

9.1.2.5 Calculation of proportion of impact mitigated by offsets

Table 29 shows the 'Quantum of Impacts' for each MNES considered to have significant residual impacts (SSTF, CPW, Koala) as well as other impacted MNES (RFEF, *Pomaderris brunnea*, GHFF, LEPB, Swift Parrot and Spotted-Tail Quoll) based on the 'Quality' scores and justification for each species provided in the offset calculations at **Appendix X.** Table 29 provides a summary of the 'Percentage of Offset met' based on the area of habitat in the proposed on-site offset areas, time loss averted, time to ecological benefit, risk of loss with and without offset and quality weightings (as defined by the EPBC Act Offset Policy (DSEWPaC 2012).

The EPBC calculated offset targets are met (i.e. proposed offsets meet or significantly exceeded 100%) for each impacted MNES when calculating the existing area of habitat in the offset areas only, and with the addition of restored habitat are exceed further.

Given the recent change in status for the Koala, whilst not required in accordance with Section 158A of the EPBC Act, the offset calculations for Koala have been undertaken both as a vulnerable and endangered species. As for other MNES, the offset targets are exceeded with between 223 and 294% target met for both existing habitat areas and restored areas respectively at the vulnerable level and 200 and 241% at the endangered status levels.

Table 28: Summary of Biobanking credit requirements for impacts to MNES

Note: Impact and Offset credit reports are provided in **Appendices V** and **W**.

	Direct Impact Area	Partial Impact Area (Mitigated)	Buffer Impacts (Mitigated)	Total Impacts (ha)	Biobank Credits Required			Offset Area	Biobank Credits Generated	Credit surplus / deficit	EPBC Quality surplus / deficit	EPBC deficit if using restored Veg
Vegetation Type					**Direct Impacts**	**Partial / Indirect Impacts**	**Total**					
SSTF D	4.39	0.38	1.25	6.03	282	105	387	87.77	1,387	1,000	423	925
SSTF B	3.32	0.06	0.27	3.65	146	14	160	6.04	91	-69		
SSTF A	18.58	0.21	0.32	19.11	539	15	554	3.01	46	-508		
SSTF TSC				0.00				2.75	37	37	502	
SSTF Restored				0.00				35.06	465	465		
CPW A	0.91	0.00	0.04	0.95	41	2	43	10.27	161	118	-136	44
CPW C	6.68	0.00	0.08	6.76	269	4	273	1.20	19	-254		
CPW TSC				0.00				3.06	45	45	180	
CPW Restored				0.00				10.51	135	135		
RFEF C	0.35	0.00	0.04	0.39	6	1	7	21.90	251	244	307	307
RFEF Regeneration				0.00				4.17	63	63		
GMDR	0.00	0.00	0.00	0.00	0	0	0	6.02	86	86	86	86
Total	**34.23**	**0.65**	**2.00**	**36.89**	**1,283**	**141**	**1,424**	**191.76**	**2,786**	**1,362**	**1,362**	**1,362**
Species										0		
Koala				47.87			1,245	208.11	1,478	233	233	233
Pomaderris				2			30	249	1,768	1,738	1,738	1,738

Table 29: Summary of EPBC Act Offset Calculator offset calculation results

Detailed work sheets for EPBC Offset calculations are provided in **Appendix X**

		IMPACTS				OFFSETS												
Impacted MNES	**EPBC Status**	**Mitigated Area (ha) / Ind**	**Quality Weighting (Condition : Context : Stocking Rate)**	**Quality[1]**	**Quantum of Impact**	**Area of Offset habitat / ind**	**Time Loss Averted (Years)[2]**	**Time until Ecological Benefit (Years)[3]**	**Risk of loss (%) without offset[4]**	**Risk of loss (%) with Offset**	**Confidence in result**	**Quality Weighting (Condition : Context : Stocking Rate)**	**Start Quality**	**Future Quality without Offset**	**Future Quality with Offset[5]**	**% of Impact Offset**	**Combined Offset %**	**EPBC Offset Target Met**
Threatened Communities																		
SSTF (Category D)	CE	6.03		8	4.98	87.77	20	10	5%	1%	95%		8	6	9	380.88%	439.06%	**Yes**
SSTF (Category B)	CE	3.65		6	2.17	6.04	20	10	5%	1%	95%		6	4	8	54.26%		
SSTF (Category A)	CE	19.11		4	7.64	3.01	20	10	5%	1%	95%		4	3	6	3.92%		
CPW (Category A)	CE	0.96		6	0.58	10.27	20	10	5%	1%	95%		6	4	8	391.96%	392.80%	**Yes**
CPW (Category C)	CE	6.76		4	2.70	1.20	20	15	5%	1%	95%		4	3	6	0.84%		
RFEF (Category C)	End	0.39		6	1.12	21.60	20	10	5%	1%	95%		6	4	8	328.55%	328.55%	**Yes**
Threatened Species																		
Pomaderris brunnea (ind)	Vul	2			2	249	20	10	20%	1%	95%	50%:25%:25%	249	200	300	3675.82%	3675.82%	**Yes**
Koala (existing habitat only)	Vul	47.87	25%:50%:25%	4	19.15	151.58	20	10	5%	1%	95%	50%:25%:25%	8	6	9	223.68%	223.68%	**Yes**
Koala (with restored habitat)	Vul	47.87	25%:50%:25%	4	19.15	208.11	20	20	5%	1%	95%	50%:25%:25%	6	4	7	294.17%	294.17%	**Yes**
Koala (existing habitat only)	End	47.87	25%:50%:25%	4	19.15	151.58	20	10	5%	1%	95%	50%:25%:25%	8	6	9	200.42%	200.42%	**Yes**
Koala (with restored habitat)	End	47.87	25%:50%:25%	4	19.15	208.11	20	20	5%	1%	95%	50%:25%:25%	6	4	7	241.18%	241.18%	**Yes**
Spot-tailed Quoll (existing habitat only)	End	48.04	25%:50%:25%	4	19.22	162.54	20	20	5%	1%	95%	50%:25%:25%	8	7	9	214.15%	214.15%	**Yes**
Spot-tailed Quoll (with restored habitat)	End	48.04	25%:50%:25%	4	19.22	208.11	20	20	5%	1%	95%	50%:25%:25%	6	4	7	240.33%	240.33%	**Yes**
Grey-headed Flying Fox (existing habitat only)	Vul	46.06	25%:50%:25%	4	18.42	155.18	20	10	5%	1%	95%	50%:25%:25%	8	6	9	96.81%	96.81%	**No**
Grey-headed Flying Fox (with restored habitat)	Vul	46.06	25%:50%:25%	4	18.42	209.08	20	20	5%	1%	95%	50%:25%:25%	6	4	7	307.16%	307.16%	**Yes**
Large-eared Pied Bat (existing habitat only)	Vul	46.06	25%:50%:25%	4	21.32	155.18	20	10	5%	1%	95%	50%:25%:25%	8	6	9	96.81%	96.81%	**No**
Large-eared Pied Bat (with restored habitat)	Vul	46.06	25%:50%:25%	4	21.32	209.08	20	20	5%	1%	95%	50%:25%:25%	6	4	7	307.16%	307.16%	**Yes**
Swift Parrot (existing habitat only)	CE	45.76	25%:50%:25%	3	18.30	143.80	20	10	5%	1%	95%	50%:25%:25%	7	5	8	155.44%	155.44%	**Yes**
Swift Parrot (with restored habitat)	CE	45.76	25%:50%:25%	3	18.30	192.50	20	20	5%	1%	95%	50%:25%:25%	6	4	7	111.86%	111.86%	**Yes**

9.2 On-site offsets

The key conservation outcome to accompany the proposed action is the establishment of two Biodiversity Stewardship Agreement sites (BSAs) under the *NSW Biodiversity Conservation Act* 2016 (BC Act). BSAs are registered on title, are in perpetuity, fully funded conservation covenants with funds required for management held by the Biodiversity Conservation Trust (BCT). Once credits are retired (prior to the commencement of the action) only the Minister for the Environment can terminate a BSA. The owner of the BSA must manage the offset area in accordance with the BSA, undertake annual monitoring and provide an annual compliance report to the BCT. The BCT undertakes annual audits and the Minister has a range of powers to ensure that the management is undertaken.

The two BSAs provide for the in-perpetuity conservation and management of 208.11 ha of native vegetation and threatened species habitat within 209.08 ha of registered offset areas across the action area (there are 0.97 ha of management trails, walking paths and water bodies in the offset area that are not included in the offset area calculations and do not generate any credits (Figure 56)). This is comprised of:

- a 189.09 ha Gilead Biodiversity Stewardship Agreement site; and
- a 19.99 ha Mt Gilead Homestead Biodiversity Stewardship Agreement site

A third Biodiversity Stewardship Agreement site, the 26.89 ha Browns Bush Stewardship Agreement site, whilst being registered as a conservation area is not needed to provide offsets for the project.

Registered Stewardship Agreement sites are recognised by the DAWE and EPBC Act offset policy as an appropriate conservation mechanism.

9.2.1.1 Timing for implementation

The applications to register the three Gilead Stage 2 Biodiversity Stewardship sites will be submitted for registration within 12 months of project approval and prior to any clearing of MNES commencing (It is noted that the sites have already been assessed and reports under the previous legislation already prepared which will require updating to comply with the BC Act and BAM requirements).

Interim management of the three Gilead Biodiversity Stewardship site will commence within 30 days after project approval with removal of grazing stock and fencing offset areas. Active management (weed control, supplementary planting of trees and shrubs reflective of CPW and SSTF, restoration of ground cover) will commence with the registration of the BSAs and retirement of credits.

No clearing of vegetation will occur until Lendlease Communities (Figtree Hill) Pty Ltd has provided proof of the retirement of the required credits and Lendlease Communities have prepared and implemented the CEMP, including pre-clearance surveys. This proof will be in the form of a ‘certificate’ of credit retirement issued by the DPIE.

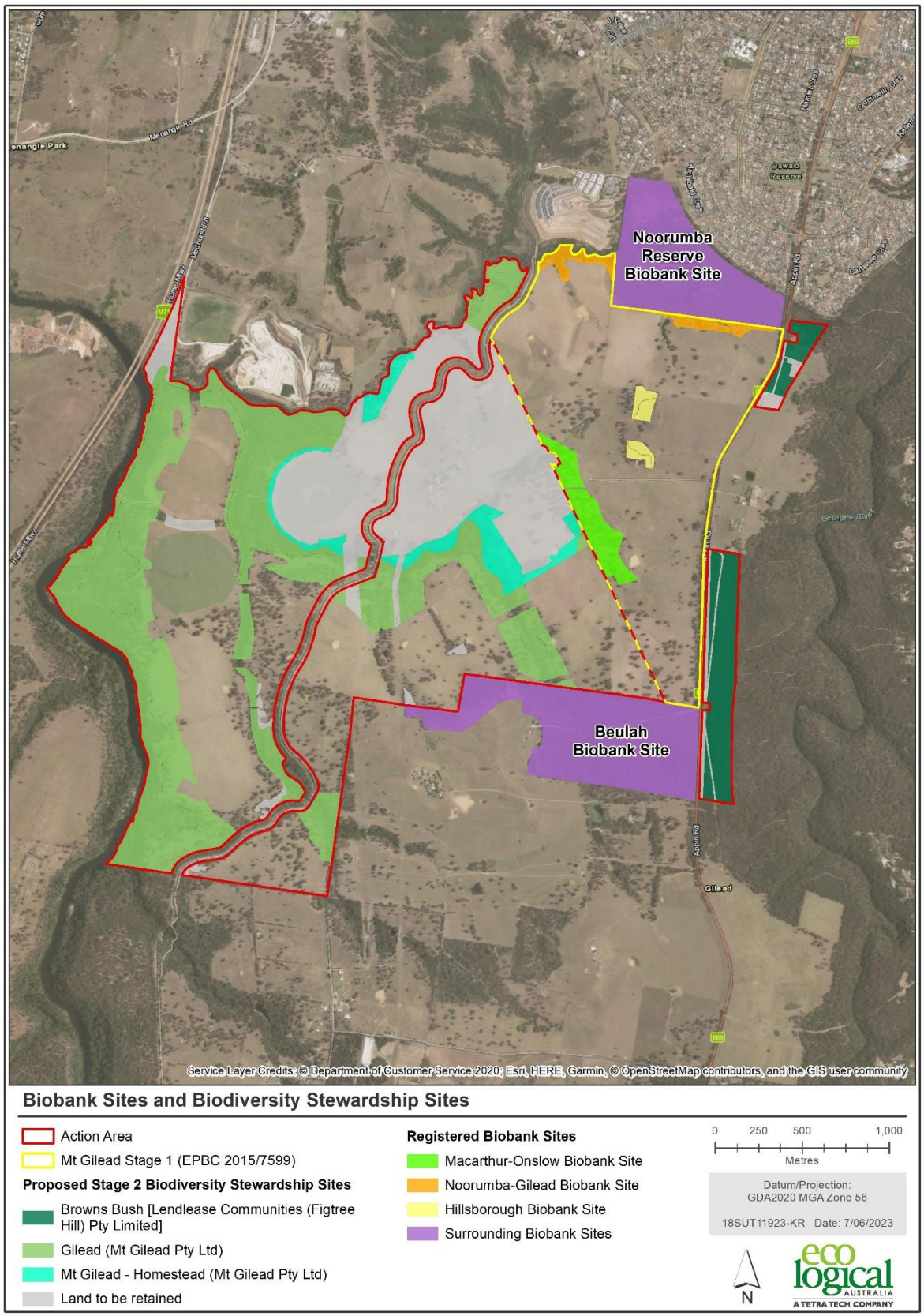


Figure 56: Location of proposed Biodiversity Stewardship sites in the study area

9.3 Biodiversity Stewardship Agreement site management actions

Applications to register the Mt Gilead Homestead, Gilead and Browns Bush sites were submitted to the then DPIE in August 2020 for assessment and registration, however, due to changes in legislation, will need to be-resubmitted as BSAs.

BSAs deliver ongoing benefits through fully funded active management of weeds, feral animals, access control, ecological burning regimes and restoration/revegetation of degraded areas. Under a BSA, landholders are legally required to improve and maintain biodiversity values on a site in perpetuity with annual audits and reporting and the ability for the Minister to obtain court directions to rectify any issues that has not been managed to the satisfaction of the BCT. The BSAs include a management plan for the conservation area that include the standard mandatory suite of BSA management actions to improve biodiversity values by the implementation of the following management actions:

- The erection and maintenance of boundary fencing to prevent inappropriate access
- Removal of rubbish
- The active management and reduction of weeds
- The application of fire, where appropriate
- Replanting or supplementary planting where natural regeneration is insufficient to bring back to benchmark condition within a reasonable timeframe
- Addition of logs to supplement the current low level of logs
- Control of rabbits and foxes (as required)
- The retention of regrowth/native vegetation, dead timber, and rocks
- A requirement for annual monitoring, reporting and audit and compliance.

These conservation areas will be managed and funded in-perpetuity as registered BSAs. The offset/conservation sites will be improved through a range of ecological restoration works set out in the BSA Management Plans. The restoration works will include fencing, removal of weeds, maintenance of drainage, and replanting where required. The offset sites will follow specific management, mitigation, and monitoring procedures to be conducted in these areas in accordance with the registered BSA Agreements.

The full cost of in perpetuity conservation management for the Stewardship Agreement sites will be provided by the proponent and when costed in 2020 were:- (Mt Gilead Homestead $14,300,000 and Gilead $6,484,000 and Browns Bush $823,000). These management cost will be updated as part of the registration of the BSA and will increase due to the additional monitoring requirements of BSAs.

9.4 Monitoring and reporting

Monitoring and reporting of all management actions in Stewardship Agreement sites is required to be undertaken annually in accordance with the relevant BSA Agreements. Photographs will be taken at permanent photo-points. This will be undertaken prior to management commencing, within 12 months of the commencement date and then at least every 12 months thereafter. The purpose of the photographs is to show changes over time. Photographs will be taken at approximately the same direction, location, height and time of day (during daylight hours). All photographs will be dated, stating their direction and identified with their locations such that they may be utilised as a performance indicators.

An annual audit of the offset sites will also be undertaken by the BCT in accordance with the BSA Agreements.

9.4.1 Measurability and performance measures

Standardised indicators can be very informative for use as performance measures. Baseline data will be available from the BSA assessments.

9.4.2 Annual report

The offset site owner/s will complete an annual report using the BSA annual reporting template. The report will detail all management actions undertaken, any incidents or events that have adversely affected the biodiversity values at the conservation areas, include all required photographs, results of inspections, and results on monitoring performance towards achieving outcomes.

9.5 Summary of EPBC Act offset commitments

The conservation outcomes achieved through the proposed action for Shale Sandstone Transition Forest, Cumberland Plain Woodland and the Koala and the relationship of these conservation outcomes to the statement of commitments made in the Biodiversity Certification Assessment Report (BCAR) are summarised in Table 30. The statement of commitments details the conservation outcomes achieved using the Biodiversity Certification Assessment Method (BCAM). As a result, the vegetation communities and credit calculations are described differently to the BBAM.

It should be noted that under the BCAM, all impacts to SSTF, CPW and Koala are fully offset within the two proposed Stewardship Agreement sites). However, as BCAM is not recognised by the EPBC Act as an endorsed methodology for calculating offsets, accordingly the BBAM was used for the purpose of calculating the impacts to EPBC Act listed matters and to determine whether the proposed offsets met that requirement. Table 30 presents the MNES affected, the impact requirements and offsetting requirements based on calculations undertaken using BBAM for the EPBC Act offset requirement and the NSW BCAM offset requirements and commitments in the BCAR.

Table 30: Relationship between the EPBC Act offset commitments and the Biodiversity Certification Statement of commitments

Note: the equations used to calculate the number of Koala credits differ between the Biobanking and Biodiversity Certification Methodologies resulting in different numbers of surplus or deficit credits.

MNES	MNES Impact	EPBC Offset Commitment (BBAM Calculations)	NSW Biocertification Offset Requirements/Commitments #
Shale Sandstone Transition Forest	26.29 ha of direct impacts 1.63 ha of partial impacts (APZs) 13.33 ha of indirect impacts to SSTF within the 30 m EEC buffer zone (note this will be fully mitigated and permanently protected and managed for conservation (partial	87.77 ha of existing EPBC Act Condition D SSTF outside of buffer zones across the two Stewardship Agreement sites, equivalent to 1,387 biobank credits. 6.04 ha of existing EPBC Act SSTF condition B outside of the buffer zones across the two Stewardship Agreement sites equivalent to 91 biobank credits	1,677 SSTF BCAM credits to be retired for 721 credit obligation for impacts to 35.06 ha of EPBC & BC Act SSTF in six condition zones/patches, including vegetation that does not meet minimum EPBC Act condition thresholds: Under the NSW BCAM, the impacts to SSTF will be fully offset by the two proposed Stewardship Agreement sites

MNES	MNES Impact	EPBC Offset Commitment (BBAM Calculations)	NSW Biocertification Offset Requirements/Commitments #
	impacts calculated at 20% and 5% loss for outer and inner buffer, respectively))	3.01 ha of SSTF condition A outside of the buffer zones across the two Stewardship Agreement sites equivalent to 46 biobank credits 2.75 ha of BC Act SSTF across the two Stewardship Agreement sites equivalent to 37 biobank credits 35.06 ha of cleared land to be restored to EPBC Act SSTF across the two Stewardship Agreement sites, equivalent to 465 biobank credits	(all credits generated will be retired, including any surplus credits). The 956 surplus SSTF credits will also be retired.
Cumberland Plain Woodland	6.68 ha of direct impacts 0.99 ha of indirect impacts to CPW within the 30m EEC buffer zone, (note all will be managed for conservation (indirect impacts calculated at 20% and 5% loss for outer and inner buffer, respectively))	10.27 ha of EPBC Act Condition A CPW outside buffer zones across the two Stewardship Agreement sites, equivalent to 161 biobanking credits 1.20 ha of EPBC Act condition C CPW outside buffer zones across the two Stewardship Agreement sites, equivalent to 19 biobanking credits 3.06 ha of BC Act CPW across the two Stewardship Agreement sites, equivalent to 45 biobanking credits 10.51 ha of cleared land to be restored to EPBC Act CPW across the two Stewardship Agreement sites, equivalent to 135 biobanking credits	308 CPW BCAM credits to be retired for a 219 credit obligation for impacts to 10.49 ha of EPBC & BC Act CPW in five condition zones/patches, including vegetation that does not meet minimum EPBC Act condition thresholds: Under the NSW BCAM, the impacts to CPW will be fully offset by the two proposed Stewardship Agreement sites and all credits generated will be retired, including any surplus credits. The 89 surplus CPW credits will also be retired.
Koala	47.87 ha of direct, partial and indirect impacts	208.11 ha of Koala habitat to be conserved across the two Stewardship Agreement sites, generating 1,478 biobanking credits to meet a 1,245 credit obligation. The 233 surplus Koala credits will also be retired.	1,249 Koala BCAM credits to be retired for direct & indirect impacts to 47.87 ha of Koala habitat, including vegetation within the APZ and vegetation to be retained in open space, but will be inaccessible to koalas for a 1,260 credit obligation. Leaving an 11 credit deficit which will be met by the approx.. 190 Koala credits generated at the 26.89 ha Browns Bush BSA site.

MNES	MNES Impact	EPBC Offset Commitment (BBAM Calculations)	NSW Biocertification Offset Requirements/Commitments #
Pomaderris brunnea	2 individual plants	249 Pomaderris brunnea plants protected, generating 1,768 BBAM credits for a 30 BBAM credit obligation. The surplus 1,738 credits will also be retired	1,494 Pomaderris brunnea species credits generated for a 30 credit obligation. 1,464 credit surplus also to be retired.

Additional conservation outcomes include the conservation and in-perpetuity management of:

- Grey-headed Flying Fox (155.18 ha of existing foraging habitat within the on-site offset sites and an additional 53.90 ha to be restored within the currently cleared portions of the offset sites)
- Large-eared Pied Bat (155.18 ha of existing foraging habitat within the on-site offset sites and an additional 53.90 ha to be restored within the currently clear portions of the offset sites)
- Swift Parrot (143.80 ha of existing potential foraging habitat within the on-site offset sites and an additional 148.70 ha to be restored within the currently clear portions of the offset sites
- Spot-tailed Quoll (162.54 ha of existing potential foraging habitat within the on-site offset sites and an additional 45.57 ha to be restored within the currently clear portions of the offset sites).

10. References

Biolink 2018a. *Comprehensive Koala Plan on Management*. Prepared by Biolink for Campbelltown City Council, 2018.

Biolink 2018b. *South Campbelltown Koala Habitat Connectivity Study*. Final report to Campbelltown City Council, updated April 2018.

Biolink 2020. Gilead Stage 2: A Commentary on Koala Carrying Capacity and Corridor Review Reports prepared by Eco Logical Australia on behalf of Lendlease Communities (Fig Tree Hill) Pty Ltd. Report prepare for Campbelltown City Council, June 2020.

Campbelltown City Council (CCC) 2020. Draft Strategic Planning Statement. A 20 year land use vision for the City of Campbelltown to 2040.

Department of Agriculture, Water and the Environment and Energy (DAWE) 2020. Conservation advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria, .31 July 2020.

Department of Agriculture, Water and the Environment and Energy (DAWE) 2021a Conservation advice for *Chalinolobus dwyeri* (Large-eared Pied Bat), Canberra 23 November 2021.

Department of Agriculture, Water and the Environment and Energy (DAWE) 2021b Conservation advice for *Pomaderris brunnea* (Rufous Pomaderris), Canberra.

Department of Agriculture, Water and the Environment and Energy (DAWE) 2021c Interactive Flying-fox Web Viewer.

Department of Agriculture, Water and the Environment (DAWE)) 2021d. National Recovery Plan for the Grey-headed Flying-fox.

Department of Agriculture, Water and the Environment and Energy (DAWE) 2021e. Species profile and threats database.

Department of Agriculture, Water and the Environment (DAWE) 2022 Conservation advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory, Canberra 12 February 2022.

Department of Environment and Conservation (DEC) 2004 *Threatened species survey and assessment; guidelines for developments and activities (working draft)* New South Wales Department of Environment and Conservation, Hurstville, NSW.

Department of Environment and Climate Change (DECC) 2007a. Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region Volume 1: Background Report. Information and Assessments Section, Metropolitan Branch, July 2007

Department of Environment and Climate Change (DECC) 2007b. Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region, Volume 2: Species of Conservation Concern and Priority Pest Species. Information and Assessments Section, Metropolitan Branch, July 2007.

Department of Environment and Climate Change (DECC) 2008a. *Vegetation Types Database*. Department of Environment and Climate Change, Sydney.

Department of Environment and Climate Change (DECC) 2008b. *Recovery Plan for Koala* DECC Goulburn St. Sydney.

Department of Environment and Climate Change (DECC) 2009a. *Biobanking Assessment Methodology and Credit Calculator Operation Manual*. Department of Environment and Climate Change, Sydney.

Department of Environment and Climate Change (DECC) 2009b. *Threatened species survey and assessment guidelines: field survey methods for fauna: Amphibians*. NSW Department of Environment & Climate Change, April 2009.

Department of Environment, Climate Change and Water (DECCW) 2009. Draft National Recovery Plan for the *Grey-headed Flying-fox Pteropus poliocephalus*. Prepared by Dr Peggy Eby, Department of Environment, Climate Change and Water, Hurstville NSW, July 2008.

Department of Environment, Climate Change and Water (DECCW) 2011a. *Biodiversity Certification Assessment Methodology*. NSW Department of Environment Climate Change and Water, Sydney.

Department of Environment, Climate Change and Water (DECCW) 2011b. *Cumberland Plain Recovery Plan*. NSW Department of Environment Climate Change and Water, Sydney.

Department of Environment, Land, Water and Planning (DELWP) 2016. National Recovery Plan for the Spotted-tail Quoll *Dasyurus maculatus*. Australian Government, Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2010a. Survey Guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the EPBC Act 1999. DEWHA, Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2010b. Survey Guidelines for Australia's threatened frogs. Guidelines for detecting frogs listed as threatened under the EPBC Act 1999. DEWHA, Canberra.

Department of the Environment, Water, Heritage and the (DEWHA) 2010b. *Survey guidelines for Australia's threatened birds*. Available at https://www.environment.gov.au/system/files/resources/ff3eb752-482d-417f-8971-f93a84211518/files/survey-guidelines-frogs.pdf

Department of the Environment (DotEE) 2013. The Draft survey guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed as 'Threatened' under The *Environment Protection and Biodiversity Conservation Act 1999.*

Department of Environment and Resource Management (DERM Qld) 2011. *National Recovery Plan for the Large-eared Pied Bat Chalinolobus Dwyeri*.

Department of Planning and Infrastructure (DP&I) 2013. Draft Metropolitan Strategy for Sydney to 2031. Prepared by the NSW Department of Planning and Infrastructure, March 2013.

DPE (Department of Planning and Environment) 2015. Greater Macarthur Land Release Investigation: Preliminary Strategy & Action Plan, NSW Department of Planning and Environment, September 2015.

DPE (Department of Planning and Environment) 2018. Greater Macarthur 2040: An Interim Plan for the Greater Macarthur Growth Area, NSW Department of Planning and Environment, November 2018.

Department of Planning, Industry and Environment (DPIE) 2019. Conserving Koalas in the Wollondilly and Campbelltown Local Government Areas.

Department of Planning, Industry and Environment (DPIE) 2020a. NSW Government Response: Inquiry in to koala populations and habitat in New South Wales. Department of Planning, Industry and Environment, Sydney, December 2020.

Department of Planning, Industry and Environment (DPIE) 2020b. The Draft Cumberland Plain Conservation Plan. A conservation plan for Western Sydney to 2056. Published by the NSW Department of Planning, Industry and Environment, August 2020.

DPIE 2021. Greater Macarthur 2040 Update December 2021. NSW Department of Planning, Industry and Environment, December 2021.

DPE 2022a. Guide to the Greater Macarthur Growth Area. Update to the 2040 Greater Macarthur 2040 Interim Plan. NSW Department of Planning, Industry and Environment, November 2022.

DPE 2022b. The Cumberland Plain Conservation Plan. A conservation plan for Western Sydney to 2056. Published by the NSW Department of Planning and Environment, August 2022.

Department of Sustainability, Environment, Population and Communities (DSEWPC) 2004a. Survey Guidelines for Australia's threatened mammals. Guidelines for detecting mammals listed as threatened under the EPBC Act 1999. DEWHA, Canberra.

Department of Sustainability, Environment, Population and Communities (DSEWPC) 2004b. Survey Guidelines for Australia's threatened reptiles. Guidelines for detecting reptiles listed as threatened under the EPBC Act 1999. DEWHA, Canberra.

Eco Logical Australia (ELA) 2006. *Mt Gilead Flora and Fauna Assessment: Stage 2*. Report prepared for Australand.

Eco Logical Australia (ELA) 2014. *Mt Gilead Rezoning: Ecological Assessment*. Report prepared for Mt Gilead Pty Ltd and S & A Dzwonnik.

Eco Logical Australia (ELA) 2016. Supplementary Myotis macropus and Green and Golden Bell Frog targeted survey – *October 2016*. Report prepared for Mt Gilead Pty Ltd and S&A Dzwonnik, December 2016.

Eco Logical Australia (ELA) 2017. *Biobank Agreement Credit Assessment Report - Noorumba Reserve Biobank site*. Report prepared for Campbelltown City Council, March 2017.

Eco Logical Australia (ELA) 2018a. *Biobank Agreement Credit Assessment Report – Macarthur-Onslow Mt Gilead Biobank Site*. Report prepared for Mt Gilead Pty Ltd, April 2018.

Eco Logical Australia (ELA) 2018b. *Biobank Agreement Credit Assessment Report – Noorumba-Mt Gilead- Biobank Site*. Report prepared for Mt Gilead Pty Ltd, April 2018.

Eco Logical Australia 2018c. Biodiversity Certification Assessment & Biocertification Strategy (ELA 2018) for the planning proposal at Appin Road, Gilead. Report prepared for Mt Gilead Pty Ltd and MR & Mrs Dzwonnik, dated 2 July 2018.

Eco Logical Australia (ELA) 2023a. Mount Gilead - Stage 2 Biocertification Assessment Report & Biocertification Strategy. Prepared for Lendlease Communities (Figtree Hill) Pty Ltd, Version 8, July 2023.

Eco Logical Australia (ELA) 2023b Mount Gilead Stage 2 Residential Development Construction Environmental Management Plan EPBC 2019/8587. Prepared for Lendlease Communities (Figtree Hill No.3) Pty Ltd, July 2023.

Eco Logical Australia (ELA) 2023c Mount Gilead Stage 2 Residential Development Koala Management Plan EPBC 2019/8587. Prepared for Lendlease Communities (Mt Gilead) Pty Ltd, July 2023.

Greater Sydney Commission 2018. Greater Sydney Region Plan, A Metropolis of Three Cities – Connecting People. Available from: https://gsc-public-1.s3-ap-southeast-2.amazonaws.com/greater-sydney-region-plan-0618.pdf.

Kavanagh, R. and Stanton, M.A. 2012. Koalas use young Eucalyptus plantations in an agricultural landscape on the Liverpool Plains, New South Wales. *Ecolog. Manage. & Restoration **13**: 297-305.*

Keith, D. A. and Simpson, C. 2006. *Spatial data layers for extant native vegetation in NSW*. Department of Environment and Climate Change.

Lendlease 2022. Figtree Hill Home Design Guidelines.

Lendlease 2022. Koala Conservation at Gilead, Lendlease November 2022.

National Parks and Wildlife Service (NPWS) 2002. Native vegetation of the Cumberland Plain, Western Sydney Vegetation Community, Condition and Conservation Significance Mapping. NSW National Parks and Wildlife Service, Sydney.

National Parks and Wildlife Service (NPWS) 2003a. The *Native vegetation of the Warragamba Special Area*. NSW National Parks and Wildlife Service, Sydney, August 2003.

National Parks and Wildlife Service (NPWS) 2003b. *The Native vegetation of the Woronora, O'Hares and Metropolitan Catchments*. NSW National Parks and Wildlife Service, Sydney, August 2003.

NSW Chief Scientist & Engineer 2020. Advice on the protection of the Campbelltown Koala population. Koala Independent Expert Panel. Office of the Chief Scientist & Engineer, 30 April 2020.

NSW Scientific Committee 2008. Squirrel Glider *Petaurus norfolcensis*. Review of current information in NSW. August 2008. Unpublished report arising from the Review of the Schedules of the Threatened Species Conservation Act 1995. NSW Scientific Committee, Hurstville.

NSW Scientific Committee 2014. Final Determination to list the shrub Pomaderris brunnea N.A. Wakefield, as an endangered species, gazetted 30 May 2014.

Office of Environment and Heritage (OEH) 2012. *National Recovery Plan, Magenta Lilly Pilly. Syzygium paniculatum*. Available at http://www.environment.gov.au/system/files/resources/35fce028-9329-4eb2-a336-75f6b6cc6d58/files/syzygium-paniculatum.pdf

Office of Environment and Heritage (OEH) 2014. *BioBanking Assessment Methodology 2014a*. Office of Environment and Heritage for the NSW Government, September 2014, Sydney. Available online: http://www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf

Office of Environment and Heritage (OEH) 2015a. Biodiversity Certification Guide to Applicants. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015b. Biodiversity Certification Operational Manual. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015c. *Threatened Species Profiles*. Office of Environment and Heritage. Available online: http://www.environment.nsw.gov.au/threatenedspecies/

Office of Environment and Heritage (OEH) 2016. NSW Guide to surveying threatened plants, NSW Office of Environment and Heritage, February 2016

Office of Environment and Heritage (OEH) 2018. 'Species credit' threatened bats and their habitats. NSW survey guide for the Biodiversity Assessment Method, Office of Environment and Heritage, September 2018.

Office of Environment and Heritage (OEH) 2019. *Atlas of NSW Wildlife database*. Office of Environment and Heritage.

Openlines 2020. Draft Cumberland Plain Assessment Report. Report prepared for the Department of Planning, Industry and Environment.

Rhind, S.G., Ellis, M.V., Smith, M. and Lunney, D. 2014. Do Kolas *Phascolarctos cinereus* use trees planted on farms? A case study form north-west New South Wales, Australia. *Pacific Conservation Biology **20(3)**: 302-312.*

RMS 2018. Appin Road Upgrade, Mt Gilead to Ambervale: Review of Environmental Factors, Roads and Maritime Services, November 2018.

Rural Fire Service 2018. Planning for Bushfire protection: a guide for Councils, Planners, Fire Authorities and developers.

Saunders, D.L. and Tzaros, C.L. 2011. National Recovery Plan for the Swift Parrot Lathamus discolor, Birds Australia, Melbourne.

Smith, M. 1992. Koalas and land use in the Gunnedah Shire: A report on the Bearcare project. NSW National Parks and Wildlife Service, Hurstville, NSW.

Tozer, M. G., Turner, K., Keith, D. A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. 2010. 'Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands'. *Cunninghamia* **11(3):** 359-405.

TSSC (Threatened Species Scientific Committee) 2008. Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

TSSC [Threatened Species Scientific Committee] (2012) *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat)*. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/183-listing-advice.pdf. In effect under the EPBC Act from 29-Jun-2012.

TSSC (Threatened Species Scientific Committee) 2014. Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approved Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion.

TSSC (Threatened Species Scientific Committee) 2016. Conservation Advice Petauroides volans (Greater Glider), 25 May 2016.

TSSC (Threatened Species Scientific Committee) 2016. Conservation Advice Latham discolor (Swift Parrot), 5 May 2016.

Ward, S.J. 2002. Koalas and the community: a study of low density populations in Southern Sydney. Unpublished PhD thesis, University of Western Sydney, Campbelltown, NSW.

Wild Conservation 2021. Wildlife Drone Surveys at Fig Tree Hill – Ecological Report. Report prepared for Lendlease Pty Ltd by Wild Conservation, 23 August 2021.

Wild Conservation 2022. Wildlife Drone Surveys at Fig Tree Hill – Ecological Report. Report prepared for Lendlease Pty Ltd by Wild Conservation, 28 August 2022.

Appendix A Mt Gilead Stage 2 EPBC Act Referral Supporting documentation

Provided as a separate Pdf document

Appendix B EPBC 2019/8587 Controlled Action Decision

Provided as a separate Pdf document

Appendix C EPBC 2019/8587 PD Requirements

Provided as a separate Pdf document

Appendix D Names, roles and qualifications of persons preparing this PD report

Name	Qualifications	PER Role
Eco Logical Australia staff		
Robert Humphries, Principal Consultant	Master Applied Science (Bushfire Ecology) 1994 Bachelor Applied Science 1985 Accredited Assessor (BC Act)	Project Manager Liaison with Lendlease PER Report preparation and review. Biocertification & Biobank Report preparation and review EPBC Offset Policy calculations
Michelle Frolich	Bachelor of Science (Marine Science Honours) 2007 Accredited Assessor (BC Act)	Map preparation and GIS area calculations BCAM & BBAM Offset Calculations
Alex Gorey	Bachelor of Science 2012 Master of Sustainability 2015 6+ years' experience in biodiversity assessment	Vegetation mapping & plots Targeted threatened flora surveys
Dr. Meredith Henderson	Bachelor of Science PhD Vegetation Dynamics Accredited BAM Assessor 30+ years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping & plots Targeted threatened flora surveys
Dr. Rod Armistead	PhD in Conservation Biology Bachelor of Advanced Since (Hons) 20+ years' experience in aquatic surveys and EIA	Senior Fauna Ecologist Targeted threatened fauna surveys
Ian Dickson	Master of tropical environmental management 2006 17 years' experience in aquatic surveys and EIA	Aquatic fauna surveys
Bronwyn Callaghan	Bachelor of Env Science 1998 Accredited BAM Assessor 10+ years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping & plots Targeted threatened flora surveys
Karen Spicer	Bachelor of Env Science (Hons) 1999 Accredited BAM Assessor 15+ years' experience in biodiversity assessment and EIA	Senior Botanist Vegetation mapping & plots Targeted threatened flora surveys
Griffin Taylor-Dalton	Bachelor of Zoology 20017 5 years' experience in biodiversity surveys & EIA	Ecologist Vegetation mapping & plots Targeted threatened flora surveys
Suzanne Eacott	Bachelor of Conservation Biology 2015	Ecologist

Name	Qualifications	PER Role
	Certificate III in Land Management 5+ years' experience in biodiversity surveys & EIA	Vegetation mapping & plots Targeted threatened flora surveys
Former ELA Staff	**2016-2018**	
Brian Towle	Bachelor Environmental Science (Honours) 2005 Accredited Biobanking and BC Act Assessor 15+ years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping and community descriptions Targeted threatened flora survey Biometric plots
Tammy Paartalu	Bachelor Environmental Science (Honours) Accredited Biobanking and BC Act Assessor 20 years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping and community descriptions Targeted threatened flora survey Biometric plots
Liz Norris	Bachelor Environmental Science (Honours) Accredited Biobanking and BC Act Assessor 20 years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping and community descriptions Targeted threatened flora survey Biometric plots
Greg Steenbeeke	Bachelor of Science (Honours) 1990 Accredited Biobanking and BC Act Assessor 25+ years' experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping and community descriptions Targeted threatened flora survey Biometric plots

Appendix E EPBC 2019/8587 Lendlease Sustainability Policy

Provided as a separate Pdf document

Appendix F Lendlease Sustainability Framework

Provided as a separate Pdf document

Appendix G Lendlease Mission Zero Road Map

Provided as a separate Pdf document

Appendix H Mt Gilead Stage 2 Biodiversity Certification Assessment Report and Biocertification Strategy – July 2023

Provided as a separate Pdf document

Appendix I Principles for Koala Protection in the Greater Macarthur and Wilton Growth areas and surrounds – Lendlease response to the NSW Chief Scientist and Engineer Report

Provided as a separate Pdf document

Appendix J DPE Methodology for determining the average width off Koala corridors (consistent with CSE recommendations)

Appendix K DPE Letter to Lendlease regarding updates to the Macarthur Growth Strategy and Koala corridors in Gilead

Provided as a separate Pdf document

Appendix L Koala Conservation at Gilead – Lendlease 2022

Provided as a separate Pdf document

Appendix M Draft EPBC Koala Management Plan prepared in accordance with Preliminary Documentation Requirements

Provided as a separate Pdf document

Appendix N Draft Construction Environmental Management Plan prepared in accordance with Preliminary Documentation Requirements

Provided as a separate Pdf document

Appendix O Protected Matters Search Tool

Provided as a separate Pdf document

Appendix P Likelihood of occurrence assessment

Provided as a separate Pdf document

Appendix Q Gilead – Figtree Hill Koala Drone surveys – Wild Conservation – August 2021

Provided as a separate Pdf document

Appendix R Gilead – Figtree Hill Koala Drone surveys – Wild Conservation – August 2022

Provided as a separate Pdf document

Appendix S EPBC Vegetation Condition and Patch Analysis

Provided as a separate Pdf document

Appendix T Flora and Fauna species lists

Provided as a separate Pdf document

Appendix U Naturalised Stormwater Strategy – E2 Designs

Provided as a separate Pdf document

Appendix V Biobanking Impact Credit Calculations

Provided as a separate Pdf document

Appendix W Biobanking Offset Credit Calculations

Provided as a separate Pdf document

Appendix X EPBC MNES Offset Calculations

Provided as a separate Pdf document

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