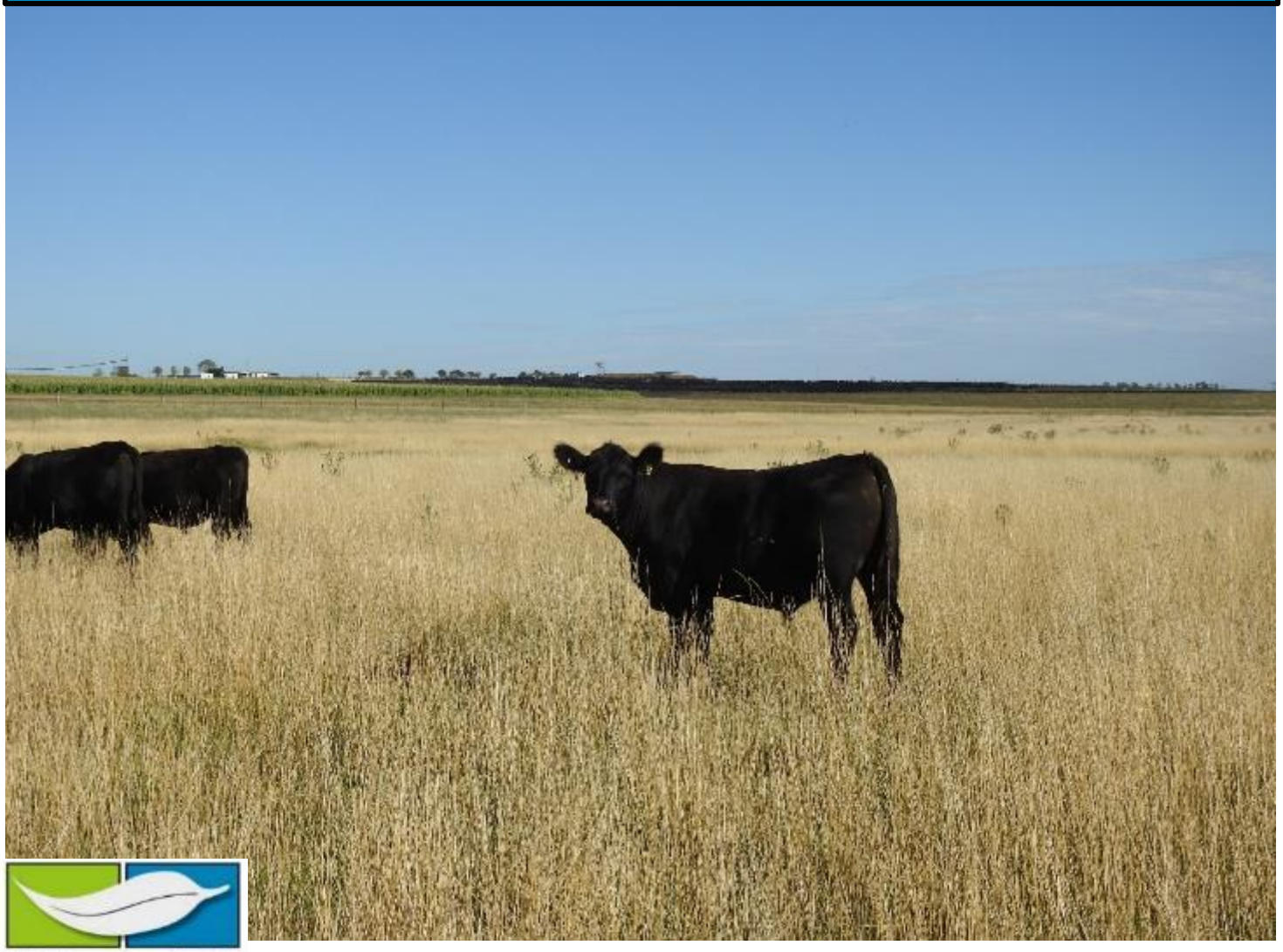
Biodiversity Development Assessment Report
Rangers Valley Feedlot
Proposed manure and effluent utilisation areas

Glen Innes Severn LGA NSW
September 2019



AREA
ENVIRONMENTAL CONSULTANTS & COMMUNICATION

AREA Environmental Consultants & Communication
(a) 6 Belmore Street Dubbo NSW 2830
(b) "Thieles Gate" (Type 2 Conservation Agreement Area) 79 Huonbrook Rd Mullumbimby NSW 2482
Ph 0409 852 098
phil@areaenvironmental.com.au

ABN:29 616 529 867
Advanced Regional Environmental Assessments (AREA)

- ✓ Environmental impact assessment, approvals and auditing
- ✓ Preliminary environmental assessment (PEA)
- ✓ Review of environmental factors (REF)
- ✓ Peer review
- ✓ Community engagement
- ✓ Biobanking and biodiversity offsetting assessments
- ✓ Aboriginal heritage assessments and community walkovers
- ✓ Landscape planning and design

AREA Environmental Consultants & Communication acknowledge Traditional Owners of the country on which we work

Cover picture: Looking north east across Middle Swamp towards feedlot yards and corn crop.

Executive Summary

AREA Environmental Consultants & Communication (AREA) was commissioned by Rangers Valley Cattle Station Pty Ltd to assess the potential environmental impact associated with application of manure or effluent to proposed additional utilisation areas.

Rangers Valley Cattle Station Pty Ltd wish to expand their beef cattle feedlot known as Rangers Valley Feedlot. As part of the expansion, additional manure and effluent utilisation areas are proposed.

This biodiversity and impact assessment will be presented in this Biodiversity Development Assessment Report (BDAR).

The proposed development is both designated and integrated development under Part 4 of the *Environmental Planning and Assessment Act 1979*. This assessment addresses requirements of the following legislative frameworks:

- *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).
- *NSW Biodiversity Conservation Act 2016* (BC Act).
- *NSW Local Land Services Act 2013* (LLS Act).
- *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (Veg SEPP).

The purpose of this proposal is to increase the productivity of the land by increasing the nutrients in the soil to support the swift and strong growth of the ground cover. The ground cover in the development site consists of native and not native vegetation.

Eleven paddocks are the subject of this BDAR. These paddocks are referred to by name in this report (see below). The paddocks are also referred to as two groups – grouped by the type of impact addressed in this report.

- Seven paddocks are proposed **manure utilisation areas** (158.30 hectares)
  - These paddocks are known as Rixons, Back Paddock, Four Mile, Perkins 3, Perkins 4, Top Sugarloaf and Middle Swamp.
- Four paddocks are proposed **effluent utilisation areas** (94.86 hectares).
  - These paddocks are known as Crouches, Show, Old 2 and Old 3.

Vegetation Zones are allocated based on a measurement of ground cover quality (percent native cover of total living ground cover):

- Zone 1 – Areas with more than 50 percent native ground cover
  - Manure utilisation areas - no tree removal required
- Zone 2 – Areas with between zero and 50 percent native ground cover.
  - Manure utilisation areas – no tree removal required
  - Effluent utilisation areas - removal of 24.44 hectares native vegetation
- Zone 3 – Areas with zero percent native ground cover - current cropped paddock
  - Effluent utilisation areas - removal of five living paddock trees and two dead paddock trees
- Zone 4 – Area with zero native ground cover - current cropped paddock
  - Effluent utilisation area – removal of 0.59 hectare patch of living trees (12 trees)

Vegetation removal can also be described by paddock:

- Crouches
  - 0.59 hectares of PCT510
  - **One dead paddock tree** (20 – 50 centimetres Diameter at Breast Height (DBH), with a hollow <20 centimetres diameter)
- Show
  - 8.55 hectares of PCT510
- Old 2
  - 15.89 hectares of PCT510
- Old 3
  - **Five living paddock trees** to be removed
    - One *Eucalyptus caliginosa* (20 – 50 centimetres DBH, with hollow <20 centimetres)
    - One *Eucalyptus bridgesiana* (>50 DBH, Hollow >20 centimetres)
    - Three *Eucalyptus melliodora* (two 20 – 50 centimetres DBH and one >50 centimetres DBH, all with hollows <20 centimetres diameter)
  - **One dead paddock tree** to be removed (>50 centimetres DBH with hollow <20 centimetres diameter)

Fifteen BAM (2017) vegetation plots were completed. These plots defined the vegetation in the development site, confirmed areas of not native vegetation and sort to understand native vegetation in areas outside the development site which had previously been the subject of fertilisation by inorganic fertilisers.

Threatened species searches were also conducted. Three species of threatened microbat were recorded using remote sensing SM2 bat recorders.

Plant Community Type 510 (a component of Box-gum Woodland EEC) was found to occur in all areas of native vegetation assessed and was identified as a candidate Serious and Irreversible Impact. While it is the appropriate regulatory authority who determine whether the impact to this community is in fact a Serious or Irreversible Impact, this report recommends that given the extent and nature of the impact, this proposal does not represent a Serious and Irreversible Impact to PCT510.

The Biodiversity Assessment Method Calculator (BAMC) was used to confirm predicted threatened species and determine any offset required as a result of the proposal. Nine threatened species were determined to have habitat within the development site and have a potential to be impacted by the proposal. These species generated a credit requirement in the BAMC.

Two threatened species were identified as candidate Serious and Irreversible Impacts. Given the extent and nature of this proposal, this report recommends that this proposal does not constitute a Serious and Irreversible Impact for these species.

Impact to native vegetation communities mapped as PCT510 requires offsetting of one ecosystem credit.

Removal of the five living and two dead paddock trees requires offsetting with seven ecosystem credits.

Potential impact to threatened species requires offsetting with 15 species credits.

Document Controls

Proponent	Rangers Valley Cattle Station Pty Ltd		
Client	Rangers Valley Cattle Station Pty Ltd		
Document Description	Biodiversity Development Assessment Report: Proposed manure and effluent utilisation areas		
Clients Representative Managing this Document	AREA Person(s) Managing this Document		
Rod Davis Director RDC Engineers	Phil Cameron (PJC) - Principal Consultant		
Location	AREA Job No. QU-0129		
\Clients\RDC Engineers\Rangers Valley			
Document Status: **DRAFT**	Version	Date	Action
Series V1.X = Internal edits	V1.0 V1.1	March 2019	AW to PJC PJC to AW
Series V2.X = Client internal edits	V2.0 V2.1 V2.2 V2.3	09.04.2019	AREA to Client AREA to Client AREA to external review AREA to Client
FINAL when draft is approved by client	V3.0		AREA to Client
	V3.1	14.08.2019	AREA to Client
	V3.2	15.08.2019	AREA to Client
	V3.3	20.09.2019	AREA to Client addressing BCD comments
Prepared For	Prepared by		
Rod Davis Director RDC Engineers Pty Ltd Phone: 0427629203 Email: rod.davis@rdcengineers.com.au	Addy Watson - Principal Environment & Community Consultant AREA Environmental Consultants & Communication Pty Ltd 6 Belmore Street Dubbo NSW 2830 M 0409 852 098 E addy@areaenvironmental.com.au ABN:29 616 529 867		

COPYRIGHT
© AREA Environmental Consultants & Communication Pty Ltd, 2019
and
© Rangers Valley Cattle Station Pty Ltd, 2019
All intellectual property and copyright reserved.
Apart from any fair dealing for private study, research, criticism or review, as permitted under the *Copyright Act 1968*, no part of this report may be reproduced, transmitted, stored in a retrieval system or adapted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without written permission.
Enquiries would be addressed to AREA Environmental Consultants & Communication Pty Ltd.

TABLE OF CONTENTS

FIGURES

TABLES

BAM definitions and acronyms used in this document

Definitions

Accredited person: has the same meaning as in the BC Act, referred to in the BAM as 'assessor'.
Ancillary rules: has the same meaning as set out in clause 6.5 of the BC Regulation.
Annual probability of decline in vegetation and habitat condition: an estimate of the average probability of decline of each attribute through clearing, stochastic factors or ongoing degrading actions (firewood removal, weed invasion, livestock grazing).
Areas of geological significance: geological features such as karst, caves, crevices, cliffs.
Assessment area surrounding the subject land: the area of land in the 1500m buffer zone around a development site, or land to be biodiversity certified or a biodiversity stewardship site, that is determined in accordance with Subsection 4.3.2.
Assessor: the person accredited under the BC Act referred to in Subsection 2.1.2 and who has been engaged by the proponent.
Averted loss: the gain in vegetation and habitat condition that arises from managing the proposed land as an offset compared to the probable future vegetation condition if the land was to be left unmanaged (see *Annual probability of decline*).
Avoid: measures taken by a proponent such as careful site selection or actions taken through the design, planning, construction and operational phases of the development to completely avoid impacts on biodiversity values, or certain areas of biodiversity. Refer to the BAM for operational guidance.
BAM: the Biodiversity Assessment Method.
BC Act: the Biodiversity Conservation Act 2016.
BC Regulation: the Biodiversity Conservation Regulation 2017.
Benchmark data: for a PCT, vegetation class or vegetation formation benchmark data is contained in the BioNet Vegetation Classification. A local reference site may also be used to establish benchmark data for a PCT that may be used in a BAM assessment.
Benchmarks: the quantitative measures that represent the 'best-attainable' condition, which acknowledges that native vegetation within the contemporary landscape has been subject to both natural and human-induced disturbance. Benchmarks are defined for specified variables for each PCT. Vegetation with relatively little evidence of modification generally has minimal timber harvesting (few stumps, coppicing, cut logs), minimal firewood collection, minimal exotic weed cover, minimal grazing and trampling by introduced or overabundant native herbivores, minimal soil disturbance, minimal canopy dieback, no evidence of recent fire or flood, is not subject to high frequency burning, and has evidence of recruitment of native species.
Biodiversity certification: has the same meaning as in the BC Act.
Biodiversity Certification Assessment Report (BCAR): has the same meaning as in the BC Act.
Biodiversity credit report: the report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity Development Assessment Report (BDAR): has the same meaning as in the BC Act.
Biodiversity offsets: management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity Stewardship Agreement: has the same meaning as in the BC Act.
Biodiversity Stewardship Assessment Report (BSAR): the report that must be prepared in accordance with the BAM and submitted as part of an application for a biodiversity stewardship agreement.
Biodiversity values: has the same meaning as clause 1.5(2) of the BC Act.

Biodiversity values map: is established according to clause 7.3 of the BC Regulation. Development within an area identified on the map requires assessment using the BAM.
BioNet Atlas: the OEH database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish.
BioNet Vegetation Classification: the master vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by OEH and available at www.environment.nsw.gov.au/research/Visclassification.htm.
Broad condition state: areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Certified more appropriate local data: has the same meaning as set out in Subsection 2.2.2.
Change in vegetation integrity score for a biodiversity stewardship site: the difference (gain) between the estimated vegetation integrity score without management at a biodiversity stewardship site and the predicted future vegetation integrity score with management at a biodiversity stewardship site, calculated in accordance with Equation 28.
Class of biodiversity credit: as defined in Section 11.3.
Clearing site: the site proposed to be cleared of native vegetation where approval is sought under Part 5A of the *Local Land Services Act 2013* or the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*.
Clonal species: flora species that propagate asexually at a site or have a limited degree of sexual reproduction, either within or between sites. Modes of asexual reproduction will include vegetative reproduction such as by rhizomes, root suckers or bulb replication.
Connectivity: the measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator: the computer program that provides decision support to assessors and proponents by applying the BAM, in particular by using the data required to be entered and the equations in Appendix 6 and Appendix 9 to calculate the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Critically endangered ecological community (CEEC): an ecological community specified as critically endangered in Schedule 2 of the BC Act and/or listed under Part 13, Division 1, Subdivision A of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
Crown cover: the vertical projection of the periphery of tree crowns within a designated area.
Derived vegetation: PCTs that have changed to an alternative stable state as a consequence of land management practices since European settlement. Derived communities can have one or more structural components of the vegetation entirely removed or severely reduced (e.g. over-storey of grassy woodland) or have developed new structural components where they were previously absent (e.g. shrubby mid-storey in an open woodland system).
Development footprint: the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials. The term *development footprint* is also taken to include clearing footprint except where the reference is to a small area development or a major project development.
Development site: an area of land that is subject to a proposed development that is under the EP&A Act. The term *development site* is also taken to include clearing site except where the reference is to a small area development or a major project development.
Ecosystem credits: a measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.

Endangered ecological community (EEC): an ecological community specified as endangered in Schedule 2 of the BC Act, or listed under the EPBC Act.
Environment Agency Head: has the same meaning as in the BC Act.
EP&A Act: the NSW Environmental Planning and Assessment Act 1979.
EPBC Act: the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
Ephemeral flora species: flora species where the abundance of the species above ground fluctuates in response to the plant life history in combination with environmental conditions and/or disturbance regimes. Fluctuations in abundance may be short-term (seasonal) or long-term (yearly to decadal). Many ephemeral species persist underground through unfavorable conditions via soil seed banks or dormant vegetative organs (bulbs, tubers, rootstocks).
Estuarine area: a semi-enclosed body of water having an open or intermittently open connection with the ocean, in which water levels do not vary with the ocean tide (when closed to the sea) or vary in a predictable, periodic way in response to the ocean tide at the entrance (when open to the sea).
Expert: a person who has the relevant experience and/or qualifications to provide expert opinion in relation to the biodiversity values to which an expert report relates.
Foliage cover: the percentage of a plot area that would be covered by a vertical projection of the foliage and branches and trunk of a plant, or plants or a growth form group. Foliage cover can also be referred to as percent foliage cover.
Gain: the gain in biodiversity values at a biodiversity stewardship site, over time from undertaking management actions at a biodiversity stewardship site. Gain in biodiversity values is the basis for creating biodiversity credits at the biodiversity stewardship site.
Grassland: native vegetation classified in the vegetation formation 'Grasslands' in Keith (2004)[2]. Grasslands are generally dominated by large perennial tussock grasses, lack of woody plants, the presence of broad-leaved herbs in inter-tussock spaces, and their ecological association with fertile, heavy clay soils on flat topography in regions with low to moderate rainfall.
Growth form: the form that is characteristic of a particular flora species at maturity. Growth forms are set out in Appendix 4.
Habitat: an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.
Habitat component: the component of habitat that is used by a threatened species for either breeding, foraging or shelter.
Habitat surrogates: measures of habitat that predict the occurrence of threatened species and communities: IBRA subregion, PCT, percent vegetation cover and vegetation condition.
Herbfield: native vegetation which predominantly does not contain an over-storey or mid-storey and where the ground cover is dominated by non-grass species.
High threat exotic plant cover: plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species. Also referred to as high threat weeds.
Hollow bearing tree: a living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the entrance width is at least 5cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1m above the ground. Trees must be examined from all angles.
IBRA region: a bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system[3], which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.
IBRA subregion: a subregion of a bioregion identified under the IBRA system.
Impact assessment: an assessment of the impact or likely impact of a development on biodiversity values which is prepared in accordance with the BAM.
Impacts on biodiversity values: loss in biodiversity values from direct or indirect impacts of development in accordance with Chapters 8, 1 and 10.
Important wetland means:

(a) a wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) from time to time, and
(b) for the purposes of all paragraphs except 4.2.1.6 the actual location on the ground that corresponds to a SEPP 14 Coastal wetland
(c) for the purposes of Paragraph 4.2.1.6:
(i) a SEPP 14 Coastal Wetland, and
(ii) the actual location on the ground that corresponds to a SEPP 14 Coastal Wetland.

Individual: in relation to organisms, a single, mature organism that is a threatened species, or any additional threatened species listed under Part 13 of the EPBC Act.

Intact vegetation: vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present.

Intrinsic rate of increase (*ir*): an estimate of the rate of gain for an attribute at a biodiversity stewardship site from actions undertaken as part of the management plan. The intrinsic rate of increase is specified for an attribute according to the formation of the PCT being assessed (see Appendix 8).

Landscape attributes: in relation to a development site or a biodiversity stewardship site, native vegetation cover, vegetation connectivity, patch size and the strategic location of a biodiversity stewardship site.

Large tree benchmark: is the largest stem size class for a PCT as determined by the benchmark for the PCT.

Life cycle: the series of stages of reproduction, growth, development, aging and death of an organism.

Life form: the form that is characteristic of a particular species at maturity. In the BAM, life form has the same meaning as growth form for flora species.

Linear shaped development: development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length.

Litter cover: the percentage ground cover of all plant material that has detached from a living plant, including leaves, seeds, twigs, branchlets and branches (<10cm in diameter).

Local population: the population that occurs in the study area. In cases where multiple populations occur in the development site or a population occupies part of the development site, impacts on each subpopulation must be assessed separately.

Local wetland: any wetland that is not identified as an important wetland (refer to definition of *Important wetland*).

Loss of biodiversity: the loss of biodiversity values from a development site, native vegetation clearing site or land where biodiversity certification is conferred.

Major project: State Significant Development and State Significant Infrastructure.

Minimise: a process applied throughout the development planning and design life cycle which seeks to reduce the residual impacts of development on biodiversity values.

Mitchell landscape: landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Multiple fragmentation impact development: developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines.

Native ground cover: all native vegetation below 1m in height, including all such species native to NSW (i.e. not confined to species indigenous to the area).

Native ground cover (grasses): native ground cover composed specifically of native grasses.

Native ground cover (other): native ground cover composed specifically of non-woody native vegetation (vascular plants only) <1m in height that is not grass (e.g. herbs, ferns).

Native ground cover (shrubs): native ground cover composed specifically of native woody vegetation <1m in height.

Native mid-storey cover: all vegetation between the over-storey stratum and a height of 1m (typically tall shrubs, under-storey trees and tree regeneration) and including all species native to NSW (i.e. native species not local to the area can contribute to mid-storey structure).

Native over-storey cover: the tallest woody stratum present (including emergent) above 1m and including all species native to NSW (i.e. native species not local to the area can contribute to over-storey structure). In a woodland community, the over-storey stratum is the tree layer, and in a shrubland community the over-storey stratum is the tallest shrub layer. Some vegetation types (e.g. grasslands) may not have an over-storey stratum.
Native plant species richness: the number of different native vascular plant species that are characteristic of a PCT.
Native vegetation: has the same meaning as in section 1.6 of the BC Act.
Native vegetation cover: the percentage of native vegetation cover on the subject land and the surrounding buffer area. Cover estimates are based on the cover of native woody and non-woody vegetation relative to the approximate benchmarks for the PCT, taking into account vegetation condition and extent. Native over-storey vegetation is used to determine the percent cover in woody vegetation types, and native ground cover is used to assess cover in non-woody vegetation types.
Number of trees with hollows: a count of the number of living and dead trees that are hollow bearing.
Offset rules: are those established by the BC Regulation.
Onsite measures: measures and strategies that are taken or are proposed to be taken at a development site to avoid and minimise the direct and indirect impacts of the development on biodiversity values.
Operational Manual: the Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM.
Patch size: an area of intact native vegetation that:
a) occurs on the development site or biodiversity stewardship site, and
b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).
Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site.
PCT classification system: the system of classifying native vegetation approved by the NSW Plant Community Type Control Panel and described in the BioNet Vegetation Classification.
Percent cleared value: the percentage of a PCT that has been cleared as a proportion of its pre-1750 extent, as identified in the BioNet Vegetation Classification.
Plant community type (PCT): a NSW plant community type identified using the PCT classification system.
Plot: an area within a vegetation zone in which site attributes are assessed.
Population: a group of organisms, all of the same species, occupying a particular area.
Probability of reaching benchmark: the probability of a specific attribute or growth form group reaching benchmark conditions in the vegetation zone at the end of the management timeframe.
Proponent: a person who intends to apply for consent or approval to carry out development, clearing, biodiversity certification or for approval for infrastructure.
Reference sites: the relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration: the proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5cm within a vegetation zone.
Residual impact: an impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits: the retirement of biodiversity credits from a biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer: an area of land determined according to Appendix 3.

Risk of extinction: the likelihood that the local population or CEEC or EEC will become extinct either in the short term or in the long term as a result of direct or indirect impacts on the viability of that population or CEEC or EEC.
SEPP 14 Coastal wetland: a wetland to which *State Environmental Planning Policy No 14 – Coastal Wetlands* applies or an area that is identified as a coastal wetland within the meaning of the term *coastal wetlands and littoral rainforests area* for the purposes of *Coastal Management Act 2016*.
Site attributes: the matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development: a development other than a linear shaped development, or a multiple fragmentation impact development.
Site context: the value given to landscape attributes of a development site or biodiversity stewardship site after an assessment undertaken in accordance with Section 4.3.
Species credit species: are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.
Species credits: the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
State Significant Development: has the meaning given by Division 4.1 of Part 4 of the EP&A Act.
State Significant Infrastructure: has the meaning given by Part 5.1 of the EP&A Act.
Stream order: has the same meaning as in Appendix 3.
Subject land: is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threat status class: the extent to which a species or ecological community is threatened with extinction, or the extent to which a PCT is estimated to have been cleared (see *Percent cleared value*).
Threatened Biodiversity Data Collection: part of the BioNet database, published by OEH and accessible from the BioNet website at www.bionet.nsw.gov.au.
Threatened ecological community (TEC): means a critically endangered ecological community, an endangered ecological community or a vulnerable ecological community listed in Schedule 2 of the BC Act.
Threatened species: critically endangered, endangered or vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Threatened species survey: a targeted survey for threatened species undertaken in accordance with Section 6.5.
Threatened species survey guidelines: survey methods or guidelines published by OEH from time to time at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/surveys-and-assessments.
Total length of fallen logs: the total length of logs present in a vegetation zone that are at least 10cm in diameter and at least 0.5m long.
Transect: a line or narrow belt along which environmental data is collected.
Upland Swamp Policy: the document entitled *Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence* as in force on the day when the BAM is published until such time as the Environment Agency Head publishes any further document for the purpose of it being adopted by the BAM as the Upland Swamp Policy.

Vegetation Benchmarks Database: a database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification. It is available at www.environment.nsw.gov.au/research/Visclassification.htm.
Vegetation class: a level of classification of vegetation communities defined in Keith (2004)[4]. There are 99 vegetation classes in NSW.
Vegetation formation: a broad level of vegetation classification as defined in Keith (2004)[4]. There are 16 vegetation formations and sub-formations in NSW.
Vegetation integrity: the condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT.
Vegetation integrity score: the quantitative measure of vegetation condition calculated in accordance with Equation 15 or Equation 16.
Vegetation zone: a relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Viability: the capacity of a species to successfully complete each stage of its life cycle under normal conditions so as to retain long-term population densities.
Vulnerable ecological community (VEC): an ecological community specified as vulnerable in Schedule 2 of the BC Act and/or listed under Part 13, Division 1, Subdivision A of the EPBC Act.
Wetland: an area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water (see also *Important wetland* and *Local wetland*).
Woody native vegetation: native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs.

Acronyms

Acronym	Definition
BAR	Biodiversity Assessment Report
BAMC	Biodiversity Assessment Method Credit Calculator
BASSR	Biodiversity Steward Site Assessment Report
BAMC	BioBanking Credit Calculator
BOM	Bureau of Meteorology
BC Act	Biodiversity Conservation Act 2016
BOS	Biodiversity Offset Strategy
BVT	Biometric Vegetation Types
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environment Management Plan
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEE	Department of Environment and Energy formerly the Department of the Environment
DEWHA	Department of Environment, Water, Heritage and the Arts
DPE	Department of Planning and the Environment
DPI	Department of Primary industries
DotE	Department of the Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC	Environment Protection and Biodiversity Conservation Act 1999
FBA	Framework of Biodiversity Assessment
GDE	Groundwater dependent ecosystems
GIS	Geographic information system
GPS	Global positioning system
IBRA	Interim Biogeographic Regionalisation for Australia
KTP	Key threatening process
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NP&W Act	National Parks and Wildlife Act 1974
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	Plant Community Types
PMST	Protected Matters Search Tool
Proposal	Highview Country Estate Dubbo Regional LGA
SAT	Scat Assessment Technique
SEARS	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SSD	State Significant Development
TAFE	Technical and Further Education Institute
TEC	Threatened Ecological Community
TSPD	Threatened Species Profile Database
VEC	Vulnerable Ecological Community
VIS	Vegetation Information System

Acronym	Definition
WIRES	Wildlife Information, Rescue and Education Services

1 Introduction to the proposal and the assessment team

1.1 Background

AREA Environmental Consultants & Communication (AREA) was commissioned by Rangers Valley Cattle Station Pty Ltd to assess the potential environmental impact associated with application of manure or effluent to proposed additional utilisation areas.

Rangers Valley Cattle Station Pty Ltd wish to expand their beef cattle feedlot known as Rangers Valley Feedlot. As part of the expansion, additional manure and effluent utilisation areas are proposed. This biodiversity and impact assessment will be presented in this Biodiversity Development Assessment Report (BDAR).

Rangers Valley Cattle Station Pty Ltd own and operate an existing beef cattle feedlot, which is located about 28 kilometres north of Glen Innes on the central New England Tablelands, New South Wales.

In 2004, Development Consent (DA-261-8-2002-i) (DIPNR, 2004) was granted to Rangers Valley Cattle Station for the expansion of the Rangers Valley Feedlot from 24,000 head to 50,000 head.

In 2018, Rangers Valley Cattle Station lodged a Development Application (DA-261-8-2002-I MOD 2) with the Department of Planning and Environment (DPE) to modify Development Consent (DA-261-8-2002-I) for the Rangers Valley Feedlot. The Development Application is being assessed as State Significant Development. Development Application (DA-261-8-2002-I MOD 2) is being sought under Section 4.55(1A) of the Environmental Planning and Assessment Act (1974).

The Development Application (DA-261-8-2002-I MOD 2) seeks to modify site layout and staging; incorporate an emergency wet weather manure storage area; amend traffic movement hours; incorporate additional effluent and manure utilisation areas; and modify conditions of consent for the Rangers Valley Feedlot.

AREA was engaged to implement a biodiversity assessment to clarify which areas are native and not native in the proposed manure and effluent utilisation areas in response to OEH's submission to DPE on biodiversity issues.

The proposed feedlot expansion is both designated and integrated development under Part 4 of the *Environmental Planning and Assessment Act 1979*.

This BDAR addresses the environmental assessment requirements of the following legislative frameworks:

- *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).
- *NSW Biodiversity Conservation Act 2016* (BC Act).
- *NSW Local Land Services Act 2013* (LLS Act).
- *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (Veg SEPP).

The purpose of this proposal is to increase the productivity of the land by increasing the nutrients in the soil to support the swift and strong growth of the ground cover. The ground cover in the development site is both native and not native.

Eleven paddocks are the subject of this BDAR. These paddocks are referred to by name in this report (see below). The paddocks are also referred to as two groups – grouped by the type of impact addressed in this report.

- Seven paddocks – proposed **manure utilisation areas** (158.30 hectares)
    - These paddocks are known as Rixons, Back Paddock, Four Mile, Perkins 3, Perkins 4, Top Sugarloaf and Middle Swamp.
- Four paddocks - proposed **effluent utilisation areas** (94.86 hectares).
    - These paddocks are known as Crouches, Show, Old 2 and Old 3.

The manure and effluent are generated at the Rangers Valley Feedlot and are processed on site to develop a product suitable for direct application.

To identify environmental constraints for the proposal, the following survey effort has been completed:

- February 2019 – Two ecologists from AREA conducted surveys over five days. This assessment included a reconnoitre of the proposal to refine the proposed field methods followed by completion of 15 BAM plots (OEH 2016), targeted bat ultrasonic assessment, species credit species transects throughout the development site. The width of the species credit transects reflected the environmental sensitivity and type of impact to the vegetation zone.

The proposal has been assessed under the Biodiversity Assessment Method (BAM) 2017 in two parts.

- Full BAM assessment
    - All areas where native vegetation is present (identified as PCT510)
- Streamlined assessment for paddock trees where the ground cover is a cropped paddock (not native)
    - Old 3 – five living trees and one dead tree
    - Crouches – one dead tree

The BAM paddock tree definition (Appendix 1: BAM) which applies to this assessment is

b) the native vegetation that comprises the groundcover is:

i. Less than 50% of the cover of indigenous species of vegetation. *Groundcover is a cropped paddock of soybean or corn and there is no native vegetation*
ii. Not less than 10% of the area is covered with vegetation (whether dead or alive) *Groundcover was more than 10% as it is a cropped paddock with virtually full growth.*
iii. The assessment is made at the time of year when the proportion of the amount of indigenous vegetation in the area to the amount of non-indigenous vegetation in the area is likely to be at its maximum, *The area is a cropped paddock and indigenous vegetation is unlikely to be there at any time* AND

c) the foliage cover for the tree growth form group is less than 25% of the benchmark for tree cover for the most likely plant community type. *Tree cover benchmark for PCT510 is 47%. Paddock trees in this assessment are in stands of one or two trees and which do not constitute cover of 11.75 percent or more.*

1.2 Report structure

This BDAR documents Stage 1 (assessing biodiversity values) and Stage 2 (Impact assessment to biodiversity values) of the Biodiversity Assessment Method (2017), hereafter 'BAM'.

This BDAR supports a Development Application under Division 4.1, Part 4 of the EP&A Act.

The structure of the report is summarised in Table 1-1.

Table 1-1: Report structure

Section reference	Section heading / BAM requirement	Description
Executive summary	Executive summary	Concise summary of this technical paper and the key findings
viii and ix	Definitions and acronyms	Provides definitions and summarises the acronyms used throughout this report.
1	Introduction to the proposal and the assessment team • Background • Report structure • Project personnel	Description of the proposal. Provides an overview of the assessment objectives, structure of technical report and staff contributing to this document.
Stage 1 BAM document (assessing biodiversity values)		
2	Introduction to the biodiversity assessment • identification of development footprint, including: ○ operation ○ construction indicating clearing associated with temporary construction facilities and infrastructure • general description of development/proposal • sources of information used in the assessment, including reports and spatial data.	Description of the proposal relevant to assessing biodiversity values in the development site. Provides an overview of the assessment objectives and structure of technical report.
3	Landscape features • IBRA bioregions and subregions, NSW landscape region and area (hectares) • native vegetation extent in the buffer area • cleared areas • evidence to support differences between mapped vegetation extent and aerial imagery • rivers and streams classified according to stream order • wetlands within, adjacent to and downstream of the site • connectivity features • areas of geological significance and soil hazard features ○ site context components, including: ○ identification of method applied (i.e. linear or site-based) ○ percent native vegetation cover in the landscape (development site).	Identifies landscape features at the development site footprint.
4	Native vegetation Describes PCTs within the development site, including: • vegetation class • vegetation type • area (hectares) for each vegetation type • species relied upon for identification of vegetation type and relative abundance	Identifies native vegetation extent within the development site, including cleared areas and evidence to support differences between mapped

Section reference	Section heading / BAM requirement	Description

	• justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.12 of the BAM)
	• TEC status (as outlined in Paragraphs 5.2.1.14–5.2.1.15 of the BAM)
	• estimate of percent cleared value of PCT (as outlined in Paragraph)
	Vegetation integrity assessment of the development site, including:
	• mapping vegetation zones (Subsection 5.3.1 of the BAM)
	• patch size (development site and proposal)
	• assessing vegetation integrity using benchmark data (Subsection)
	• survey effort as described in Subsection 5.3.4 (number of plots)
	• determining the vegetation integrity score (Appendix 6 of the BAM):
	  ○ composition condition score
	  ○ structure condition score
	  ○ function condition score
	  ○ vegetation integrity score.
	Where use of local data is proposed:
	• identify relevant vegetation type
	• identify source of information for local benchmark data
	• justify use of local data in preference to database values.
		vegetation extent and aerial imagery.

5	Threatened species Identify ecosystem credit species associated with PCTs in the development site as outlined in Section 6.2, including: • list of species derived • justification for exclusion of any ecosystem credit species predicted above. Identify species credit species on both the development site and the proposal as outlined in Sections 6.3 to 6.5, including: • list of candidate species • justification for inclusions and exclusions based on habitat features • indication of presence based on targeted survey or expert report • details of targeted survey technique, effort, timing and weather • species polygons • biodiversity risk weighting for the species • threatened species survey • additional requirements for wind farm developments. Where use of local data is proposed: • identify relevant species • identify aspect of species data • identify source of information for local data • justify use of local data in preference to database values. Where expert reports are used in place of targeted survey: • identify the relevant species • justify the use of an expert report • indicate and justify the likelihood of presence of the species and information considered in making this assessment • estimate the number of individuals or area of habitat (whichever unit of measurement applies to the species/individual) for the development site or proposal, including a description of how the estimate was made • identify the expert and provide evidence of their expert credentials.	Identifies the list of species and habitat components and their sensitivity classes and risk to development
Stage 2 BAM document - Impact assessment (biodiversity values)		
6	Matters of National Environmental Significance	Provides information of MNES species, populations or communities with potential to be recorded in the proposal.
7	Minimise impacts and nature of impact • Demonstration of efforts to avoid and minimise impact on biodiversity values in accordance with Chapter 8 of BAM (2017). • Assessment of direct and indirect impacts unable to be avoided at the development site in accordance with Sections 9.1 and 9.2 of	Provides information on minimising harm to the environment in the proposal

Section reference	Section heading / BAM requirement	Description
	BAM (2017). The assessment would include but not be limited to: type, frequency, intensity, duration and consequence of impact. • For major projects: details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (Section 9.4 of BAM (2017). • Identification and an assessment of the impacts which are potential serious and irreversible impacts, in accordance with Subsections 10.2.2 for impacts on CEECs and 10.2.3 for threatened species. • Identification of impacts requiring offset in accordance with Section 10.3. Identification of impacts not requiring offset in accordance with Paragraph 10.3.2.2. • Identification of areas not requiring assessment in accordance with Section 10.4.	Provides information on residual harm to the environment in the proposal
8	Mitigation measures	Provides actions to minimise harm to the environment
9	Biodiversity offsets	Identifies if biodiversity offsets have been triggered
10	Conclusions and recommendations • Conclusions • Recommendations	Concise statement of key findings of biodiversity values in the proposal.
11	References	Information sources used

1.3 Project personnel

This assessment was carried out by appropriately qualified and experienced ecologists (refer to Table 1-2Error! Reference source not found.).

Table 1-2: Summary of AREA project teams' qualifications

Name	Position	CV Details	Role in this project
Phillip Cameron	Principal Consultant	• BSc. Major in Biology. Macquarie University • Ass Dip App Sci. University of Queensland • Certified Environmental Practitioner (EIANZ) and practicing member • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117 • NSW OEH Biodiversity Assessment Method Assessor: accreditation number BAAS17082 • NSW OEH Scientific License: 101087 • NSW DPI Ethics Approval 17/459 (3) • Practicing member of the NSW Ecological Consulting Association	Certification. Fieldwork Project Management. Report editing
Addy Watson	Principal Environment and Community Consultant	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW (current) • B. Env. Sc. University of New England. • Diploma Project Management	Fieldwork Report writing
Heidi Kolkert	Principal Ecologist	• PhD candidate (Science) University of New England 2013 to current • BSc. (Hons) and Bachelor of Arts University of Tasmania Graduated 2005 • NSW OEH BioBanking and Bio-certification Assessor TAFE NSW • Practicing member of the NSW Ecological Consulting Association • WHS White Card and Blue Card • Apply First Aid (Medilife), Remote First Aid (St John)	Bat call analysis

STAGE 1 BAM: BIODIVERSITY ASSESSMENT

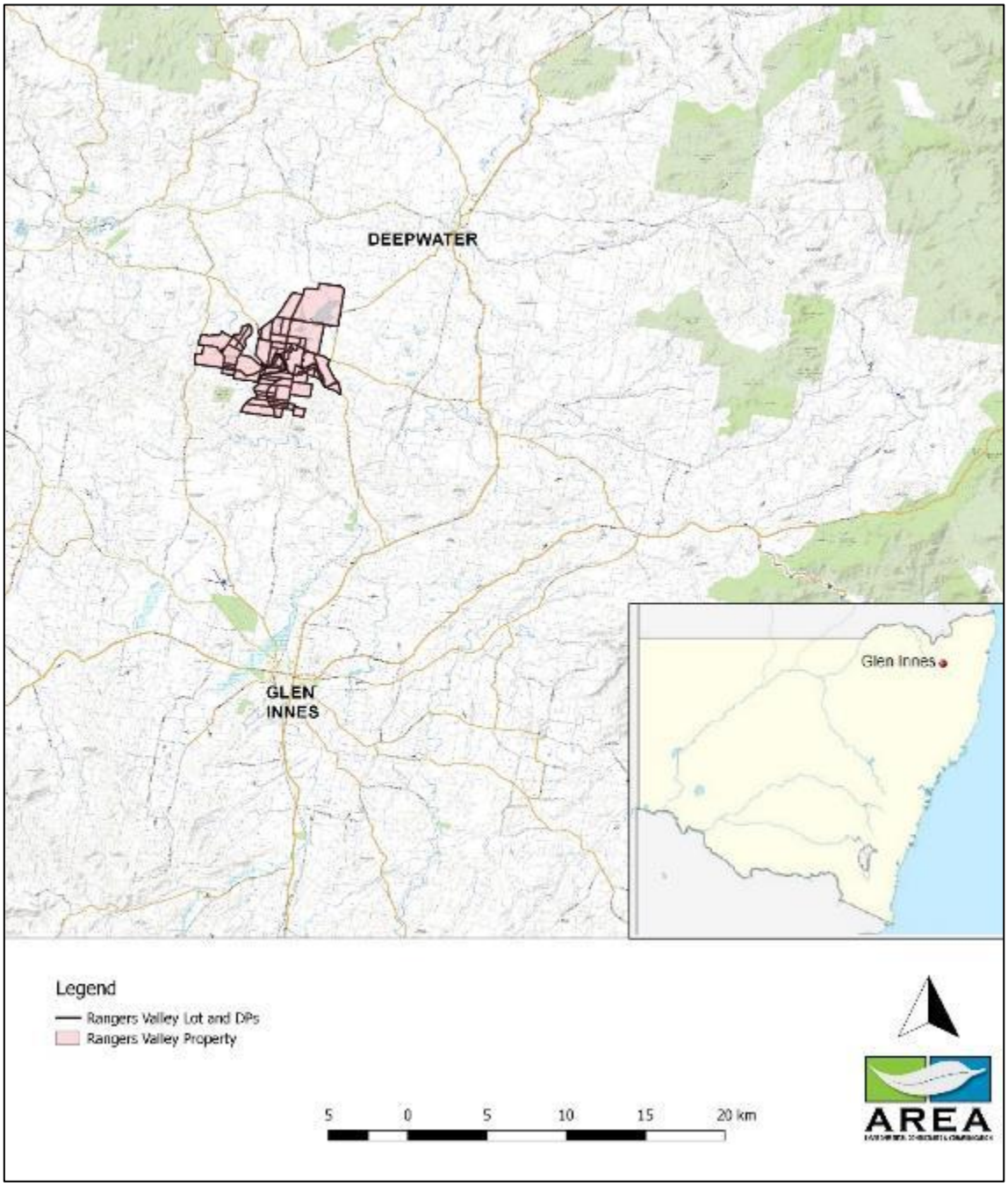
2 Introduction to the biodiversity assessment

This chapter has been prepared in accordance with Chapters 3 and 4 of the BAM.

2.1 Identification of proposal footprint

The proposal affects 253.16 hectares of land on the Rangers Valley property which is owned by Rangers Valley Cattle Station Pty Ltd and is located approximately 28 kilometres north of Glen Innes, NSW (Figure 2-1). Rangers Valley is also a locality based on a pastoral run much larger than the current property.

Figure 2-1: Location of the Rangers Valley property



The development site is eleven paddocks across the Rangers Valley property (Figure 2-2). These are identified as proposed manure utilisation areas and effluent utilisation areas.

The development site falls within the following Lot and DPs (Figure 2-3):

- Lots F, G and H, DP32737
- Lots 1, 2 and 3, DP1111949
- Lots 15, 21 and 24, DP 753278
- Lot 83, DP40605
- Lots 6, 8, 21, 22, 23, 120, DP753291
- Lot A, DP38870
- Lot 1, DP1111657.

Figure 2-2: Location of proposal footprint

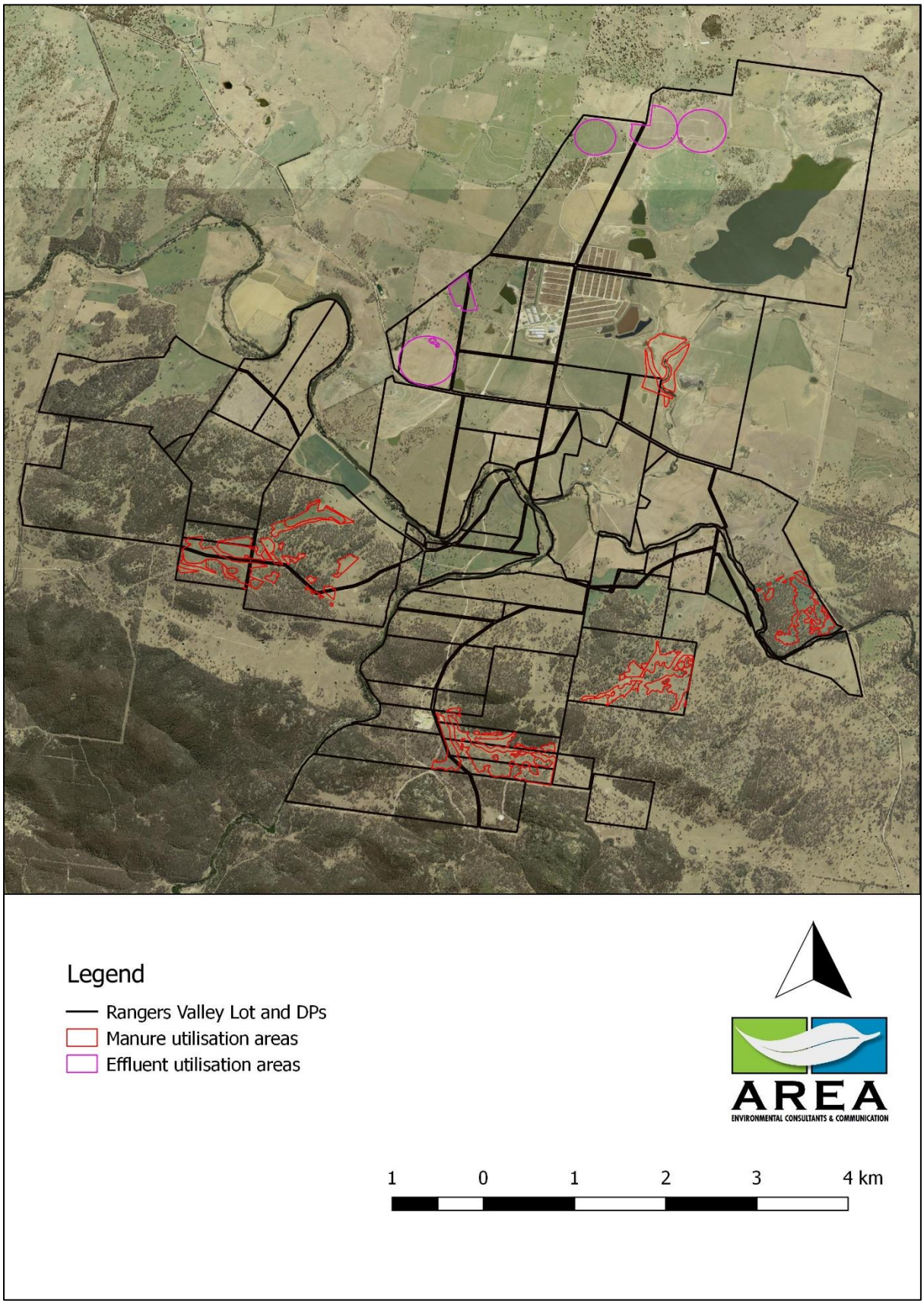
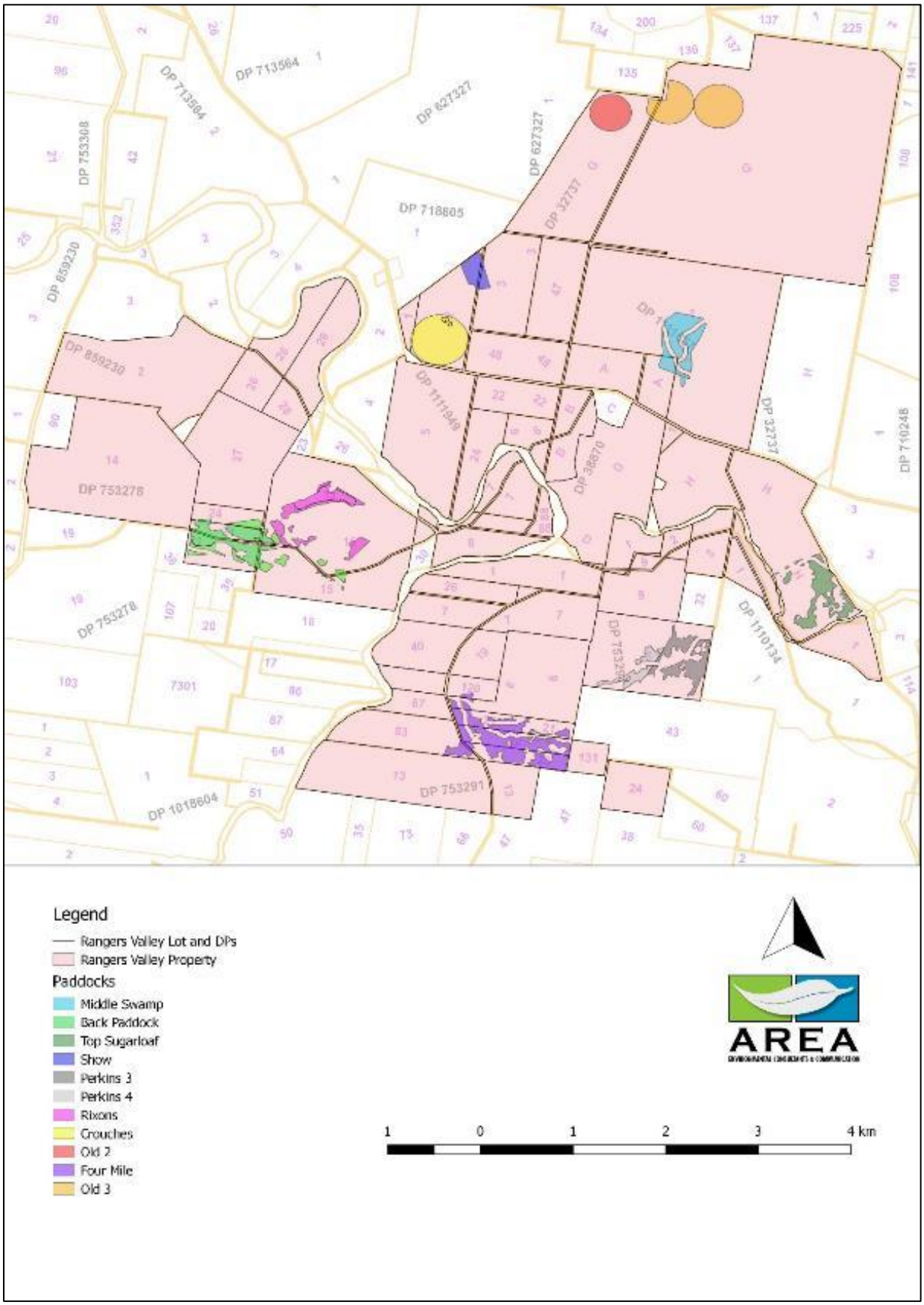


Figure 2-3: Lots and DPs (per Section 4.2 of BAM)



2.1.1 History of disturbance

Rangers Valley was settled by Europeans in 1839. Sheep wool production was the industry developed and the area was renowned for quality wool.

Within six years Rangers Valley had grown to cover an area of 45,000 acres and was stocked with sheep and cattle. Property acquisition and expansion of the operation continued until it was sold in the 1900s.

From the 1900s cattle became the primary stock farmed at Rangers Valley, and a feedlot was established in the 1960s.

Clearing of vegetation has been occurring throughout the region since farming commence, however the Rangers Valley property and surrounding property still support large areas of native forest.

Rangers Valley now consists of around 4856 hectares of grazing and feedlot land. Rangers Valley feedlot is the one of the largest in Australia, having a capacity of around 32,000 cattle.

2.1.2 The regional context of the development site

The regional context of the development site is provided in Table 2-1.

Table 2-1: Regional context of the proposal

Attribute	Response
Interim Biogeographic Regionalisation for Australia (IBRA Region)	New England Tablelands Bioregion. Deepwater Downs subregion and Severn River Volcanics subregion (**Figure 2-4**)
State	New South Wales
Topographical map sheet	Glen Innes (9237) / Clive (9239)
Local Government Area	Glen Innes Severn LGA
Nearest town / locality	Glen Innes (**Figure 2-1**)
Accessed from nearest town by	Yarraford Road, Rangers Valley Road and New England Highway
Lot and Development Portion of the proposal	18 Lots within 7 DPs – See section 2.1(**Figure 2-3)**.
Land use / disturbance	See section 2.11.
Nearest drainage line (Name, Strahler Order)	The Severn River and Beardy Waters both run across the property between development site. The run closest to the Top Sugarloaf paddock, running approximately 50 metres from the proposal. There are also numerous minor watercourses and drainage lines across the property.
Spot point Australian Height Datum (AHD)	900 - 1000 m..
Surrounding land use	Grazing agriculture**.**

Regional context is depicted in Figure 2-4, Figure 2-5 and Figure 2-6. Images of each paddock are provided in section 2.1.3 as Figure 2-7 to Figure 2-13.

Figure 2-4: LGA and IBRA subregions

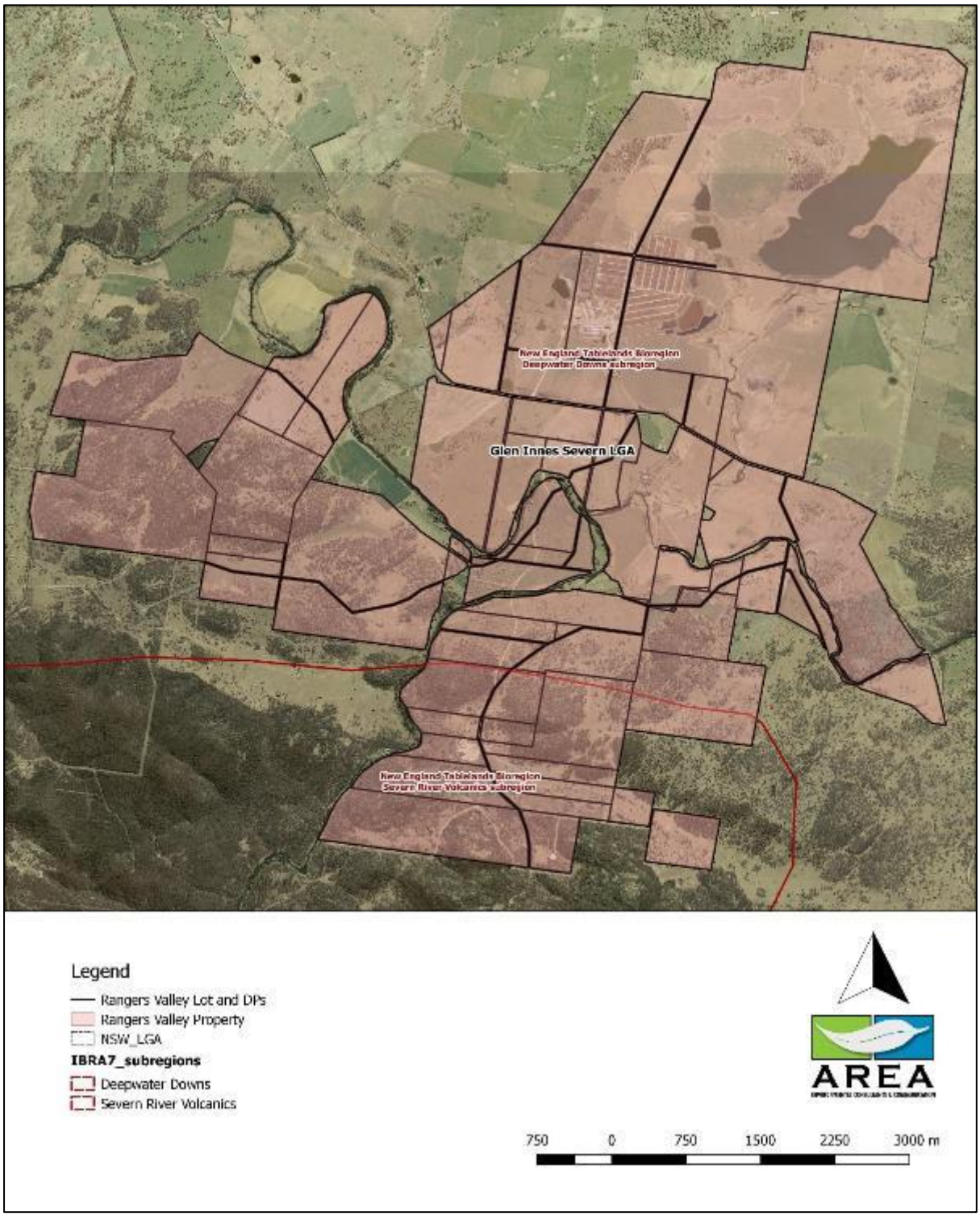


Figure 2-5: Aerial location map of Rangers Valley property (per Section 4.2 of BAM)

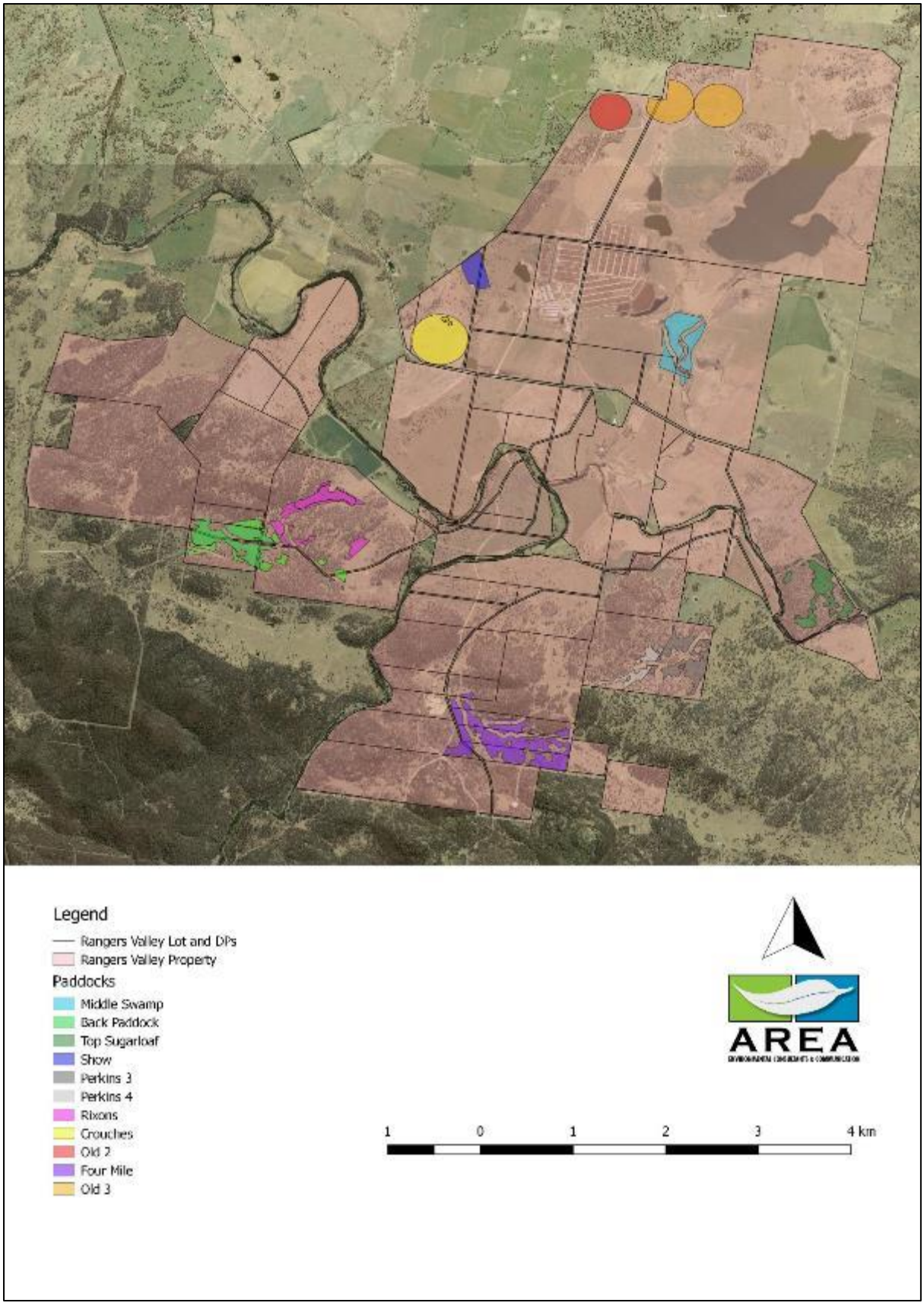
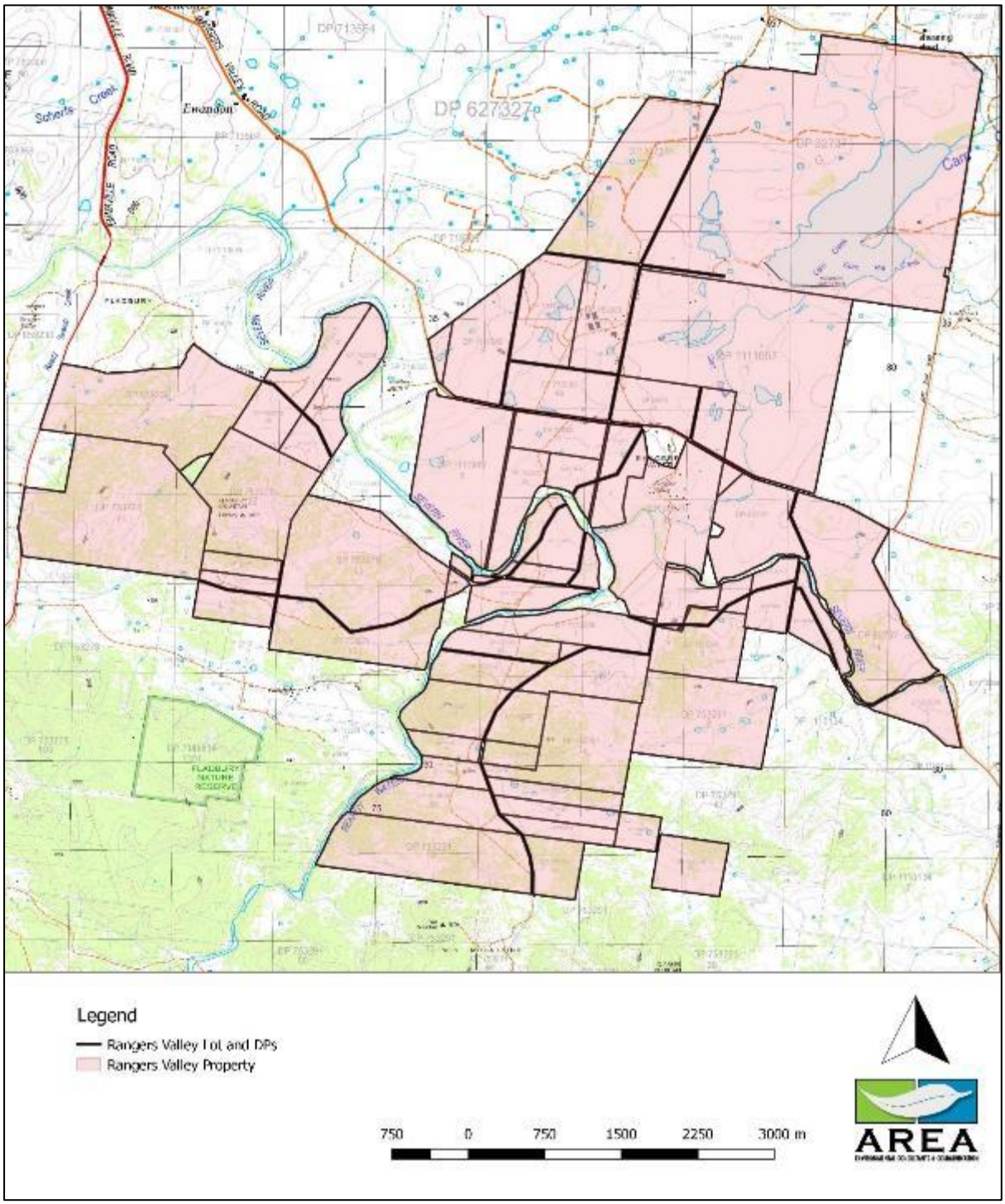

Legend
Rangers Valley Lot and DPs
Rangers Valley Property
Paddocks
Middle Swamp
Back Paddock
Top Sugarloaf
Show
Perkins 3
Perkins 4
Rixons
Crouches
Old 2
Four Mile
Old 3
AREA
1 0 1 2 3 4 km

Figure 2-6: Topographic location map of the Rangers Valley property (per Section 4.2 of BAM)



2.1.3 Development footprint

The development footprint is all the area assessed by this report and is the development site. This is a total of 253.16 hectares (183.33 hectares of native vegetation and 69.83 hectares of not native vegetation).

The areas occupied by this development site are summarised in Table 2-2.

Table 2-2 Development sites

Paddock name	Proposed utilisation	Total (hectares)	Native or Not native
Rixons	Manure	19.86	Native
Back Paddock	Manure	33.02	Native
Four Mile	Manure	42.71	Native
Perkins 3	Manure	17.01	Native
Perkins 4	Manure	7.67	Native
Top Sugarloaf	Manure	17.33	Native
Middle Swamp	Manure	20.69	Native
Old 2	Effluent	15.89	Native
Old 3	Effluent	40.25	Not Native Five living and one dead paddock tree
Show	Effluent	8.55	Native
Crouches	Effluent	0.59	Native
		29.58	Not Native One dead paddock tree
Total		253.16	

Figure 2-7: Proposal detail. Old 2 (area on left) and Old 3 (two areas on right)

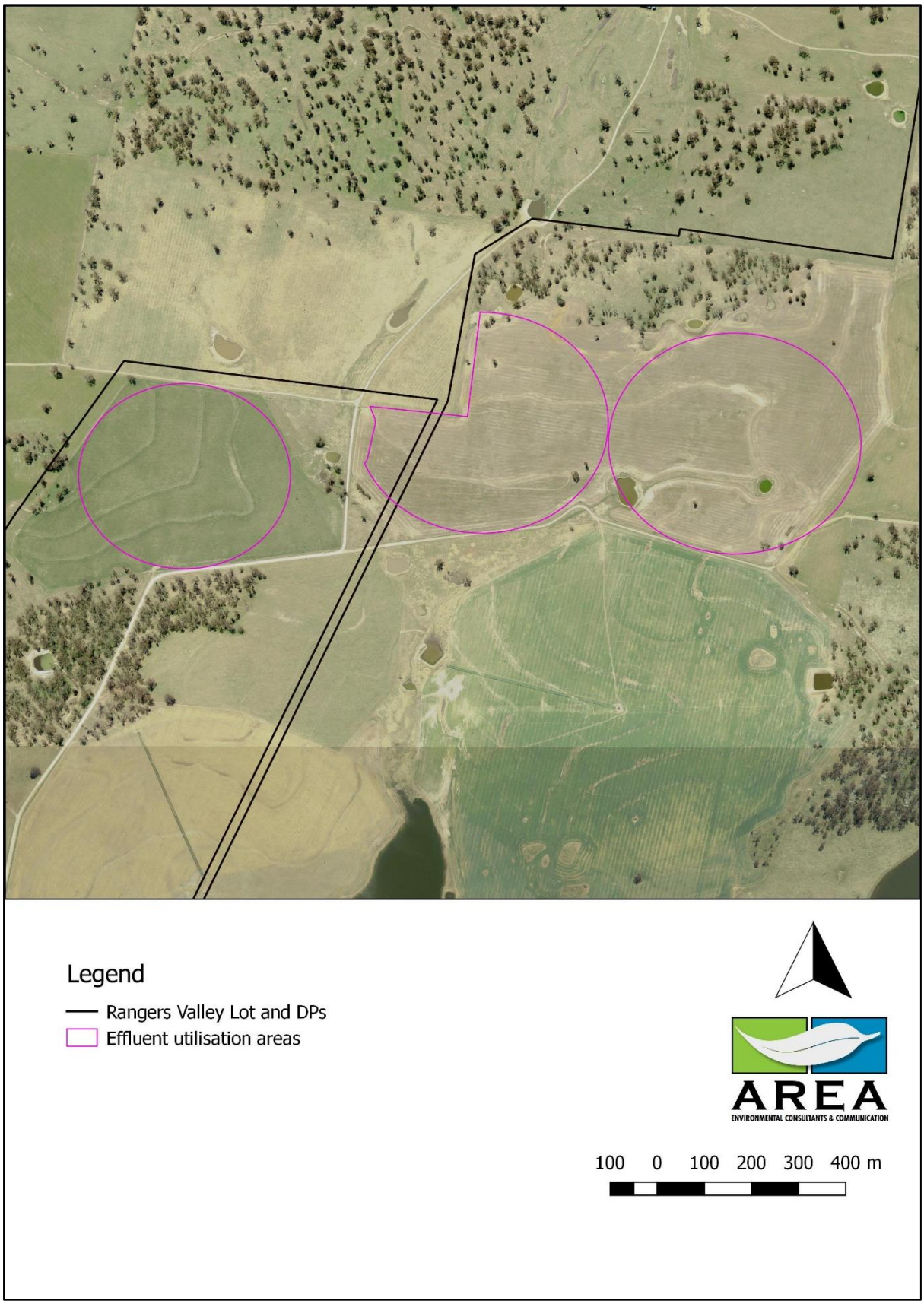


Figure 2-8: Proposal detail. Crouches (lower area with patch of PCT510 indicated) and Show (upper area)

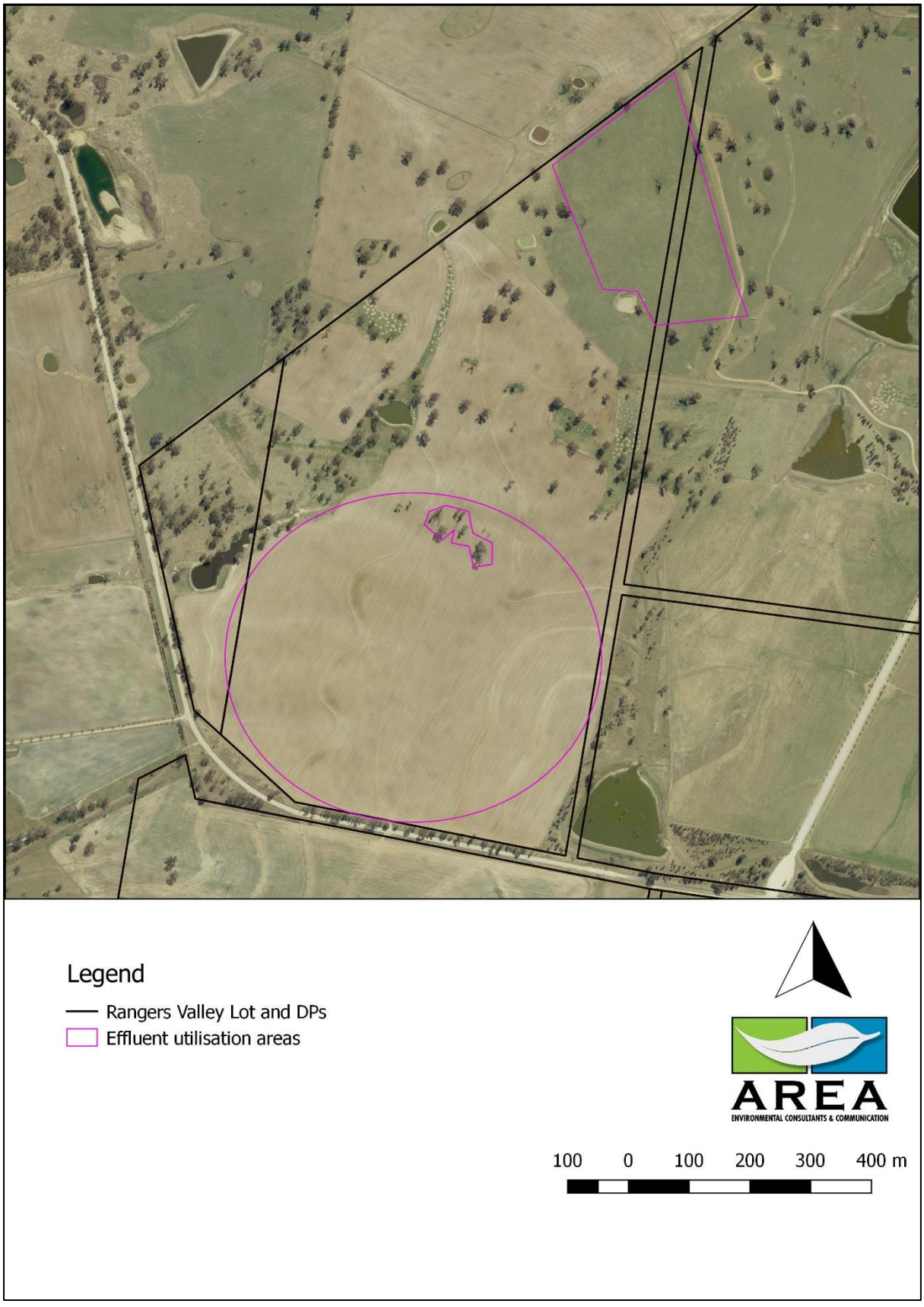


Figure 2-9: Proposal detail. Rixons and Back Paddock

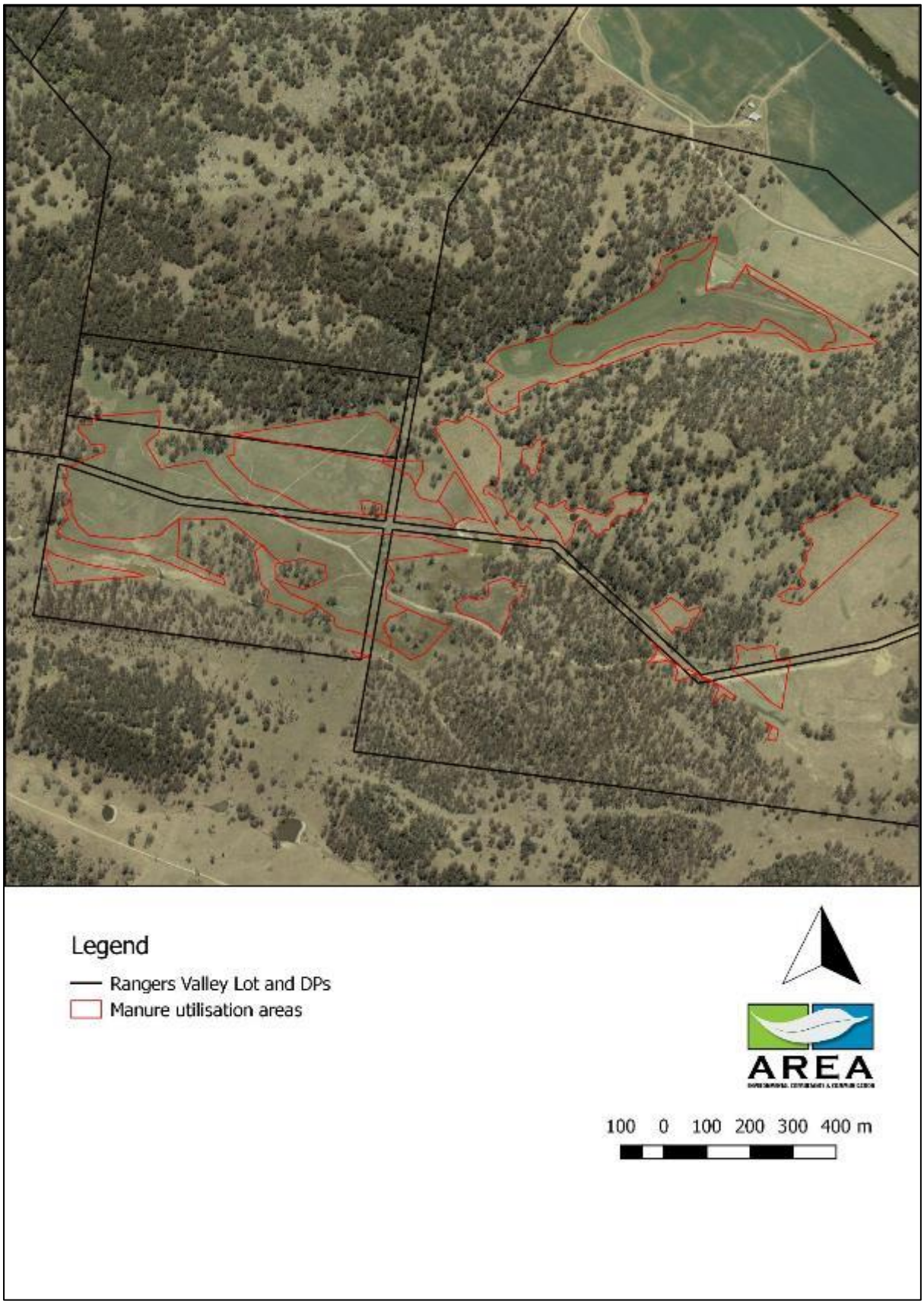


Figure 2-10: Proposal detail. Four Mile

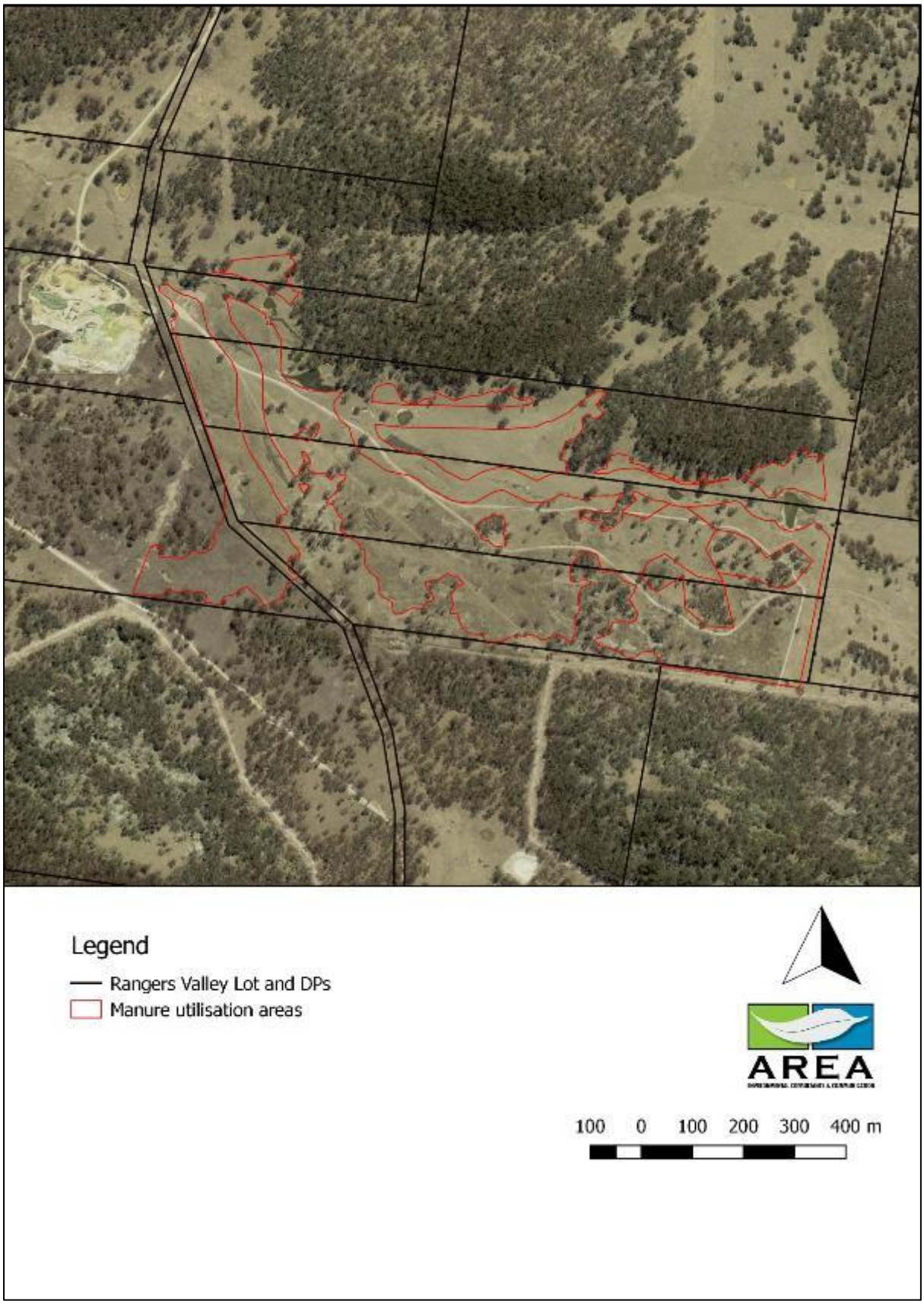


Figure 2-11: Proposal detail. Perkins 3 and Perkins 4.

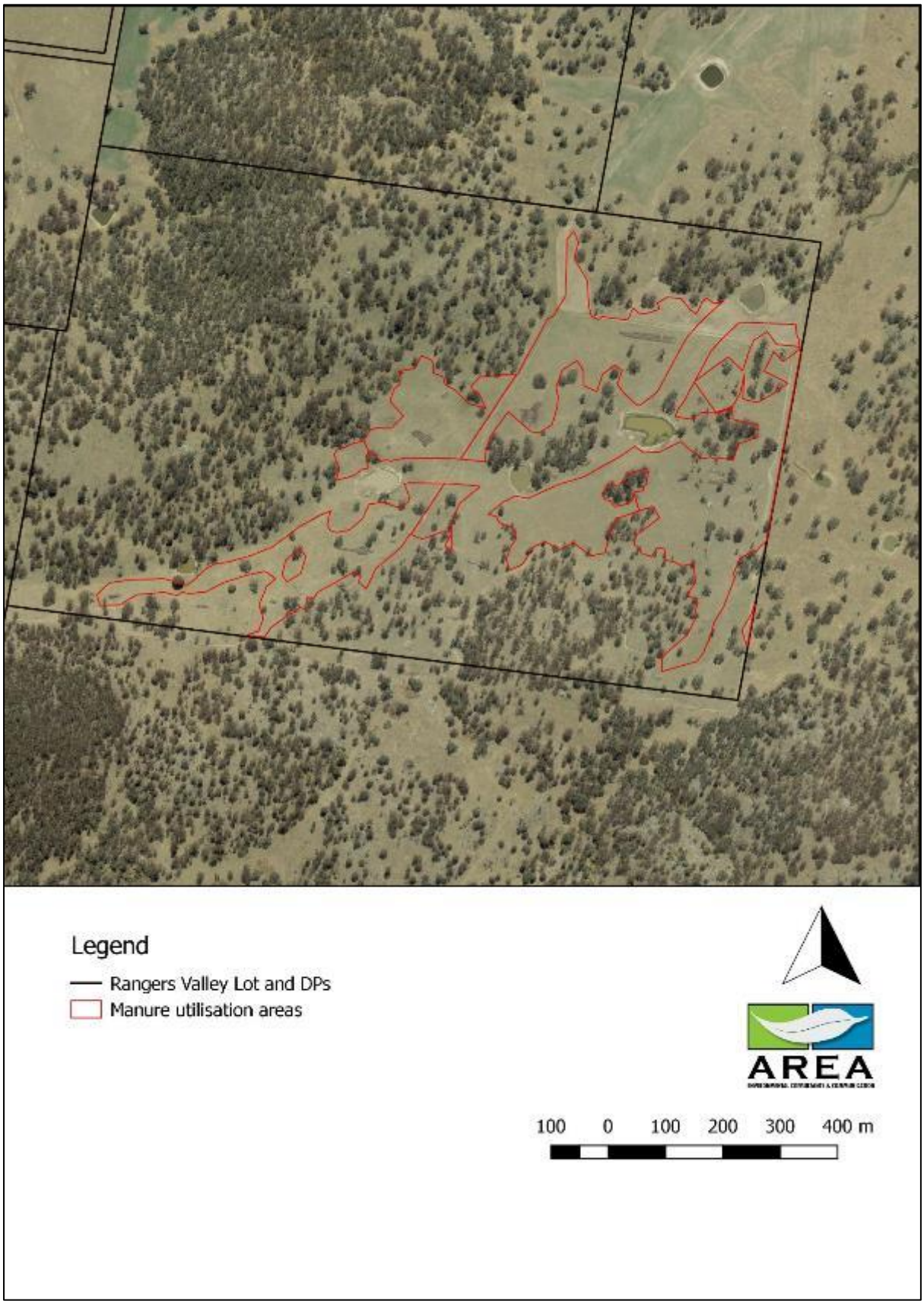


Figure 2-12: Proposal detail. Top Paddock

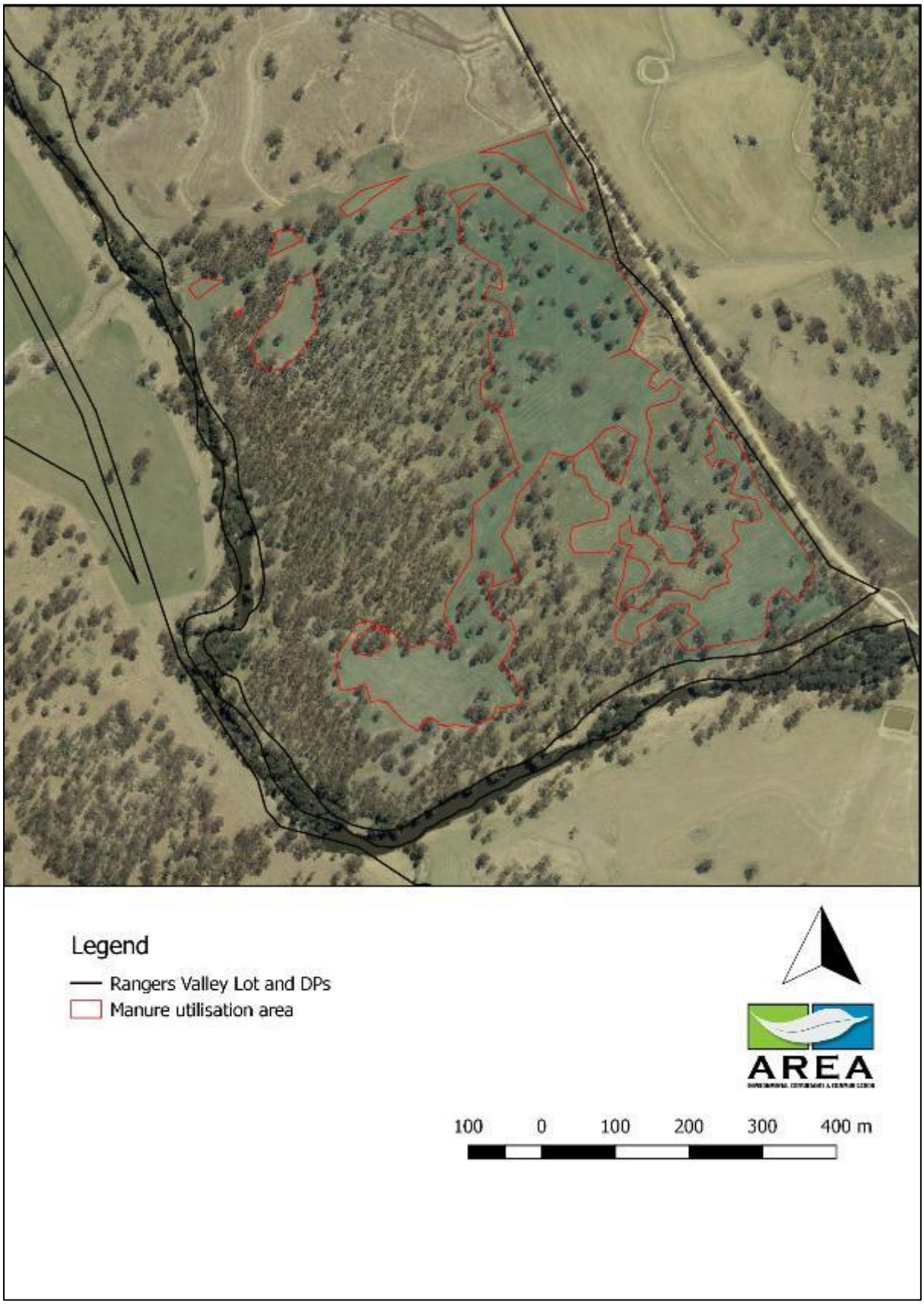
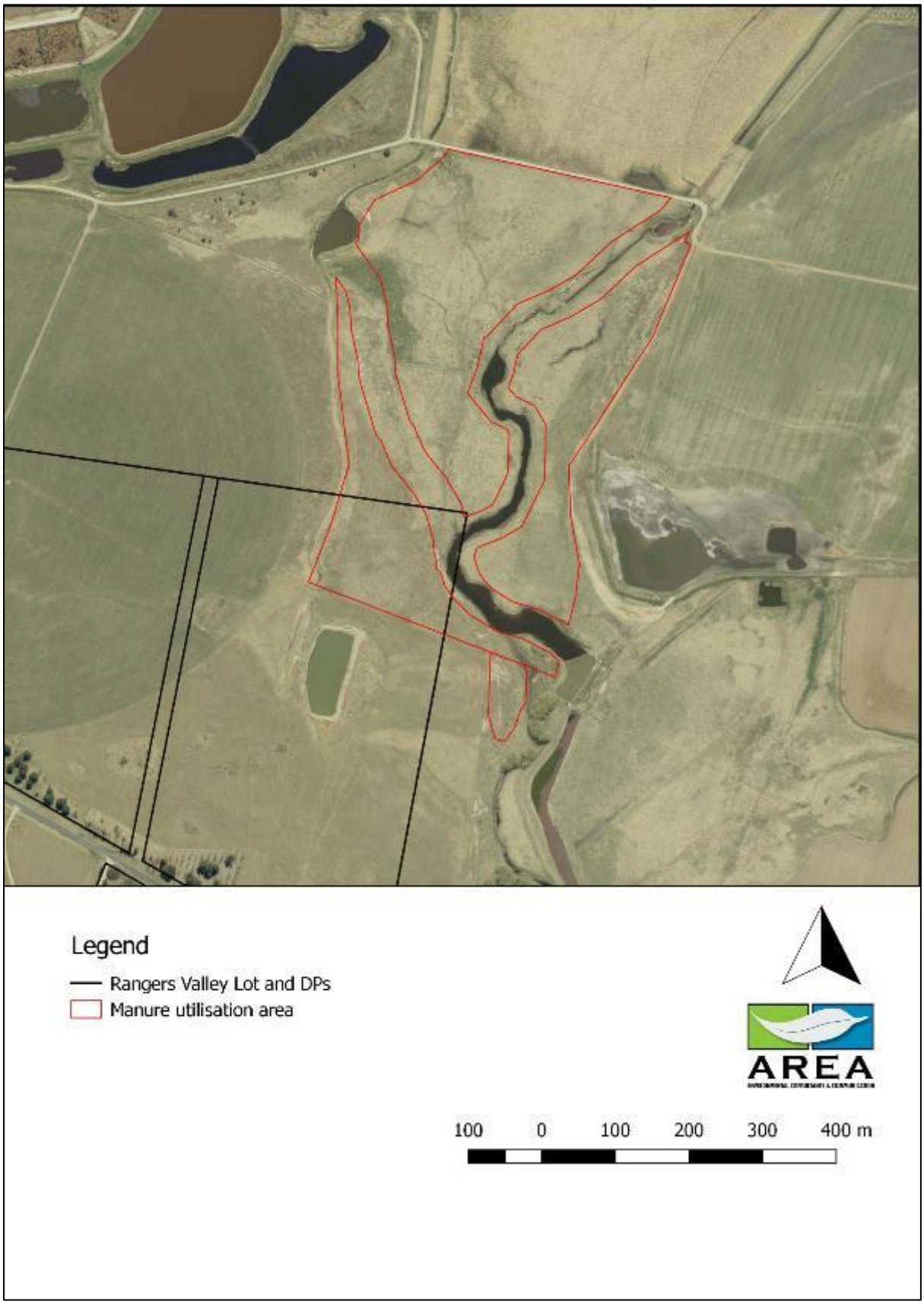


Figure 2-13: Proposal detail. Middle Swamp.



2.2 General description of the proposal

The proposal will allow manure to be applied to seven paddocks and the effluent to be applied to four paddocks via centre pivot or other irrigation systems. This proposal aim is to increase the productivity of the land, increasing ground cover and growth. The definition of manure and effluent is outlined below.

Currently, improved pasture and crops are grown in the proposed manure and effluent utilisation areas. Inorganic fertilisers are applied to pasture and crops as required. No manure or effluent is currently applied to these paddocks.

Manure application

Manure is harvested from the production pens every 8-10 weeks, taken to the manure stockpile area, the manure is screened to remove gravel and breakdown large clumps and placed into windrows. Windrows may remain for up to 12 months in the stockpile area over which time the manure ages and breaks down further. Aged manure is taken to the manure utilisation area on an as-required basis in line with cropping program and weather conditions and spread on the utilisation area with a tractor drawn manure spreader prior to incorporation into the soil if crops are to be grown or directly onto pasture.

Effluent application

Stormwater runoff from the controlled drainage areas of the development (production/hospital/induction pens, cattle washing, cattle handling facility, solid waste stockpile, roads etc) is termed effluent and is directed towards a sedimentation basin. The effluent is temporarily held in a sedimentation basin where most of the sediment entrained in the runoff settles out. The effluent then flows to holding pond(s) where it is temporarily held pending irrigation to land when weather conditions permit. Effluent may be held in the holding ponds for weeks to months depending on volume of effluent generated, cropping program etc. Effluent is applied to land with a low pressure overhead centre pivot irrigator or similar system.

In proposed manure utilisation areas, no trees or other vegetation will be cleared. Manure utilisation areas have been selected to avoid areas of dense trees, steep and significantly rocky areas.

All native vegetation within the proposed effluent utilisation areas will be removed to enable centre pivot or other irrigator to travel across the paddocks. Effluent utilisation areas have been designed to avoid tree removal as much as possible. A total of 25.03 hectares of PCT510 and seven paddock trees will be removed by this proposal:

Crouches
- 0.59 hectares of PCT510
- **One dead paddock tree** (20 – 50 centimetres Diameter at Breast Height (DBH), with a hollow <20 centimetres diameter)

Show
- 8.55 hectares of PCT510

Old 2
- 15.89 hectares of PCT510

Old 3
- **Five living paddock trees** to be removed
  - One *Eucalyptus caliginosa* (20 – 50 centimetres DBH, with hollow <20 centimetres)
  - One *Eucalyptus bridgesiana* (>50 DBH, Hollow >20 centimetres)

    - Three *Eucalyptus melliodora* (two 20 – 50 centimetres DBH and one >50 centimetres DBH, all with hollows <20 centimetres diameter)
  - **One dead paddock tree** to be removed (>50 centimetres DBH with hollow <20 centimetres diameter)

Access roads to the proposal already exist and no additional work on these are required for the proposal.

Application of manure and effluent will be done so to avoid impact to sensitive areas such as waterways in accordance with Rangers Valley feedlot's POEO licence conditions.

Areas of native vegetation were mapped as part of the biodiversity assessment process.

Vegetation Zones are allocated based on a measurement of ground cover quality (percent native cover of total living ground cover):

- Zone 1 – Areas with more than 50 percent native ground cover
  - Manure utilisation areas - no tree removal required
- Zone 2 – Areas with between zero and 50 percent native ground cover.
  - Manure utilisation areas – no tree removal required
  - Effluent utilisation areas - removal of 24.44 hectares native vegetation
- Zone 3 – Areas with zero percent native ground cover - current cropped paddock
  - Effluent utilisation areas - removal of five living paddock trees and two dead paddock trees
- Zone 4 – Area with zero native ground cover - current cropped paddock
  - Effluent utilisation area – removal of 0.59 hectare patch of living trees (12 trees)

Examples of these zones are provided in Plate 2-1 and Plate 2-4.

Plate 2-1: Example of Zone 1 - proposed manure utilisation area (Rixons)

Plate 2-2: Example of Zone 2 - proposed manure utilisation area (Perkins 3). Note manure utilisation areas avoid stands of trees.

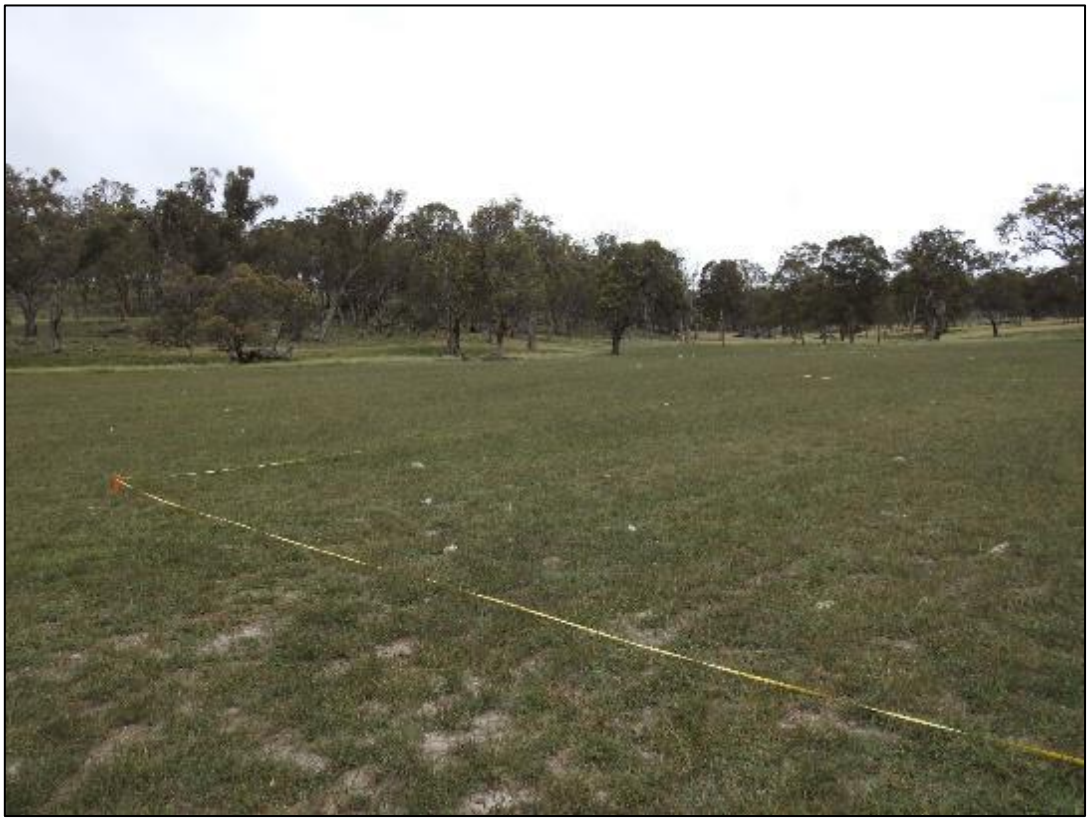


Plate 2-3: Example of Zone 3 - proposed effluent utilisation area with paddock trees only (Soybean crop - Old 3)

Plate 2-4: Example of Zone 4 (patch of trees) surrounded by Zone 3 (corn crop) - proposed effluent utilisation area (Crouches)

2.3 Sources of information used in the assessment, including reports and spatial data.

Information used to inform this BDAR has been provided in the following sections of this report and in Table 2-3 and Table 2-4.

2.3.1 Spatial data

Table 2-3: Spatial data used in this report

GIS layer name	Reference
IBRA bioregions and subregion	NSW data porthole
NSW landscape regions	Mitchell Landscapes V3
Rivers and streams	Six Viewer / SEED WMS topographic layer
Wetlands	Directory of Important Wetlands
Waterways	Waterways_NSW_Final
Key Fish Habitat	DPI Key Fish Habitat GIS layer
Connectivity of different areas of habitat	Namoi VIS 4467 veg map and Six Viewer
Native vegetation extent	Namoi VIS 4467 veg map and Six Viewer

2.3.2 Web sites (and links to documents)

The resources in Table 2-4 were reviewed for Stage 1 of this BDAR:

Table 2-4: Web sites and links to documents used in this report

Title	Web address
Legislation	
Commonwealth Environment Protection & Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/~/view/act/2016/63
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Local Land Services Act 2013	https://www.legislation.nsw.gov.au/~/view/act/2013/51
Biodiversity	
Biodiversity Assessment Methodology (OEH, 2017)	http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm
BAM Credit Calculator	http://www.environment.nsw.gov.au/biobanking/calculator.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Survey requirements (birds, bats, reptiles, frogs, fish and mammals) for species listed under the EPBC Act	http://www.environment.gov.au/topics/environmentprotection/environment-assessments.
Guide to Surveying Threatened Plants (OEH, 2015)	http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf
Threatened biodiversity profile search	http://www.environment.nsw.gov.au/threatenedspeciesapp/
NSW BioNet	http://www.bionet.nsw.gov.au/
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase. htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org.au/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance	http://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip .htm

2.3.3 Reports and books

The following articles were reviewed to inform decisions of the impact of applying inorganic fertiliser to native grasses

1. Campbell M. H., Bowman A. M., Bellotti W. D., Munich D. J. & Nicol H. I. (1996). Recruitment of curly Mitchell grass (Astrebla lappacea) in North-Western New South Wales. *The Rangeland Journal* **18**, 179-87.
2. Carr D. B. (2014). Expert advice regarding EPBC Act-listed Natural Grasslands on alluvial basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland, in relation to the alleged clearing of native vegetation on a property located near Moree, NSW. Stringybark Ecological, Armidale, NSW.
3. Clarke P. J. (2003). Composition of grazed and cleared temperate grassy woodlands in eastern Australia: patterns in space and inferences in time. *Journal of Vegetation Science* **14**, 5-14.
4. Clarke P., Gardener M., Nano C. & Whalley R. (1998). *The vegetation and plant species of Kirramingly*. Division of Botany, University of New England, Armidale, NSW.
5. Cunningham, G., Mulham, W., Milthorpe, P., & Leigh, J. (1992). *Plants of Western New South Wales*. Collingwood, VIC: CSIRO Publishing.

6. Eco Logical Australia. (2006). A Review of Vegetation Types in the PVP-Developer for the Border Rivers/Gwydir, Central West, Lachlan, Lower Murray Darling, Namoi and Northern Rivers Catchment Management Authority Areas. Report No. 21- 09. Ecological Australia Pty Ltd.
7. Gibson-Roy P., Delpratt J. & Moore G. (2007). Restoring the Victorian western (Basalt) Plains grassland 2, Field emergence, establishment and recruitment following direct seeding. *Ecological Management & Restoration* **8**, 123-32.
8. Good M.K, Price J.N, Clarke P and Reid N, (2011) Densely regenerating coolibah (Eucalyptus coolabah) woodlands are more species-rich than surrounding derived grasslands in floodplains of eastern Australia. Australian Journal of Botany, 2011, **59**, 468–479.
9. Harden, G. (1990-2002). *Flora of New South Wales* (Vols. 1 (Revised Ed.), 2 (Revised Ed.), 3 and 4). Sydney: New South Wales University Press.
10. Hunter J. & Earl J. (1999). *Floristics descriptions of grasslands on the Moree Plains*. Report to the NSW National Parks and Wildlife Service and the Department of Land and Water.
11. King A. and Buckney R. (2002) Invasion of exotic plants in nutrient-enriched urban bushland. Department of Environmental Sciences, University of Technology Sydney, NSW.
12. Lewis T. (2006). Management for conservation of plant diversity in native grasslands of the Moree Plains, NSW. PhD Thesis. University of New England, Armidale, NSW.
13. Lewis T., Clarke P. J., Reid N. & Whalley R. D. B. (2008). Perennial grassland dynamics on fertile plains: Is co-existence mediated by disturbance? *Austral Ecology* 33, 128-39.
14. Lewis T., Reid N., Clarke P. J. & Whalley R. D. B. (2010). Resilience of high-conservation- value, semi-arid grassland on fertile clay soils to burning, mowing and ploughing. *Austral Ecology* ***35***, 464-81.
15. Lodge G. M. & Roberts E. A. (1979). The effects of phosphorous, sulphur and stocking rate on the yield, chemical and botanical composition of natural pastures. *Australian Journal of Experimental Agriculture and Animal Husbandry* ***19***, 698-705.
16. Lodge G. M. & Whalley R. D. B. (1981). Establishment of Warm- and Cool-season native perennial grasses on the North-West Slopes of new South Wales. I. Dormancy and germination. *Australian Journal of Botany* ***29***, 111-9.
17. Lodge G. M. & Whalley R. D. B. (1985). The manipulation of species composition of natural pastures by grazing management on the northern slopes of New South Wales. *Australian Rangelands Journal* ***7***, 6-16.Mitchell. (2002).
18. McGufficke B. R. (2003). Native Grassland Management: A botanical study of two native grassland management options on a commercial cattle property. *Rangelands Journal* **25**, 37-46.
19. McIntyre S. & Lavorel S. (1994). How environmental and disturbance factors influence species composition in temperate Australian grasslands. *Journal of vegetation Science* **5**, 373-84.
20. McIntyre S. & Martin T. G. (2002). Managing intensive and extensive land uses to conserve grassland plants in sub-tropical eucalypt woodlands. *Biological Conservation* **107**, 241-52.
21. McIvor J. G. (2001). Pasture management in semi-arid tropical woodlands: regeneration of degraded pastures protected from grazing. *Australian Journal of Experimental Agriculture* **41**, 487-96.
22. Nadolny C., Hunter J. & Hawes W. (2010). *Native Grassy Vegetation in the Border Rivers- Gwydir Catchment: diversity, distribution, use and management*. Report to the Border Rivers-Gwydir Catchment Management Authority.
23. Nadolny C. & Lemon J. (2004). Re-colonisation patterns of native plants in cultivation paddocks at Gunnedah, NSW. In: *19th Annual Conference of the Grassland Society of NSW* (ed S. Boschma). Grassland Society of NSW Inc., Tamworth, NSW.

24. Natural Resources Commission. (2013). Listing Yellow Mimosa (*Vachellia farnesiana*) as a feral native species: Recommendations. Natural Resources Commission., Sydney, NSW.
25. Waters C., Whalley R. D. B. & Huxtable C. (2000). Grassed Up: Guidelines for revegetating with Australian native grasses. NSW Agriculture.
26. Wiedemann, S., 2019, *Assessment of Biodiversity Impacts Associated with Proposed Manure Application at Rangers Valley Cattle Station*, Unpublished.

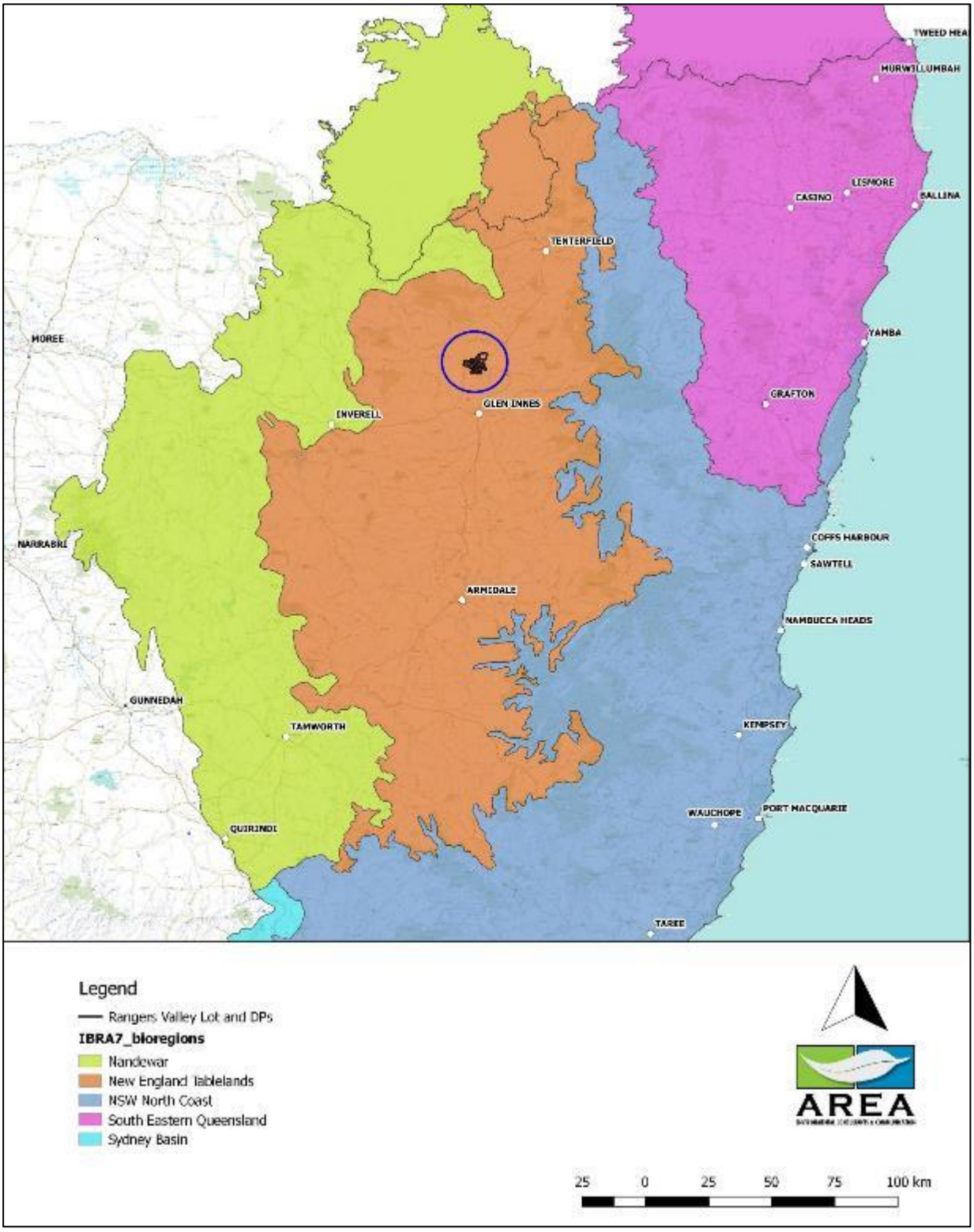
3 Landscape features

Landscape features of the development site are provided in Table 3-1.

Table 3-1: Landscape features of the proposal

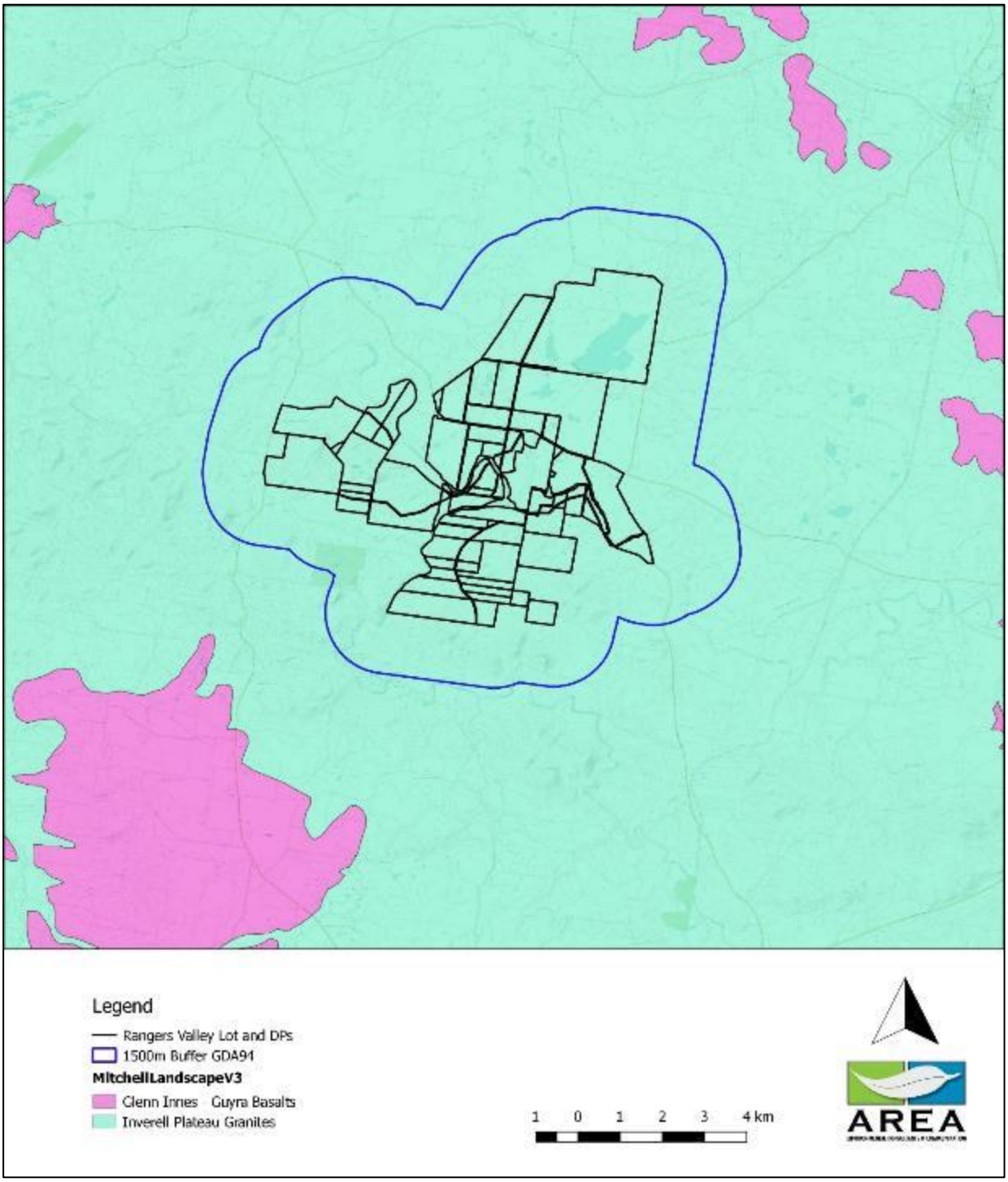
Landscape feature	BAM reference	Response
IBRA bioregions and subregions See figure below and Figure 2.2.	IBRA bioregions and subregions (as described in Paragraphs 4.2.1.3–4.2.1.4)	The New England Tableland Bioregion has an area of 3,004,202 hectares of which 2,860,758 hectares or 95.23 per cent of the bioregion lies within NSW. This bioregion is one of the smaller bioregions in NSW, occupying 3.57 per cent of the state. The bioregion lies between the North Coast and Nandewar bioregions in north-east NSW, extending north just into Queensland. In NSW, the bioregional boundary extends from north of Tenterfield to south of Walcha and includes towns such as Armidale and Guyra, with Inverell just outside the boundary. The bioregion includes parts of the MacIntyre, Clarence, Gwydir, Macleay, Namoi and Manning River catchments. https://www.environment.nsw.gov.au/bioregions/NewEnglandTablelandBioregion.htm The development site is within the Deepwater Downs and Severn River Volcanics subregions. **Overview of the Deepwater Downs Subregion** (Source: OEH https://www.environment.nsw.gov.au/bioregions/NewEnglandTableland-Subregions.htm) **Geology** Permian diorite, acid volcanics and small areas of shales. **Characteristic landforms** Hilly to undulating with broad valleys, elevation 950 m. **Typical soils** Harsh red and yellow texture contrast soils with thin gritty topsoils. **Vegetation** Woodland of Blakely's red gum, apple box, New England stringybark, narrow-leaved peppermint, New England peppermint, rough-barked apple and bull oak. **Overview of the Severn River Volcanics Subregion** (Source: OEH https://www.environment.nsw.gov.au/bioregions/NewEnglandTableland-Subregions.htm) **Geology** Permian mixed volcanics and fine sedimentary rock. Granite intrusions and ridge top patches of Tertiary basalt with underlying sand and gravel. **Characteristic landforms** Undulating to hilly and rugged, elevation range 600 -1200 m. Well developed dendritic drainage with rocky gorges. Rock outcrop common on steep slopes.. **Typical soils** Shallow stony sandy loams on steep slopes, harsh texture contrast soils with gritty topsoils common, structured brown loams on small areas of basalt. Some evidence of salinity. **Vegetation** Low western slopes; woodland or heath of orange gum, Caley's ironbark, tumbledown gum, and black cypress pine. Woodlands and forest of red stringybark, western New England blackbutt, narrow-leaved ironbark, white box, yellow box and rough-barked apple. Highest eastern slopes; open forest of New England stringybark, Tenterfield wollybutt, yellow box, narrow-leaved ironbark, apple box, Blakely's red gum with orange gum in rocky outcrops.

Landscape feature	BAM reference	Response



Landscape feature	BAM reference	Response
NSW landscapes region and area (hectares). See figure below.	Sections 4.2 and 4.3, Appendix 3 NSW landscape regions (as described in Paragraph 4.2.1.5)	The proposal and the associated patches of native vegetation are entirely within the Inverell Plateau Granites Mitchell Landscapes. Widely distributed and defined undulating plateau with domed peaks on Permian New England granites and granodiorites. Several intrusions have distinctive contact ridges of metamorphosed sedimentary rocks. The area includes Permian acid volcanics and pyroclastics and some undifferentiated Permo-Carboniferous mudstone and lithic sandstone. General elevation 900 to 1500m, local relief 200m. The highest elevations are along the eastern edge above the Great escarpment, most of the plateau lies ate 900 to 1200m. As mapped this is a large landscape and it might require subdivision on the basis of vegetation. Domed rock outcrop is common with tors. Shallow gritty loam thickens downs lope to red or yellow earthy sand and red, red-yellow and yellow texture-contrast soil on lower slopes and valley floors. Wide valleys may have deep dark clay deposits in swampy streamlines. The vegetation varies with topography, soil, drainage and temperature. In dry areas open forest of; silvertop stringybark (Eucalyptus laevopinea), broad-leaved stringybark (Eucalyptus caliginosa), Blakely's red gum (Eucalyptus blakelyii), narrow-leaved peppermint (Eucalyptus radiata), yellow box (Eucalyptus melliodora), apple box (Eucalyptus bridgesiana), red ironbark (Eucalyptus sideroxylon), Caley's ironbark (Eucalyptus caleyi), rough-barked apple (Angophora floribunda) and black cypress pine (Callitris endlicheri). In moist areas open forest of; New England peppermint (Eucalyptus cinerea), manna gum (Eucalyptus viminalis), mountain gum (Eucalyptus dalrympleana), New England blackbutt (Eucalyptus andrewsii ssp. campanulata), diehard stringybark (Eucalyptus cameronii), Deane's gum (Eucalyptus deanei), messmate (Eucalyptus obliqua), privet-leaved stringybark (Eucalyptus ligustrina), Youman's stringybark (Eucalyptus youmanii), swamp gum (Eucalyptus camphora), Gibraltar rock blackbutt (Eucalyptus pyrocarpa), tumbledown red gum (Eucalyptus dealbata) and orange gum (Eucalyptus prava) sometimes with closed forest species in the understorey especially in the eastern parts of the landscape. In cold areas snow gum (Eucalyptus pauciflora), black sallee (Eucalyptus stellulata) woodlands are the norm with manna gum and mountain gum along some streams. Most granite peaks have specialised joint crevice heath communities typically with about 100 plant genera and almost always containing local endemic species. In this landscape the following communities are recognised; Gonocarpus teucriodes - Isotoma axillaris herbfield with black cypress pine, orange gum, tumbledown red gum, Caley's ironbark, and western New England blackbutt. Babingtonia densifolia - Homoranthus prolixus shrubland with black cypress pine, orange gum, tumbledown red gum, and Acacia neriifolia. New England tea tree - Brachyloma saxicola heath on the escarpment of the Gibraltar Range with New England mallee ash (Eucalyptus approximans), diehard stringybark, apple box, forest oak (Allocasuarina torulosa), black cypress pine and orange gum.

Landscape feature	BAM reference	Response

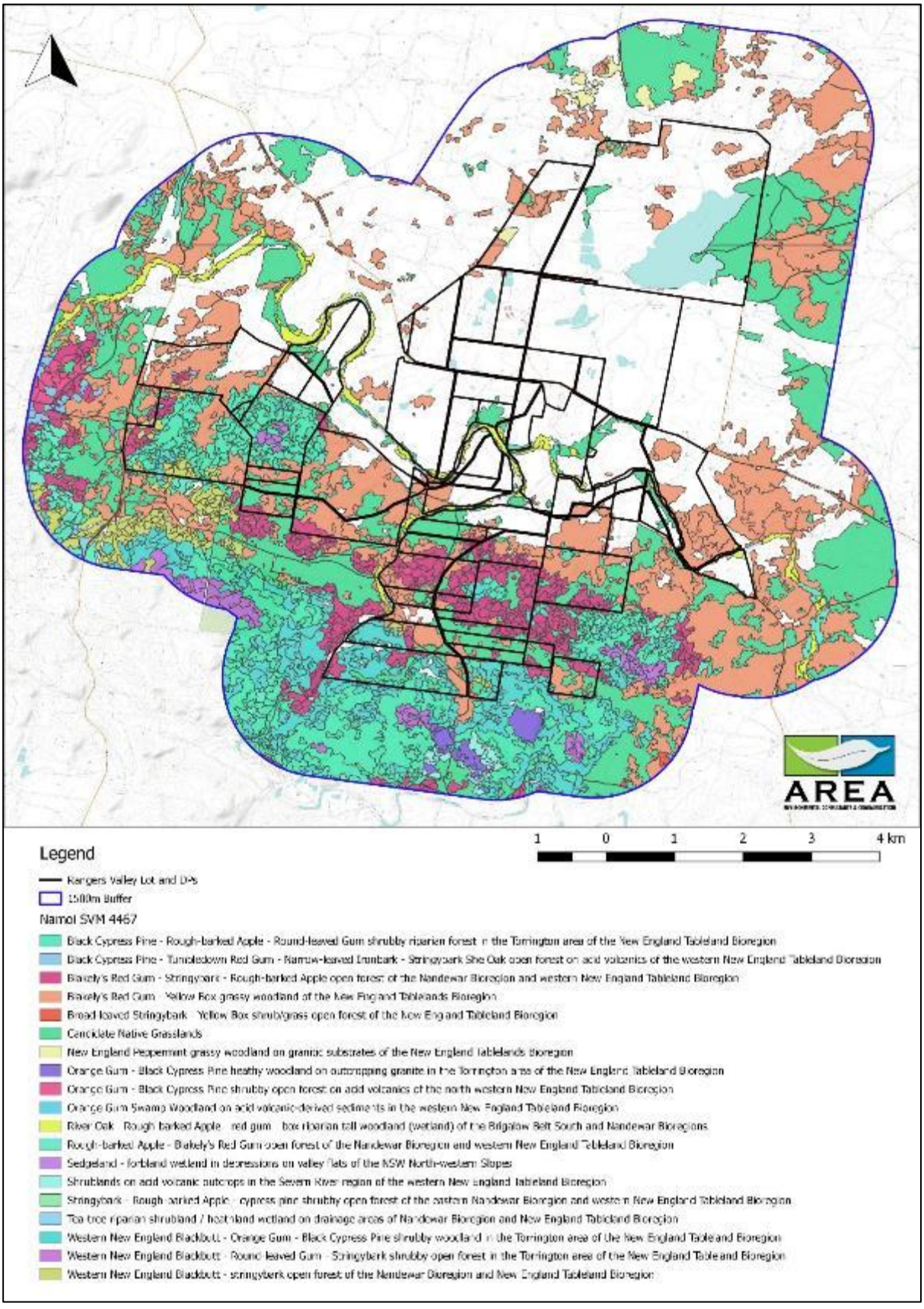


<table>
<tr><th>Landscape feature</th><th>BAM reference</th><th>Response</th></tr>
<tr>
<td>Native vegetation extent in the buffer* area

See figure below – areas of no shading indicate ‘not native’.

* Within 1500 metres</td>
<td>Native vegetation extent (as described in Subsection 4.3.2)</td>
<td>59.22 percent of vegetation within a 1500 metre buffer area of the property is native vegetation (See figure below). The native vegetation cover in the landscape was determined by QGIS software with reference to vegetation maps provided by the Namoi SVM 4467. Native vegetation cover per cent was calculated as a proportion of all land within the assessment buffer area containing mapped native vegetation and is comprised of the following Plant Community Types:
<table>
<tr><th colspan="2">PCTs within 1500 metre buffer around the property (12070.14 hectares)</th><th>Hectares</th></tr>
<tr><td>1</td><td>Candidate Native Grassland</td><td>1891.77</td></tr>
<tr><td>84</td><td>River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion</td><td>191.71</td></tr>
<tr><td>447</td><td>Sedgeland - forbland wetland in depressions on valley flats of the NSW North-western Slopes</td><td>0.78</td></tr>
<tr><td>505</td><td>Black Cypress Pine - Tumbledown Red Gum - Narrow-leaved Ironbark - Stringybark She Oak open forest on acid volcanics of the western New England Tableland Bioregion</td><td>34.36</td></tr>
<tr><td>508</td><td>Blakely’s Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion</td><td>553.90</td></tr>
<tr><td>510</td><td>Blakely’s Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion</td><td>2332.06</td></tr>
<tr><td>514</td><td>Black Cypress Pine - Rough-barked Apple - Round-leaved Gum shrubby riparian forest in the Torrington area of the New England Tableland Bioregion</td><td>936.44</td></tr>
<tr><td>533</td><td>New England Peppermint grassy woodland on granitic substrates of the New England Tableland Bioregion</td><td>45.62</td></tr>
<tr><td>535</td><td>Orange Gum - Black Cypress Pine heathy woodland on outcropping granite in the Torrington area of the New England Tableland Bioregion</td><td>49.00</td></tr>
<tr><td>536</td><td>Orange Gum - Black Cypress Pine shrubby open forest on acid volcanics of the north western New England Tableland Bioregion</td><td>36.73</td></tr>
<tr><td>538</td><td>Rough-barked Apple – Blakely’s Red Gum open forest of the Nandewar Bioregion and western New England Tableland Bioregion</td><td>140.09</td></tr>
<tr><td>542</td><td>Stringybark - Rough-barked Apple - cypress pine shrubby open forest of the eastern Nandewar Bioregion and western New England Tableland Bioregion</td><td>3.87</td></tr>
<tr><td>557</td><td>Western New England Blackbutt - Round-leaved Gum - Stringybark shrubby open forest in the Torrington area of the New England Tableland Bioregion</td><td>125.71</td></tr>
<tr><td>558</td><td>Western New England Blackbutt - stringybark open forest of the Nandewar Bioregion and New England Tableland Bioregion</td><td>171.08</td></tr>
<tr><td>561</td><td>Shrublands on acid volcanic outcrops in the Severn River region of the western New England Tableland Bioregion</td><td>29.83</td></tr>
<tr><td>567</td><td>Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion</td><td>4.21</td></tr>
<tr><td>574</td><td>Tea-tree riparian shrubland / heathland wetland on drainage areas of Nandewar Bioregion and New England Tableland Bioregion</td><td>8.73</td></tr>
<tr><td>585</td><td>Western New England Blackbutt - Orange Gum - Black Cypress Pine shrubby woodland in the Torrington area of the New England Tableland Bioregion</td><td>591.03</td></tr>
<tr><td>605</td><td>Orange Gum Swamp Woodland on acid volcanic-derived sediments in the western New England Tableland Bioregion</td><td>1.05</td></tr>
<tr><td>Not Native</td><td>N/A</td><td>4922.17</td></tr>
<tr><td colspan="2">Total</td><td>12070.14</td></tr>
<tr><td colspan="2">Native veg (%)</td><td>59.22</td></tr>
<tr><td colspan="2">Not Native (%)</td><td>40.78</td></tr>
</table>
</td>
</tr>
</table>

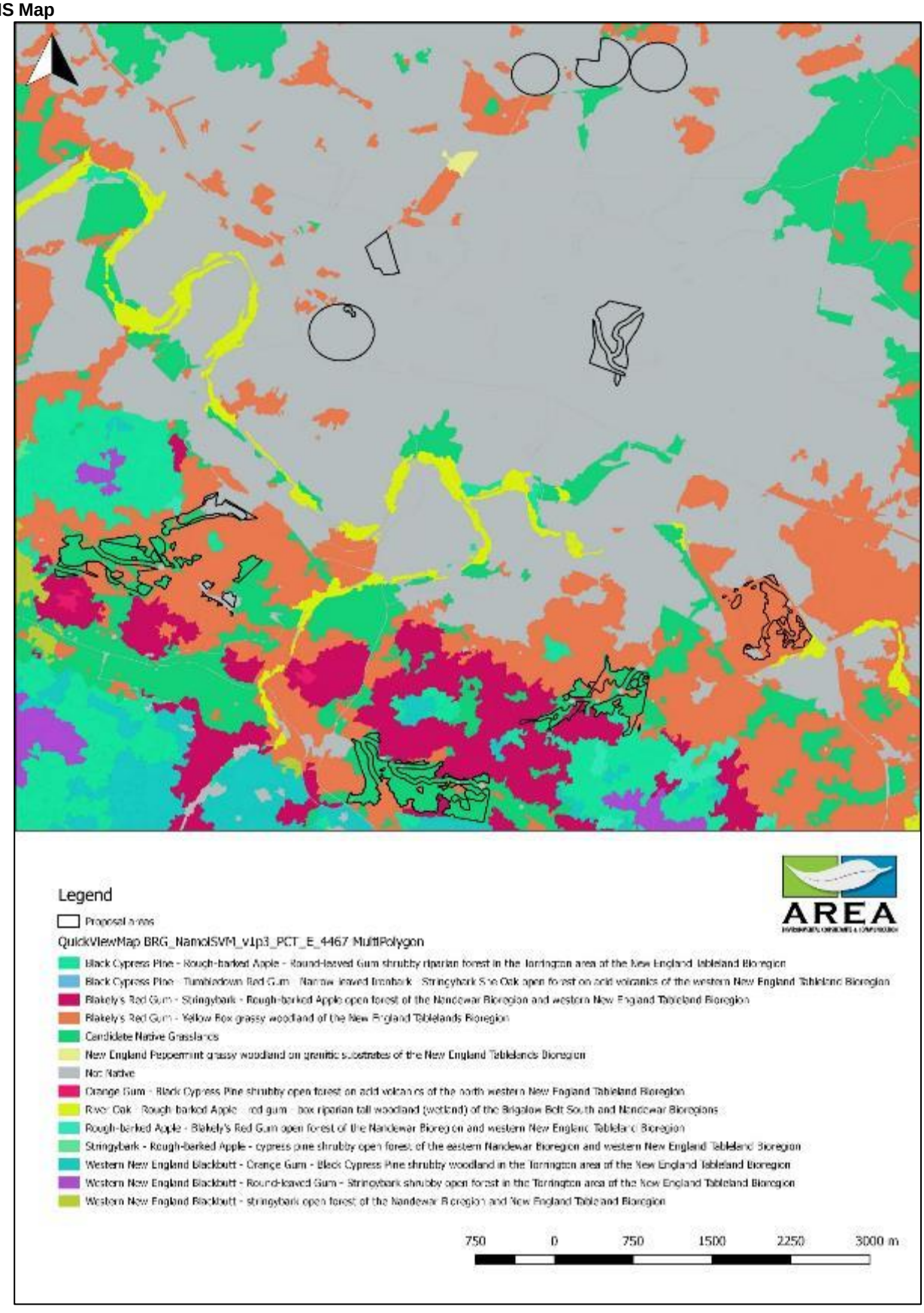
Landscape feature	BAM reference	Response



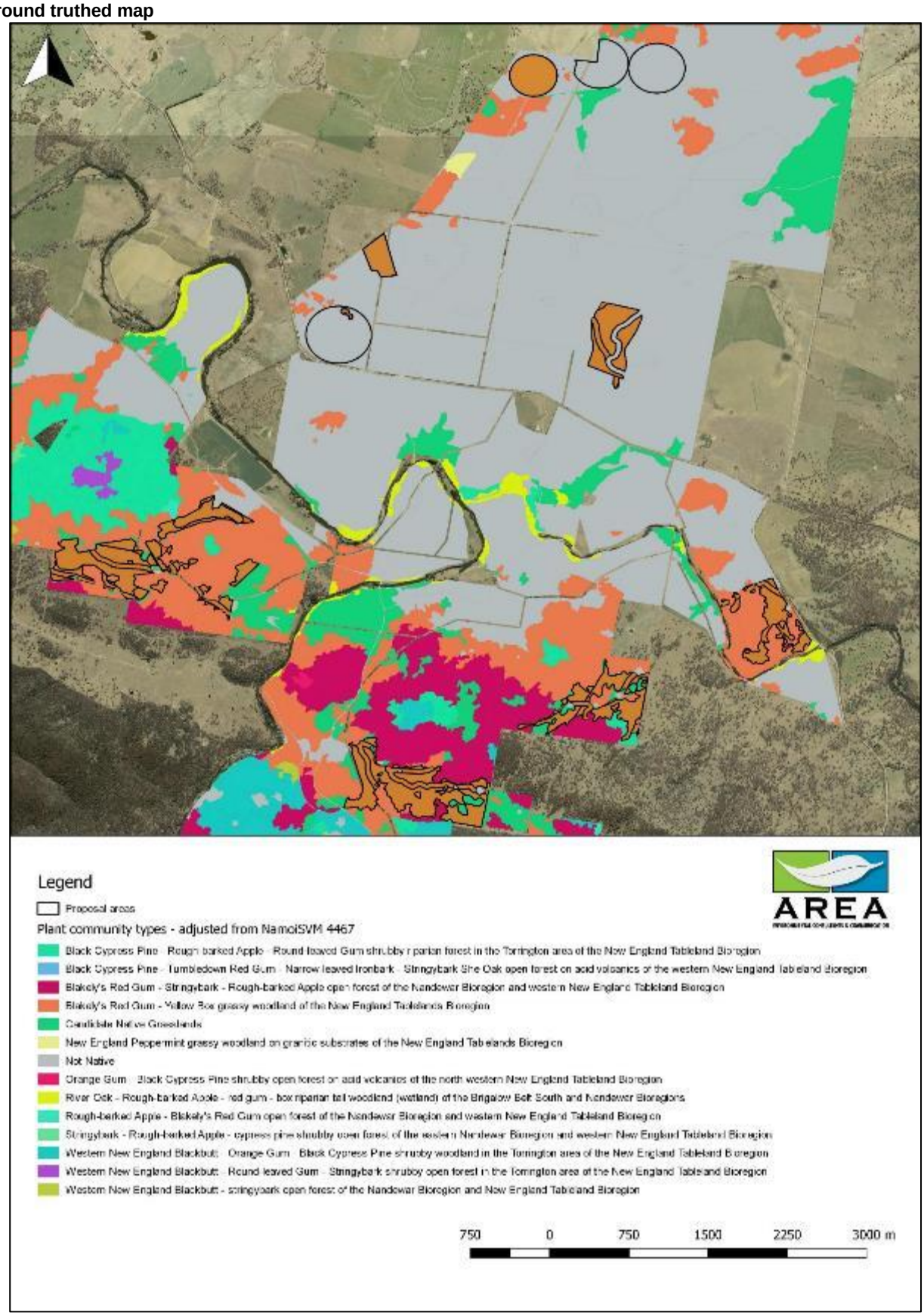
Landscape feature	BAM reference	Response
Cleared areas. See uncoloured areas in figure above	As above	4922.17 hectares or 40.78 percent of the 1500 metre buffer area is cleared area/ mapped as not native vegetation. Cleared areas (non-native vegetation) in the landscape was determined as per vegetation mapping within the 1500 metre buffer (above).

Evidence to support differences between mapped vegetation extent and aerial imagery	Sections 5.1.1.6 and 5.1.1.7	The PCT map, Namoi VIS 4467 was not completely accurate for the area assessed.
		
		PCT510 was determined to occur across all areas where native vegetation occurred within or adjacent to the development sites.
		
		The determination of PCT510 was based on the following factors:
		
		• Proximity: PCT510 was mapped in the area of the proposal and therefore an expected community for the area.
		• Floristics – the vegetation seen included species which best matched PCT510, namely:
		  ○ Blakely's Red Gum
		  ○ Yellow Box
		  ○ Rough Bark Apple
		  ○ Apple Box
		  ○ Broadleaved Stringybark
		  ○ Tussock grass/ snow grass.
		• Vegetation structure:
		  ○ Very space shrub layer consistent with the PCT description.
		• Landscape position:
		  ○ The areas assessed are largely valley flats or lower slopes of undulating hills.
		
		Where candidate native grasslands were mapped in the development site, these were remapped as either pact of a PCT or as not native.

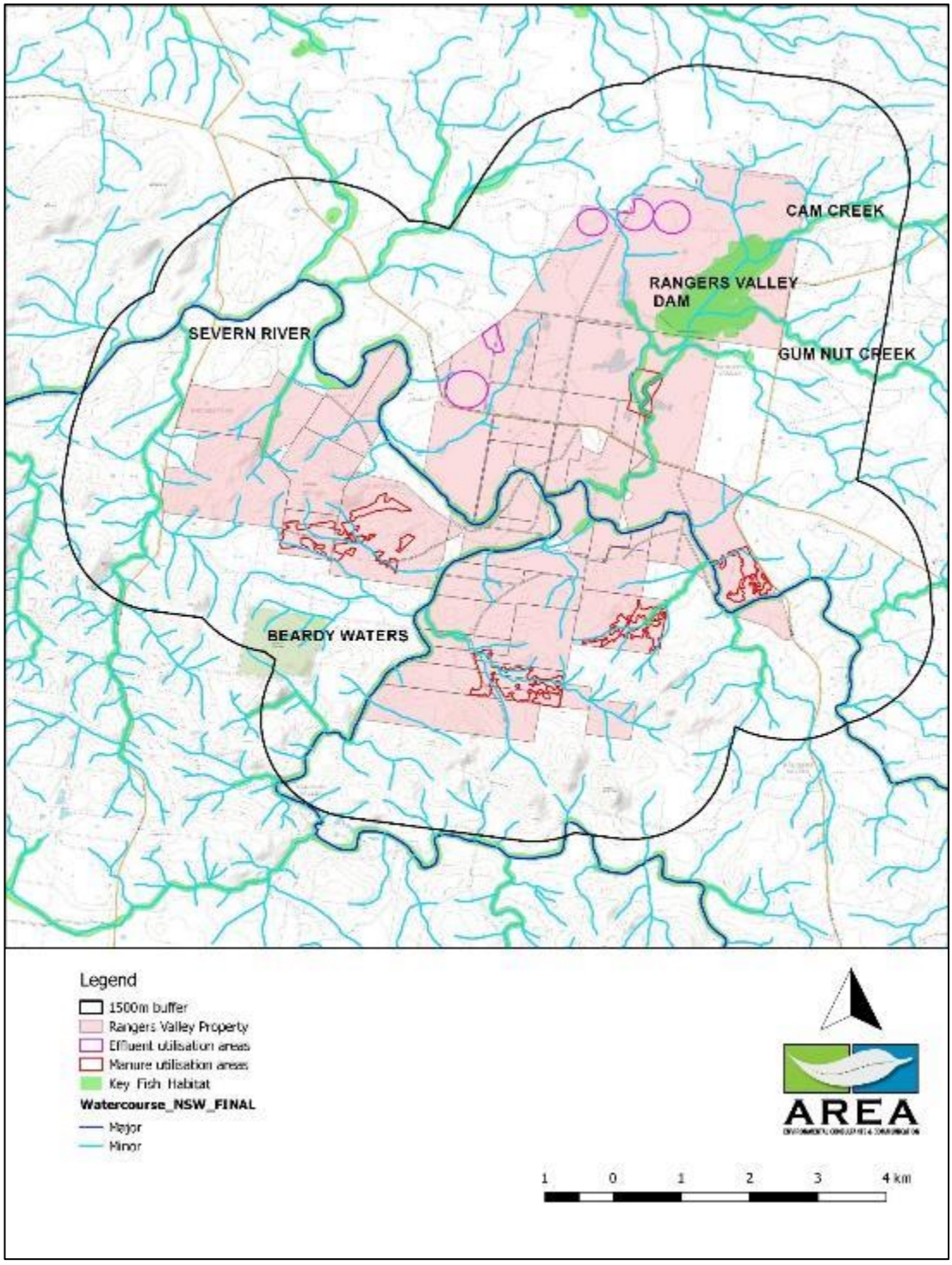
VIS Map


Legend
Proposal areas
QuickViewMap BRG_NamoiSVM_v1p3_PCT_E_4467 MultiPolygon
Black Cypress Pine - Rough-barked Apple - Round-leaved Gum shrubby riparian forest in the Torrington area of the New England Tableland Bioregion
Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tablelands Bioregion
Candidate Native Grasslands
New England Peppermint grassy woodland on granitic substrates of the New England Tablelands Bioregion
Non Native
Orange Gum - Black Cypress Pine shrubby open forest on acid volcanics of the north western New England Tableland Bioregion
Rough-barked Apple - Blakely's Red Gum open forest of the Nandewar Bioregion and western New England Tableland Bioregion
Stringybark - Rough-barked Apple - cypress pine shrubby open forest of the eastern Nandewar Bioregion and western New England Tableland Bioregion
Western New England Blackbutt - Orange Gum - Black Cypress Pine shrubby woodland in the Torrington area of the New England Tableland Bioregion
Western New England Blackbutt - Round-leaved Gum - Stringybark shrubby open forest in the Torrington area of the New England Tableland Bioregion
Western New England Blackbutt - stringybark open forest of the Nandewar Bioregion and New England Tableland Bioregion
AREA
750 0 750 1500 2250 3000 m

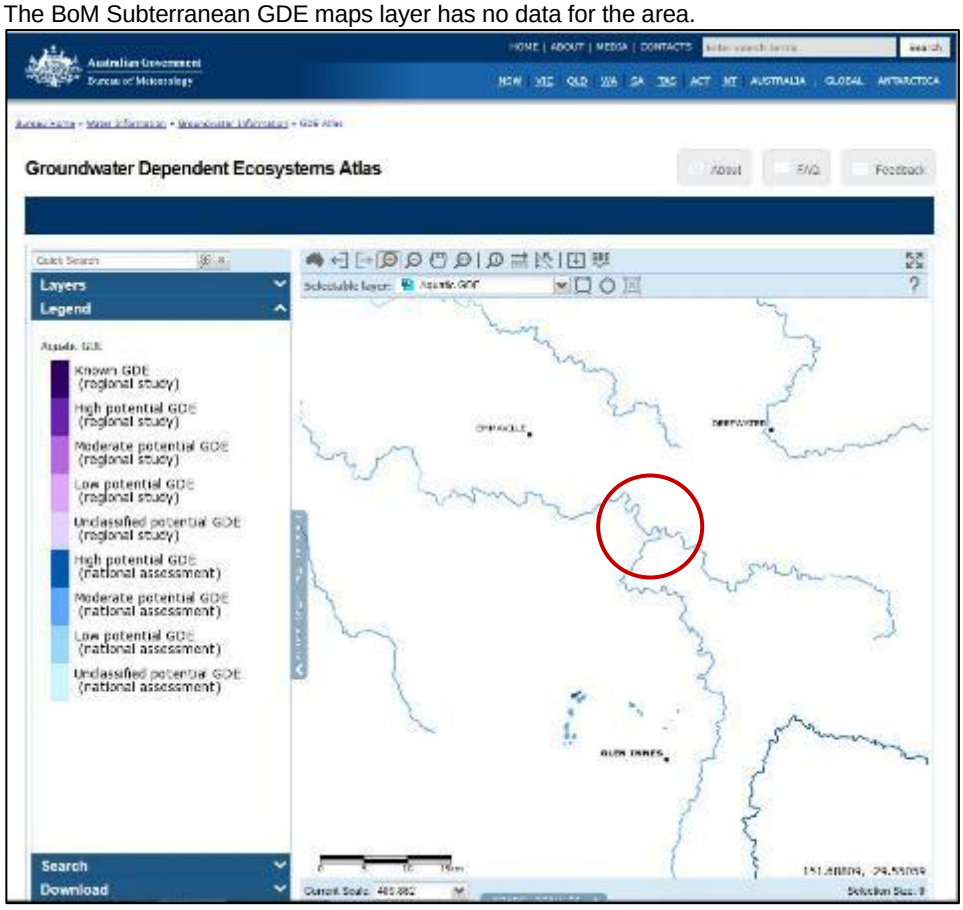
Ground truthed map

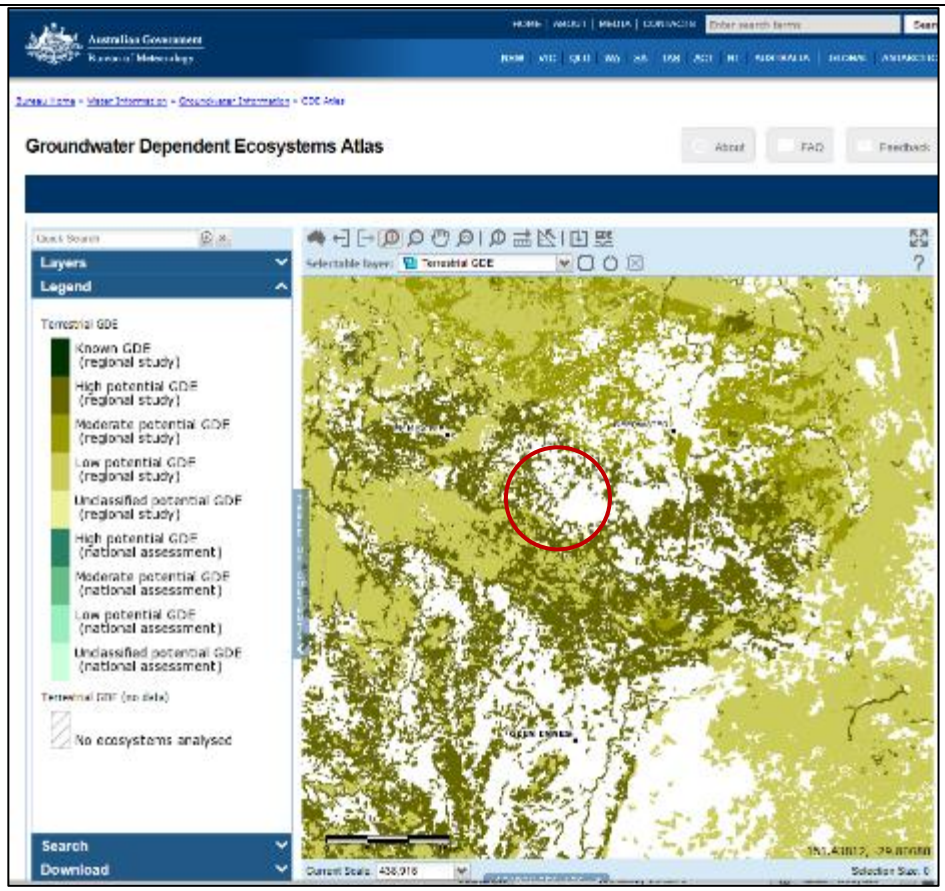


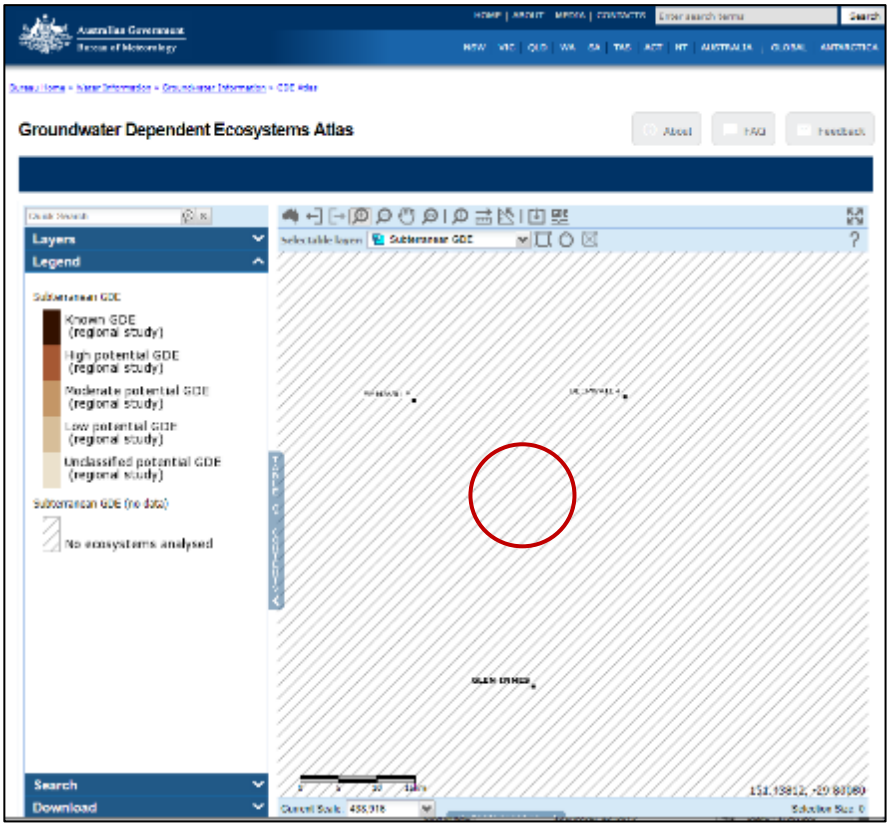
Rivers and streams classified according to stream order. See figure below.	Rivers and streams (as described in Paragraph 4.2.1.6)	Within the property, there are four named waterways – Severn River, Cam Creed, Beardy Waters and Gum Nut Creek. The Severn River is the only major waterway and it bisects the property and the development site. It runs closest to Top Sugarloaf about 70 metres as its closest. The Severn River is a perennial third and fourth order waterway. Beardy Waters into the Severn River from the south. It is approximately 70 metres from Back Paddock and Four Mile at its closest to the development site. It is a perennial third and fourth order waterway. Cam Creek is a minor waterway and runs from north to south, through the Rangers Valley Dam before joining the Severn River. Cam Creek runs through the Middle Swamp paddock. It is a perennial third order waterway. Gum Nut Creek runs into the Rangers Valley Dam from the east and is at least two kilometres from the development site. It is a perennial third order waterway. Numerous non-perennial first and second order waterways occur on the property and in the development site. These area ephemeral drainage lines, with the second order drainage lines occasionally sustaining pools with little or no aquatic vegetation during times of no flow. See figure below.



Wetlands within, adjacent to and downstream of the site. See figure above	Wetlands (as described in Paragraph 4.2.1.7)	No wetlands of International Importance occur in the property 10 kilometre buffer. One wetland occurs within 1500 metres of the property and this is Rangers Valley Dam and is located on the Rangers Valley property. The wetlands of the broader locality provide suitable breeding and foraging habitat for a range of fauna species of birds, fish (possibly), frogs, mammals and reptiles and provide a movement corridor and important habitat for migratory bird species. The BioNet database shows one no wetland migratory birds have been recorded within 10 kilometres of the property.

		The BioNet search criteria used was: Public Report of all Valid Records of Threatened (listed on BC Act 2016), Commonwealth listed, CAMBA listed, JAMBA listed or ROKAMBA listed entities within an area of greater than 10 kilometres around the property. This returned a total of 113 records of 27 species. Report generated on 26.03.2019.
Groundwater dependant ecosystems		Groundwater plays an important ecological role in directly and indirectly supporting terrestrial and aquatic ecosystems. Groundwater sustains terrestrial and aquatic ecosystems by supporting vegetation and providing discharge to channels, lacustrine and palustrine wetlands, and both the estuarine and marine environment. Aquifer ecosystems are inherently groundwater dependent (DEHP, 2017). The BoM Aquatic GDE maps Moderate Potential GDE (national assessment) as occurring in the vicinity of the proposal. The BoM Terrestrial GDE maps High, Moderate and Low Potential GDE (regional study) as occurring in the vicinity and in the location of the proposal. The BoM Subterranean GDE maps layer has no data for the area. 


Groundwater Dependent Ecosystems Atlas
Layers
Legend
Terrestrial GDE
Known GDE (regional study)
High potential GDE (regional study)
Moderate potential GDE (regional study)
Low potential GDE (regional study)
Unclassified potential GDE (regional study)
High potential GDE (national assessment)
Moderate potential GDE (national assessment)
Low potential GDE (national assessment)
Unclassified potential GDE (national assessment)
No ecosystems analysed
Search
Download


Groundwater Dependent Ecosystems Atlas
Layers
Legend
Known GDE (regional study)
High potential GDE (regional study)
Moderate potential GDE (regional study)
Low potential GDE (regional study)
Unclassified potential GDE (regional study)
No ecosystems analysed
Search
Download

Connectivity features	Connectivity of different areas of habitat (as described in Paragraphs 4.2.1.8–4.2.1.11)	A connectivity site-based assessment was undertaken in accordance with the BAM. No formal state or regional biodiversity links are recorded across the proposal or Rangers Valley property. Rangers Valley Dam occurs on the property and the Severn River and Beardy Waters bisect the property. These waterways may be used as habitat for migratory species. The assessment of the impact of the development on movement of threatened species that maintains their life cycle must: *a) identify movement patterns key to the life cycle of relevant threatened species that intersect with the subject land* ➢ No migratory species have been recorded or were observed in the proposal. Movement patterns for migratory species will therefore not be affected. *b) describe the nature, extent and duration of short and long-term impacts* ➢ Application of manure and effluent is expected to commence in 2019 and will be ongoing as required. ➢ No other construction impacts will occur. *c) describe, with reference to relevant literature and other reliable published sources of information, the importance of the movement of the threatened species to their life cycle* ➢ BioNet shows 42 individual records of listed species within 10 kilometres of the property. i. 10 records are from five species of birds ii. 15 records are from Eastern Bent-wing Bat (2), Spotted-tailed Quoll (1) and Koala (12). iii. Two records are from one species of plant iv. Four records are from one species of reptile (Bell's Turtle/ Western Sawshelled Turtle ➢ None of these species will have their movement affected by the proposal. *d) predict the consequences of the impacts for the bioregional persistence of the threatened species, with reference to relevant literature and other published sources of information* ➢ The impact to movement of threatened species in the development site would not be affected as there is significant residual habitat within 1500m, vegetation and habitat are not being removed from most of the development site and 12 trees are the only vegetation that will be removed.
Areas of geological significance and soil hazard features	Areas of geological significance and soil hazard features (as described in Paragraphs 4.2.1.12–4.2.1.15)	Rocky outcrops exist on the property however these do not include cliff, cave or karst formations. Dialogue with RDC Engineers did not identify areas of geological significance and soil hazard features in the development site. The MNES report did not identify area areas of geological significance in the development site.
Site context: identification of method applied (i.e. linear or site-based)		The proposal is a site-based project.
Site context: percent native vegetation cover in the landscape (proposal).	Section 4.3.2	The proposal (the impact footprint) is 253.16 hectares, of this 183.33 hectares is native vegetation (72.08 percent native vegetation). The 1500m buffer (12070.14 hectares) is 59.22 is estimated to be covered by native vegetation.

4 Native vegetation

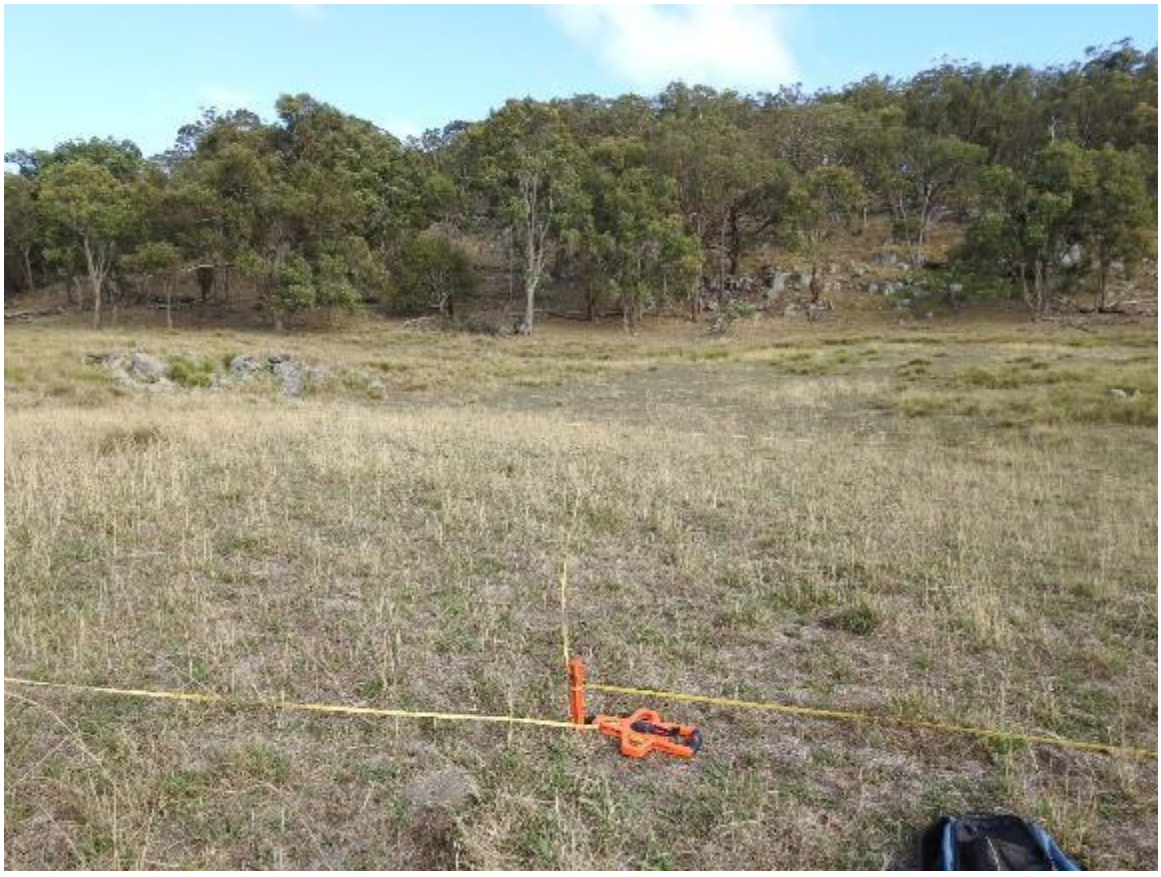
4.1 Plant community types (PCTs) within the development site

One PCT was recorded in the development site: *PCT510 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion* (Table 4-1).

Table 4-1: PCT510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion - Vegetation zone, PCT and management zone

PCT 510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	
Vegetation zones:	Zone 1 (High Native Ground Cover – no tree removal) **86.99 hectares**
	Zone 2 (Low Native Ground Cover – Some dead paddock tree removal) **95.75 hectares**
	Zone 3 (No native ground cover) – Paddock trees **69.82 hectares**
	Zone 4 (No native ground cover – PCT **0.59 hectares**
PCT Code:	510
Vegetation formation:	Grassy woodlands
Vegetation class:	New England Grass Woodlands
Conservation status:	Endangered (BC Act) and Critically Endangered (EPBC Act)
PCT Percent cleared:	79
Composition condition score (BAMC): Zone 1	10.5
Structure condition score (BAMC): Zone 1	54.2
Function condition score (BAMC): Zone 1	15
Current vegetation integrity score (BAMC): Zone 1	20.4
Extent in the Proposal: Zone 1	86.99 hectares
Plots completed in vegetation zones: Zone 1	7 (Plots 1, 2, 5, 6, 7, 13 and 14)
Composition condition score (BAMC): Zone 2	5
Structure condition score (BAMC): Zone 2	5.7
Function condition score (BAMC): Zone 2	15
Current vegetation integrity score (BAMC): Zone 2	7.5
Extent in the Proposal: Zone 2	95.75 hectares
Plots completed in vegetation zones: Zone 2	6 (Plots 3, 4, 10, 11, 12 and 15)
Zone 3 – cropped paddock (corn and soybean – no native plot data collected)	N/A
Composition condition score (BAMC): Zone 4	10.3
Structure condition score (BAMC): Zone 4	0.6
Function condition score (BAMC): Zone 4	38.2
Current vegetation integrity score (BAMC): Zone 4	6.1
Extent in the Proposal: Zone 4	0.59
Plots completed in vegetation zones: Zone 4	Modelled/ estimated data used.
An overview of vegetation attributes collected from the plot data is provided in section 4.2.3.	

Plot 1 midline



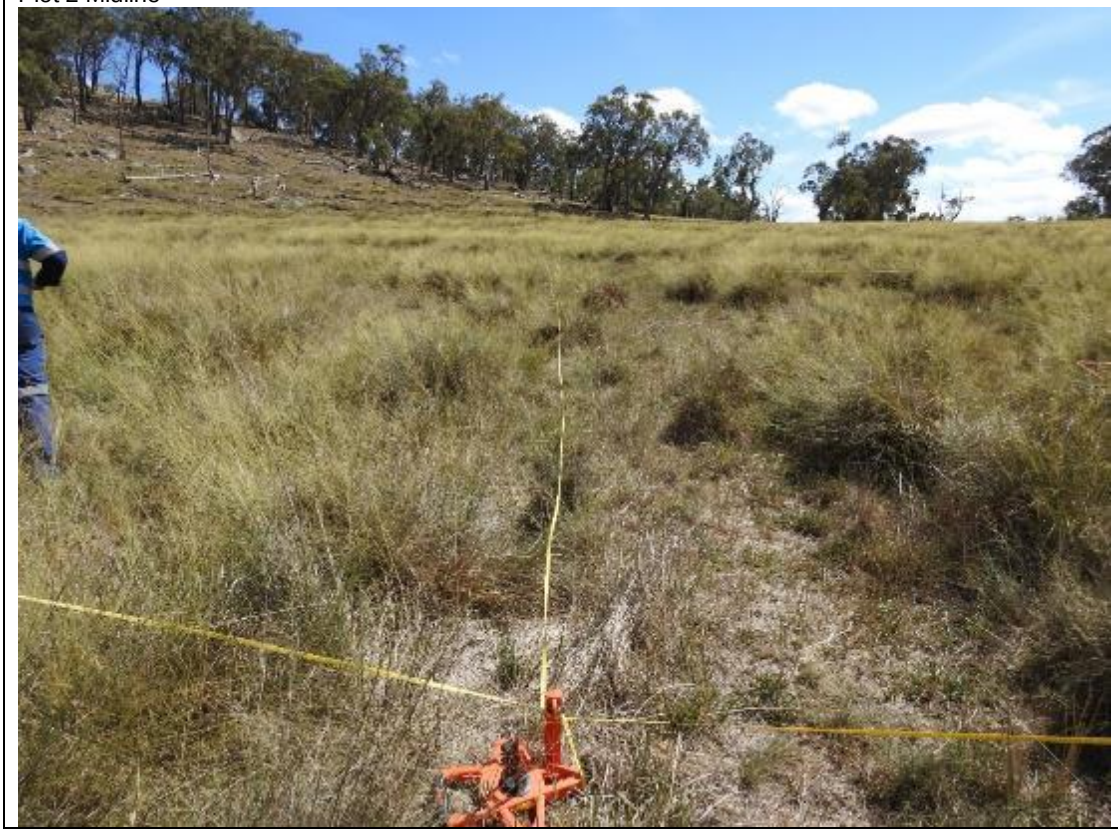
Plot 1 Leaf Litter Plots



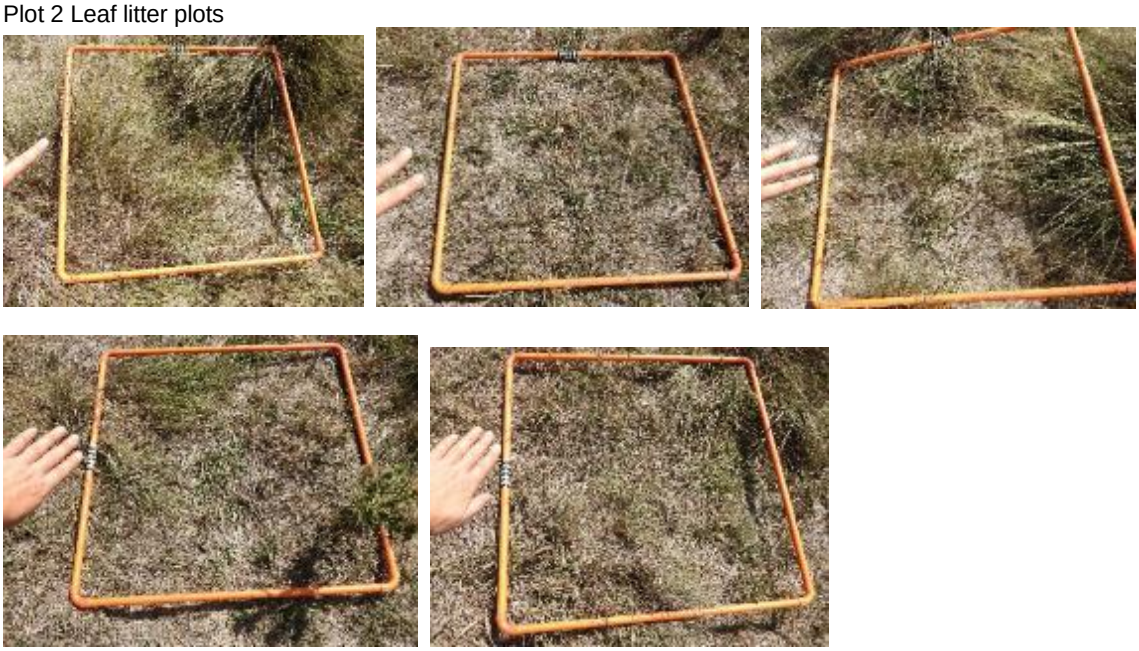


Plot 1 end of midline

Plot 2 Midline

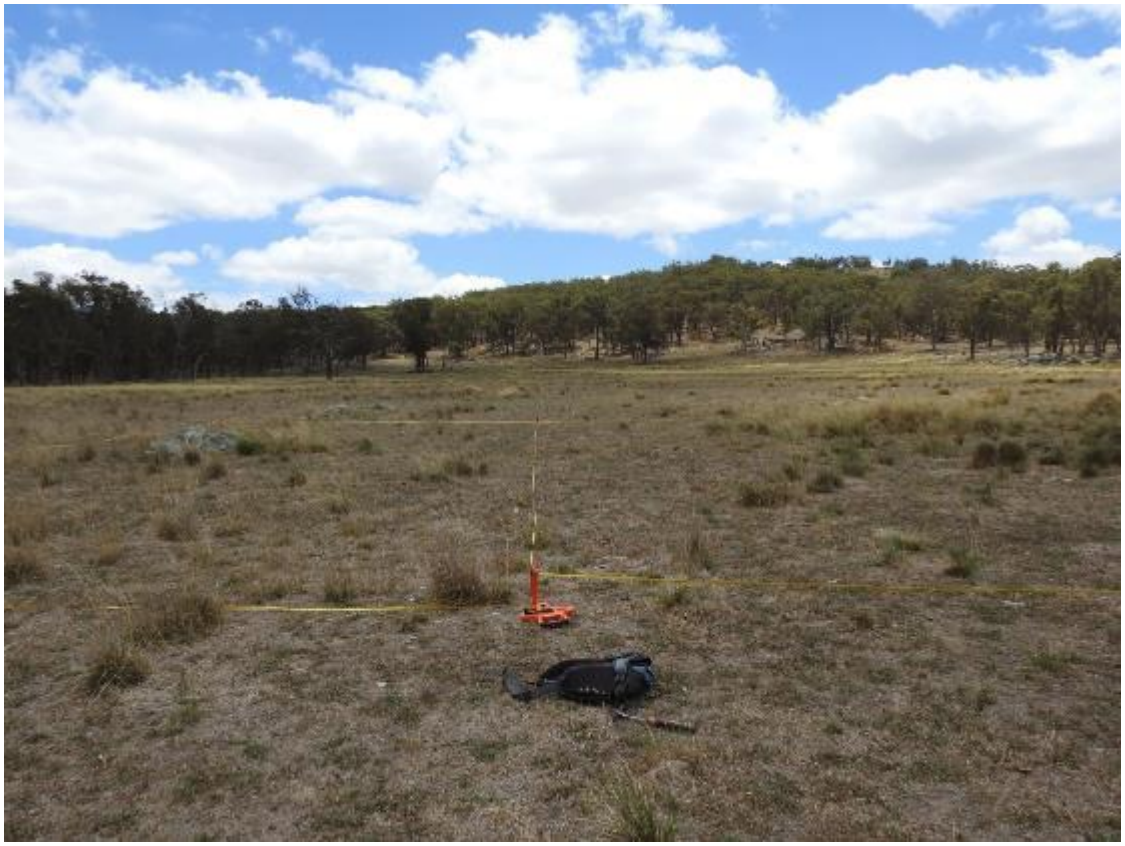


Plot 2 Leaf litter plots



Plot 2 end of midline

Plot 3 midline

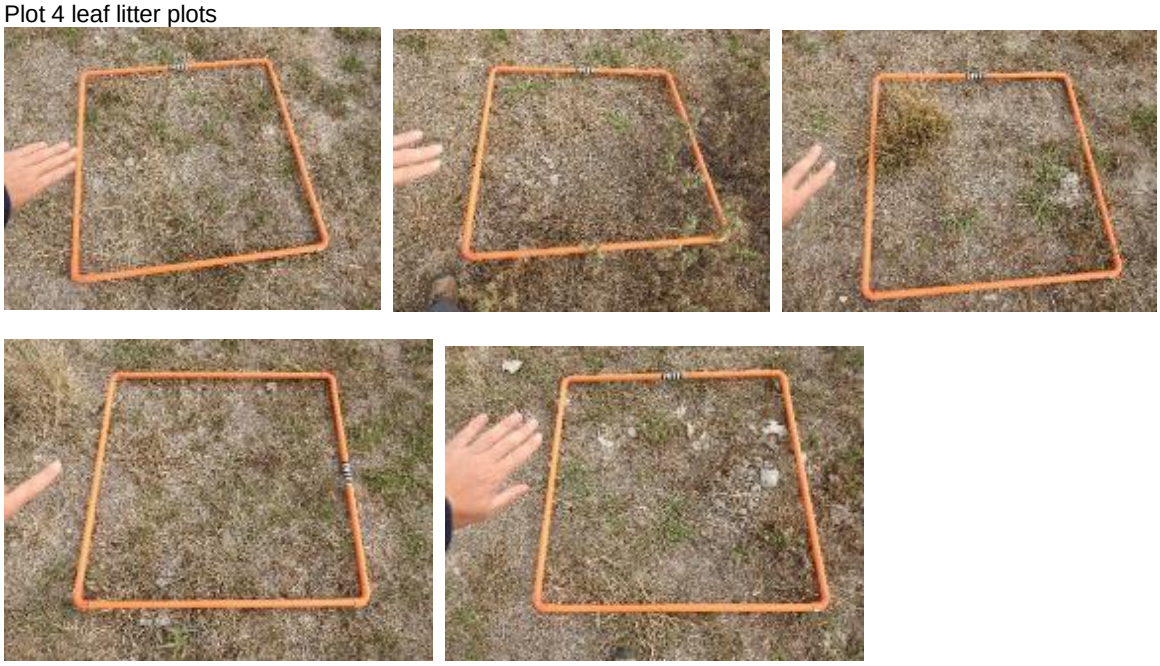


Plot 3 leaf litter plots

Plot 3 end of midline

Plot 4 midline

Plot 4 leaf litter plots



Plot 4 end of midline

Plot 5 midline

Plot 5 leaf litter plots

Plot 5 end of midline

Plot 6 midline

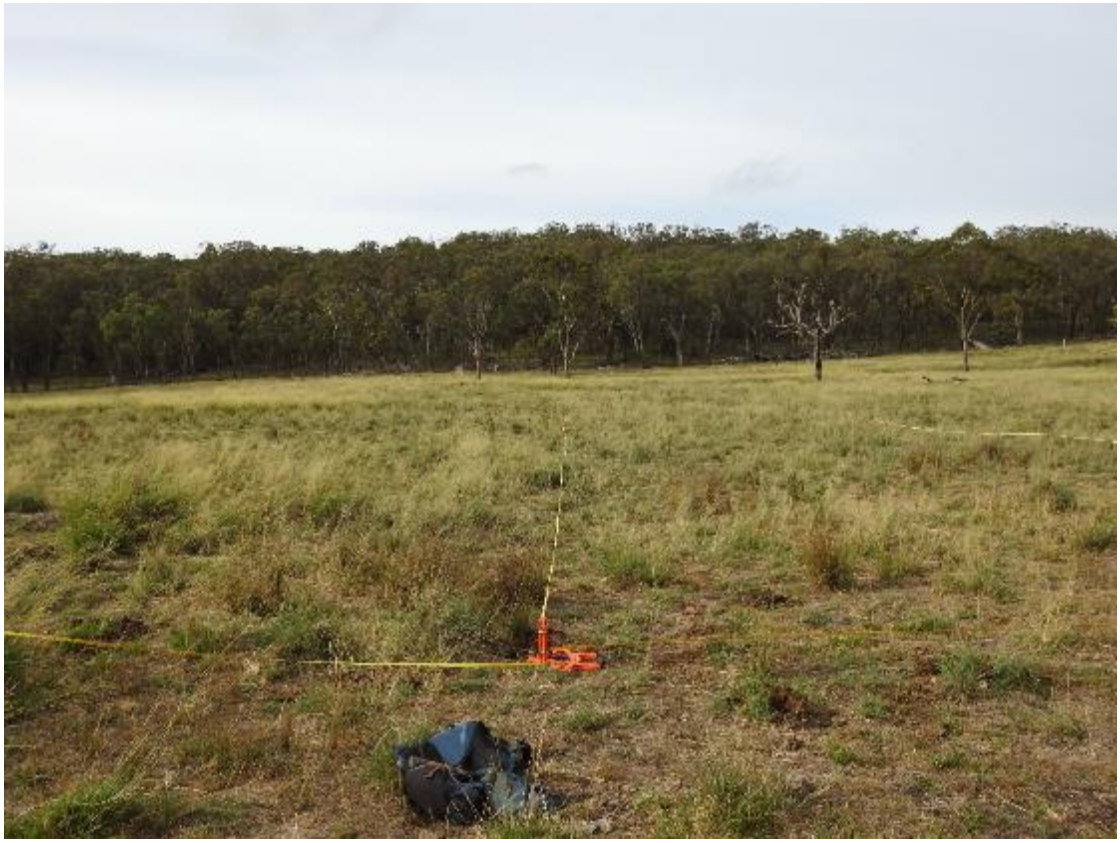
Plot 6 leaf litter plots





Plot 6 end of midline

Plot 7 midline



Plot 7 leaf litter plots

Plot 7 end of midline

Plot 8 midline

Plot 8 leaf litter plots

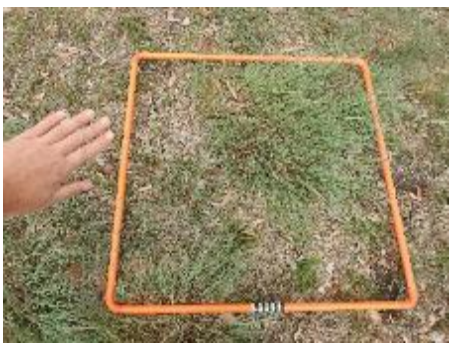




Plot 8 end of midline

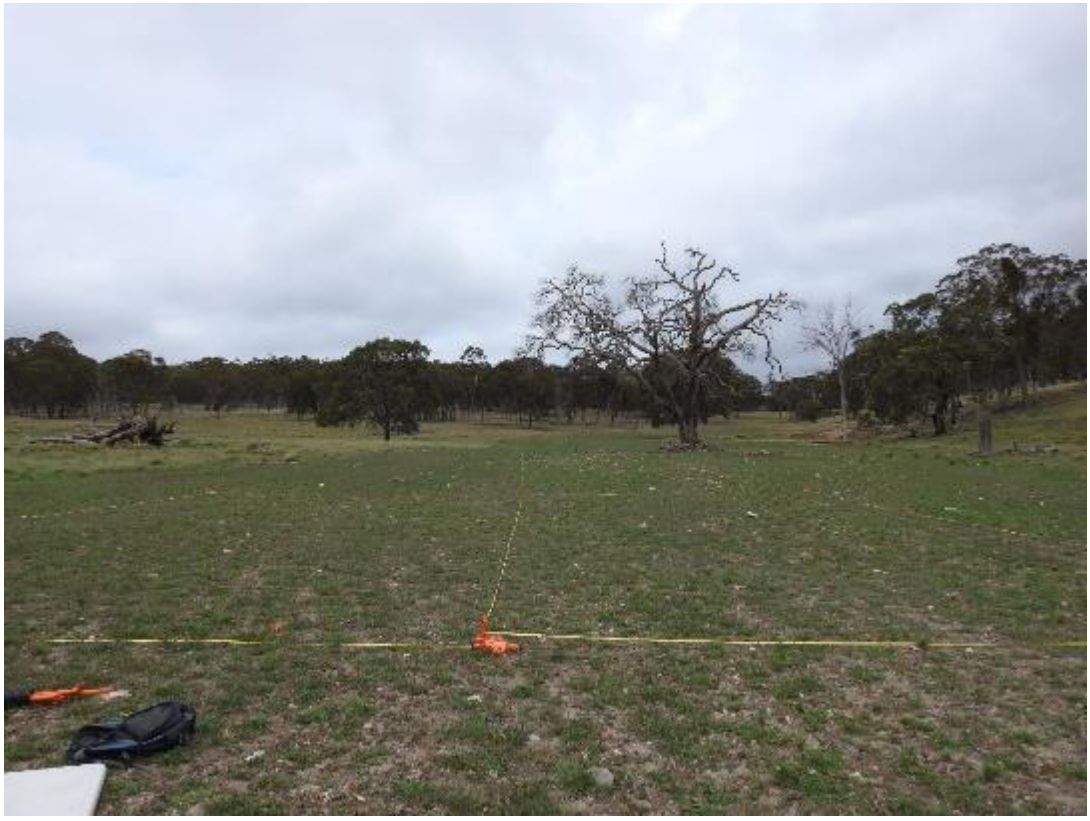
Plot 9 midline

Plot 9 leaf litter plots



Plot 9 end of midline

Plot 10 midline



Plot 10 leaf litter plots

Plot 10 end of midline

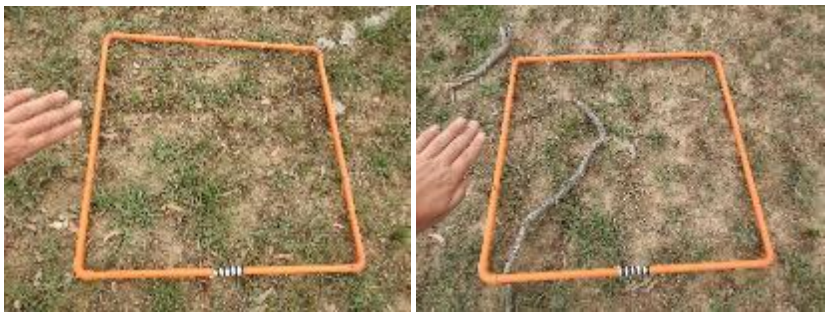
Plot 11 midline

Plot 11 leaf litter plots

Plot 11 end of midline

Plot 12 midline

Plot 12 leaf litter plots



Plot 12 end of midline

Plot 13 midline

Plot 13 leaf litter plots

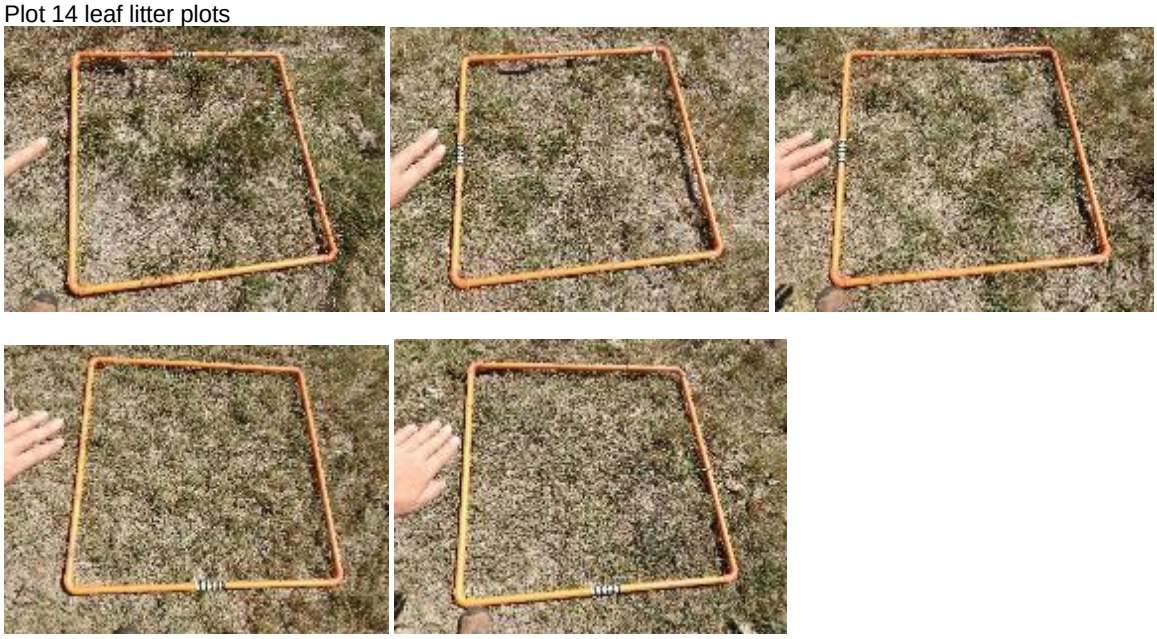




Plot 3 end of midline

Plot 14 midline

Plot 14 leaf litter plots



Plot 14 end of midline

Plot 15 midline

Plot 15 leaf litter plots

Plot 15 end of midline

Description (VIS BioNet Profile):
PCT510 is a tall open forest or woodland that occurs on undulating areas at intermediate to high altitudes, with local stands in the Horton area east of Mount Kaputar. Similar to ID599 Yellow Box - Blakely's Red Gum grassy woodland of Brigalow Belt South and Nandewar Bioregions, it occupies deep, relatively fertile soils on a number of different geologies, but mainly sedimentary rocks and basalt. Dominated by Rough-barked Apple (Angophora floribunda), Yellow Box (Eucalyptus melliodora) and/or Blakely's Red Gum (Eucalyptus blakelyi). Ribbon Gum (Eucalyptus viminalis), Apple Box (Eucalyptus bridgesiana) and Broad-leaved Stringybark (Eucalyptus caliginosa) are sometimes present, and the vulnerable Eucalyptus rubida subsp. barbigerorum can occur within this unit east of Inverell. The shrub layer is either sparse or absent, with typical species including Acacia implexa, Acacia fimbriata, Cassinia quinquefaria or Olearia elliptica subsp. elliptica. The ground layer is well developed with dominant species including Kangaroo Grass (Themeda australis), Snow Grass (Poa sieberiana), Cymbopogon refractus and Lespedeza juncea subsp. sericea. Less frequent groundcover species include Aristida ramosa, Sorghum leiocladum, Dianella revoluta var. revoluta, Microlaena stipoides var. stipoides, Desmodium brachypodum, Viola betonicifolia, Chrysocephalum apiculatum, Glycine tabacina, Lomandra longifolia, Bothriochloa macra and Carex breviculmis. This association represents part of the TSC Act and EPBC Act listed Box-Gum Woodland EEC/TEC.
Landscape features: Occurs on undulating areas at intermediate to high altitudes, with local stands in the Horton area east of Mount Kaputar. It occupies deep, relatively fertile soils on a number of different geologies, but mainly sedimentary rocks and basalt. May occur on footslopes, valley flats, hillslopes or drainage depressions.
Site and Regional Distribution: An estimated 79 percent of this PCT has been cleared. Clearing for grazing agriculture in the New England Tablelands Bioregion has occurred.
Diagnostic features: No more information available.
Threatened ecological community: White Box Yellow Box Blakely's Red Gum Woodland (part) listed as an Endangered Ecological Community (BC Act) and Critically Endngered Ecological Community (EPBC Act).
Fauna habitat features: Woodlands provide important habitat for a diverse range of native fauna. The upper stratum provides nectar for many types of animal's including insects as well as tree hollows. The shrub layer provides essential resources such as nesting/breeding sites, protection from predators and sources of food (nuts, seeds, nectar from flowers and invertebrate prey). Many animals are only likely to be part of the Woodland at certain times. For example, seasonal transients through the community, such as honeyeaters, are most likely to visit during the local flowering season. Some bird species, such as the nationally vulnerable *Grantiella picta* (painted honeyeater) travel to these when resources are available. The grassy ground stratum layers provide protection for fauna such as Dunnarts and listed reptiles. Many bat species (insectivores, frugivores and nectivores) commonly use woodlands (Pennay and Freeman, 2005).

Condition (on site observation): The development site is a mix of improved pasture, cropped land and grazed and currently un-grazed native vegetation. The areas surrounding the proposal are rocky areas of grassy woodland.

Zone 1 has a native tree upper stratum, a virtually absent shrub layer and ground cover with greater than 50% of the living ground cover being native.
Zone 2 has a native tree upper stratum, a virtually absent shrub layer and ground cover with less than 50% of the living ground cover being native.
Zone 3 has a ground cover which is a cropped paddock with no native ground cover vegetation. Some paddock trees occur.
Zone 4 has a ground cover which is a cropped paddock with no native vegetation. Native trees occur as a PCT.

The assessment focussed on areas where the application of manure and effluent is proposed. This area did not contain trees or shrubs despite tress being scattered across the development site, and woodlands being present immediately outside the development sites in many cases.

Areas where Zone 2 exists have been subject of pasture improvement or are generally in a weedy state.

The seven paddock trees to be removed by this proposal are remnant of PCT510 (and not included in the vegetation integrity score) will also be removed by this proposal. Two of these are dead trees containing hollows and five are alive trees containing hollows which have been assessed in the BAMC paddock trees assessment. These seven trees occur in Old 3 (six) and Crouches (one).

4.2 Vegetation integrity assessment of the development site

4.2.1 Mapping vegetation zones (Subsection 5.3.1 of the BAM)

Vegetation zones are defined as a 'relatively homogeneous area of native vegetation within a proposal that is the same PCT and broad condition state' (OEH 2014a). In this report we use two reference points stating:

1. how many hectares of each PCT zone are in the development site?
2. how many hectares are within the 1500m buffer (The local populations / the patch size)?

Vegetation zones within the 253.16 hectare development site were identified and mapped as four zones, three of which consist of PCT510 and the other zone is not native vegetation with paddock trees. Table 4-2 shows the native vegetation, including PCT510, as mapped in the Namoi VIS 4467 vegetation map and the areas of vegetation in each zone.

Table 4-2: Identification of vegetation zones in the proposal

Zone	PCT ID	Plant Community Type (PCT) Name	Hectares in 1500 metre buffer	Hectares in development site
1	510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	2332.06	86.99
2	510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion		95.75
3	N/A	Cropped paddocks with paddock trees	N/A	69.82
4	510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	2332.06	0.59
		Native veg Not Native	59.22 (%) 40.78 (%)	Total 183.33 Total 69.83

Seven paddock trees also occur in the development site and are not included in the figures for native vegetation above. Vegetation zones area mapped in Figure 4-1, Native vegetation within 1500 metres of the property is shown in Figure 4-2 and paddock trees are mapped in Figure 4-3.

Figure 4-1: Vegetation map showing vegetation zones and the proposal

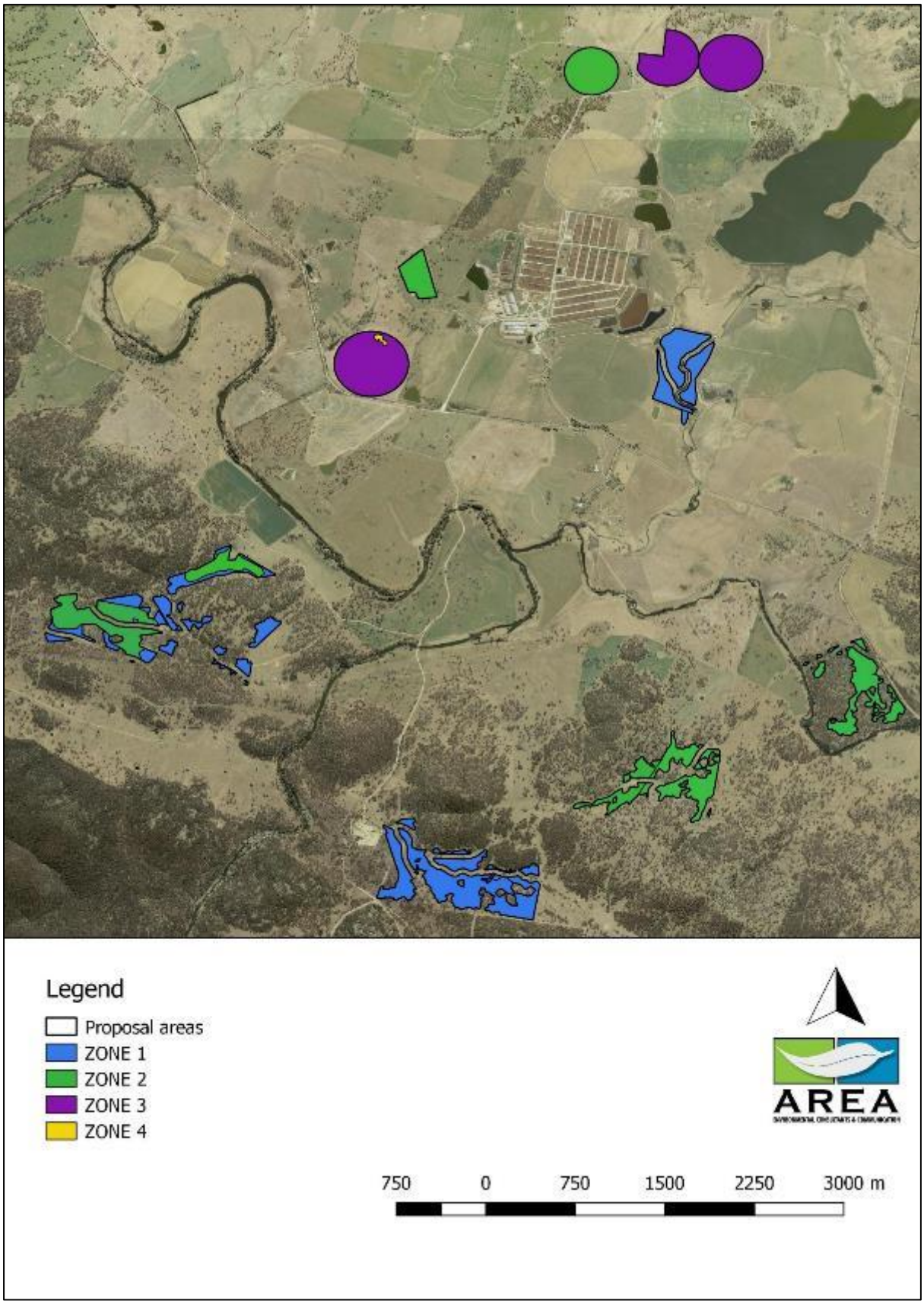


Figure 4-2: Vegetation map within 1500m (VIS) of development sites

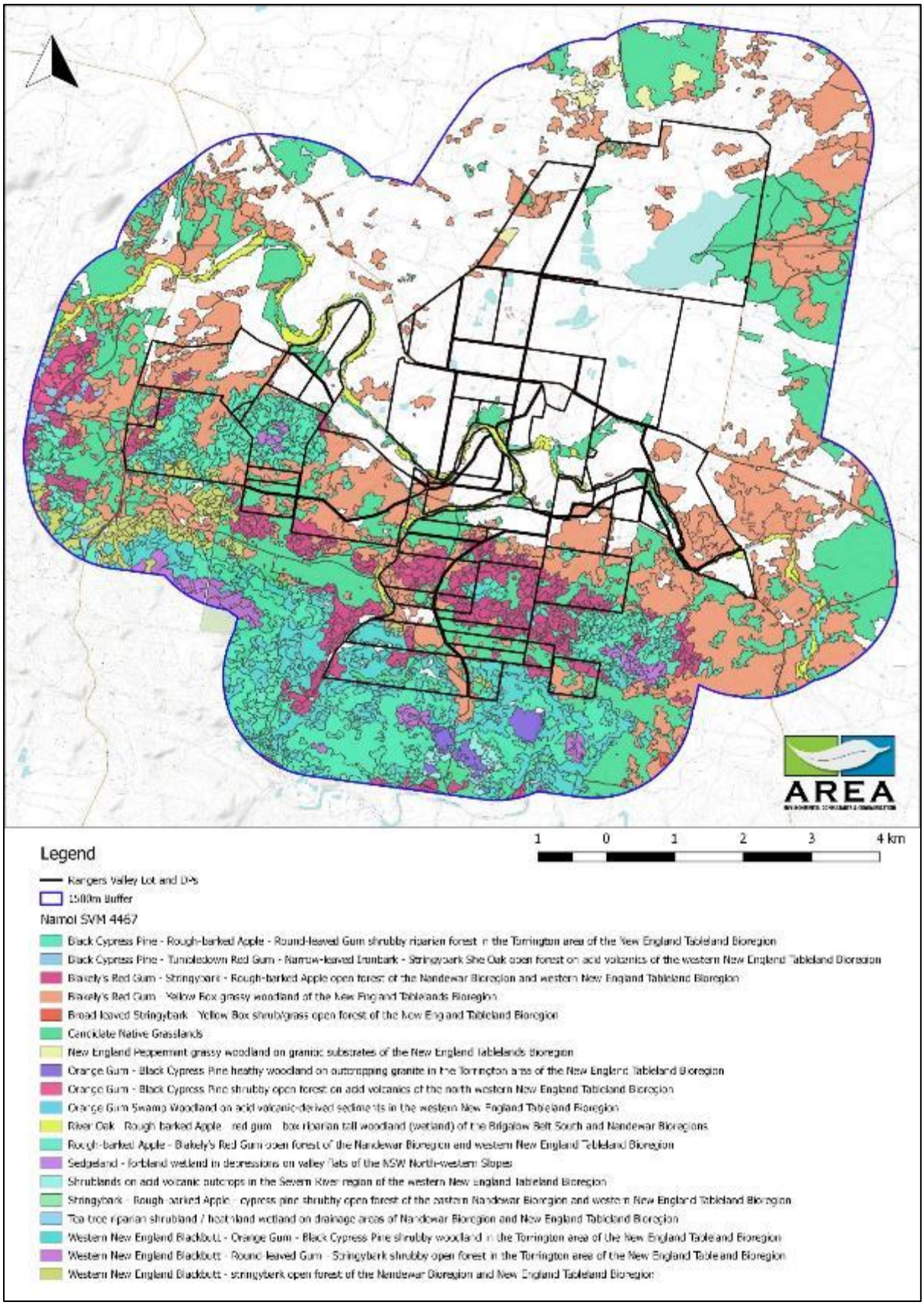
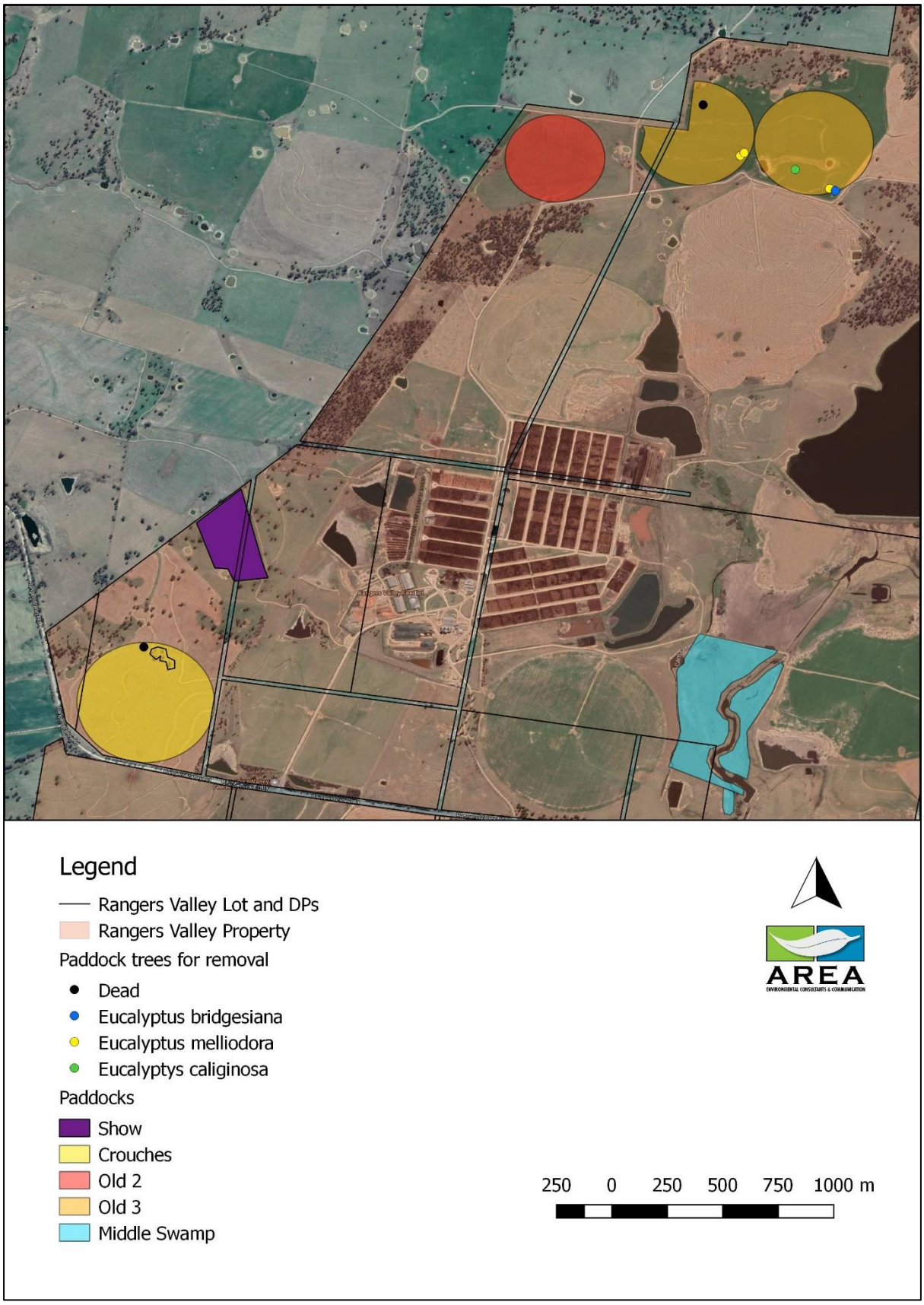


Figure 4-3: Paddock trees in the development sites



4.2.2 Patch size (Proposal)

The proposal possesses 183.33 hectares of PCT510 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion.

There is approximately 2332.06 hectares of PCT510 within 1500m of the property.

The proposal is on the edge of a large patch of wooded vegetation which is approximately 65 square kilometres.

4.2.3 Assessing vegetation integrity using benchmark data

Data collected from each plot was measured against the benchmark values for the PCT. Each parameter was further considered by whether it achieved more than 25% of the benchmark values.

Table 4-3: Plot data against PCT benchmark data

PCT510 benchmark				Zones															
Vegetation Class	New England Grassy Woodlands			1	1	2	2	1	1	1	N/A	N/A	2	2	2	1	1	2	
IBRA	New England Tablelands			Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot12	Plot13	Plot 14	Plot 15	
Benchmark Calculation Level	Class/IBRA	25% of benchmark value																	
Tree Richness	4	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Shrub Richness	6	1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Grass and Grass Like Richness	10	2.5		3	3	5	4	5	4	4	3	4	2	1	0	5	3	0	
Forb Richness	15	3.75		1	1	1	1	0	2	6	8	8	3	3	3	3	3	2	
Fern Richness	1	0.25		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Other Richness	3	0.75		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tree Cover	47	11.75		0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	
Shrub Cover	6	1.5		0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	
Grass and Grass Like Cover	82	20.5		75.1	90.1	20	17.1	68.2	55	57.1	80.4	90.1	0.2	0.1	0	58.3	85.5	0	
Forb Cover	13	3.25		0.2	0.1	0.3	5	0	7	7.1	1.3	8.1	20.1	0.3	6.1	1.3	0.8	7	
Fern Cover	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Other Cover	1	0.25		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total length of fallen logs	26	6.5		0	0	0	0	0	0	1.6	0	0.4	1.1	0	0	0	0	33	
Litter Cover	30	7.5		36	52	62	59	72	53	46	49	34	27	2	27	24	50	37	
Number of Large Trees	3	0.75		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Large Tree Threshold Size	50																		
Less than 25% of the benchmark																			
More than 25% of the benchmark																			

4.2.4 Survey effort as described in Subsection 5.3.4 (number of plots)

The field data collected using 15 BAM (2017) plots is presented Appendix A.

The following site attributes were assessed in the plots to obtain a quantitative measure of vegetation condition.

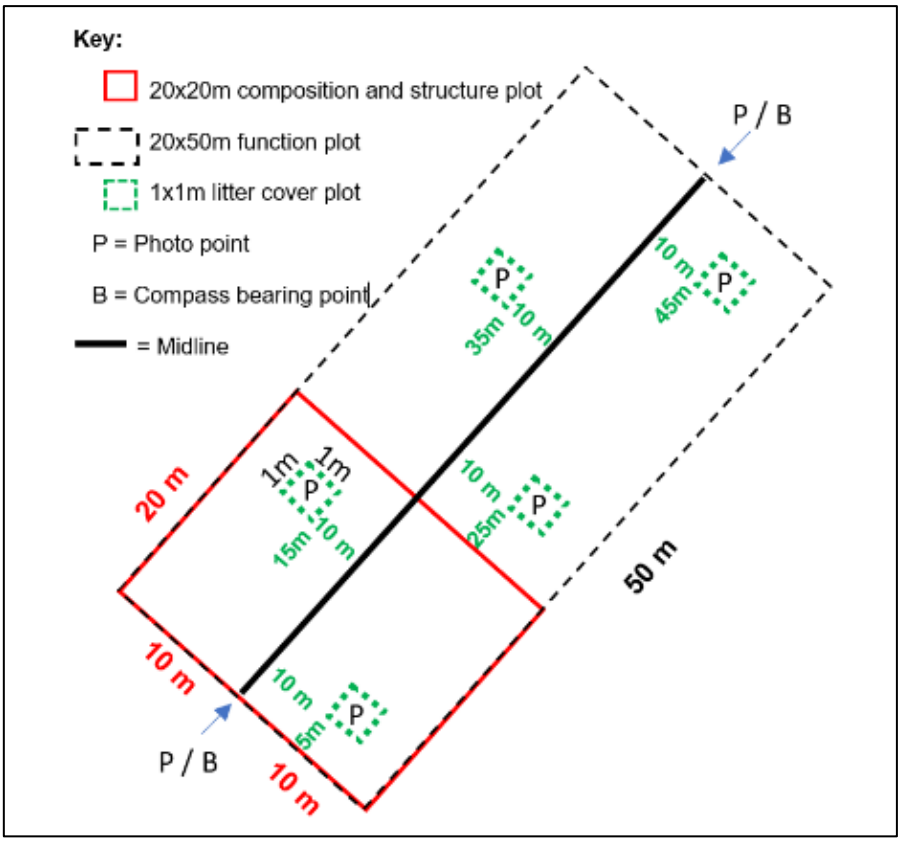
- **Composition score** based on the number of native plant species (richness) recorded by the assessor within the 20 metre x 20 metre plot boundary for each growth form group (Figure 4-3)
- **Structure score** based on the assessment of foliage cover for each growth form group within the 20m x 20m plot boundary
    - Foliage cover for a growth form group is the percentage of cover of all living plant material of all individuals of the species (Figure 4-3).
- **Function score** based on the number of large trees, tree stem size class, tree regeneration, tree hollows and length of fallen logs is recorded within a 20 metre x 50 metre plot boundary (Figure 4-3)
- Additionally, a High Threat Exotic weed assessment was undertaken.

Plot-based floristic survey

Vegetation in each plot was assessed with 20 by 20 metre quadrats nested inside 20 by 50 metre transects. The following information was collected:

- Stratum and layer – in which each species occurs.
- Growth form – for each recorded species.
- Species name – above ground vascular plant species were identified to the lowest taxonomic order possible using nomenclature consistent with PlantNet NSW.
- Cover – a measure or estimate of the appropriate cover measure for each recorded species; recorded from one to five per cent and then to the nearest five per cent. If the cover of a species is less than one per cent and the species is considered important, then the estimated cover should be entered (e.g. 0.4).
- Abundance rating – a relative measure of the cover abundance of individuals or shoots of each species within the plot was estimated and assigned a cover abundance score using the BAM.

Figure 4-4: BAM plot layout (not to scale)



The vegetation survey was completed using field survey methods in line with Chapters 5 and 6 of the BAM and by implementing the guidelines for *Threatened Biodiversity Survey and Assessment* (DEC, 2004) and *NSW Guide to Surveying for Threatened Plants* (2016). AREAs Principal Consultant and Principal Environment and Community Consultant completed surveys for this proposal:

- Four and a half days of strategic vegetation survey and targeted threatened species searches from 4 February to 8 February 2019 following the Biodiversity Assessment Method 2017 and relevant threatened species search protocols.
- One night of nocturnal species and frog searches.

Table 4-4: Minimum number of transects / plots required per vegetation zone area

Vegetation zone area (hectares)	Minimum number of transects/plots (Table 4: BAM)
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects
>20–50	4 plots/transects
>50–100	5 plots/transects
>100–250	6 plots/transects
>250–1000	7 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone
>1000	8 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone

Zone 1 required five plots and seven were completed, all of which were used for the BAM credit calculator analysis and all are provided in Appendix C.

Zone 2 required five plots and six were completed, all of which were used for the BAM credit calculator analysis and all are provided in Appendix C.

Zone 3 consists of cropped paddocks of corn and soybean. No plots were completed in this zone as the ground cover contained no native vegetation and the paddock trees were assessed under the streamline assessment.

Zone 4 required one plot. No plots were collected in this zone as the ground cover is a cropped corn paddock and consisted of no native vegetation. Estimated modelled data was used in the BAMC for this zone. Modelled data represents no native vegetation apart from the trees, other parameters were estimated and informed by operations during inspection of the trees.

Two plots were completed outside the development site where native vegetation had received applications of inorganic fertiliser previously. Both these plots indicated the area was continuing as native vegetation.

The survey effort for all threatened flora was consistent with the document published by OEH: *NSW Guide to Surveying Threatened Plants 2016.* Two surveyors walked or slowly drove 10 to 20m spaced transects across development sites. The exception to this was Crouches (a cropped corn paddock), Old 2 (a grassed and agriculturally managed paddock) and Old 3 (a paddock grazed and cropped with soybean). Show paddock was the subject of threatened species searches on foot, however personnel tracking devices were not used at this time.

Preliminary understanding of the vegetation was by inspection of the Namoi VIS 4467 GIS map layer. This mapping was then ground-truthed using a mobile GPS unit and GIS and was converted into polygons. The polygons were then mapped as PCTs and any identified Threatened Ecological Communities (TECs).

Surveys were used to identify variation within vegetation zones in the development site. The structure, function and composition condition of PCTs were then assessed in accordance with Chapter 5 of the BAM. Vegetation zones were assigned by comparing the dominant canopy species, general description of location and landscape position, soil type and other attributes described in the TSPD (OEH 2016b) and OEH online VIS classification database (OEH 2016c).

4.2.5 Determining the vegetation integrity score (Appendix 6 of the BAM):

The vegetation integrity scores according to the BAMC are:

- Zone 1 (86.99 hectares) is 20.4
- Zone 2 (95.75 hectares) is 7.5
- Zone 4 (0.59 hectares) is 6.1

Impact to Zone 1 will trigger offsetting as the vegetation integrity score is greater than 15 (as per section 10.3.1 of BAM). Offsetting is not triggered for Zone 2 and Zone 4 as the vegetation integrity score is less than 15.

Figure 4-5: vegetation integrity score

Zone	BAM item number	Area (ha)	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
1	1	86.99	10.5	54.2	15	20.4
2	2	95.75	5	5.7	15	7.5
4	3	0.59	10.3	0.6	38.2	6.1

4.3 Local data

Local benchmark data of BAM plots collected on the property have not been used for this assessment.

An understanding of the implications of applying organic fertiliser on the local native vegetation was gained by completing two BAM plots in areas adjacent to the development site and which had previously had inorganic fertiliser applied.

5 Threatened species

The following section addresses the potential presence of threatened flora and fauna species to be considered in the assessment of impacts and targeted surveys:

- Ecosystem credit species (predicted species) are predicted to occur based on their known presence or predicted presence in the IBRA subregion, the known association with PCTs and the size and condition of the vegetation patches on the site.
- Species credit species (candidate species) are those that cannot be reliably predicted from the habitat surrogates and their presence is to be assessed through habitat assessment and targeted surveys. When species credit species have habitat constraints within the development site, they require further consideration.

A default list of threatened species with potential to occur in the proposal was firstly identified using the assessment filtering tool in the BAMC. A background review was also conducted to confirm these and possible additional threatened species using the resources shown in Table 5-1.

Table 5-1: Wildlife databases used to identify potentially occurring threatened species

Database / resource	Search area	Date accessed
BAM credit calculator (BAMC)	New England Tablelands – Deepwater Downs IBRA > Inverell Plateau Granites > PCT510	28 March 2019
OEH NSW Atlas of Wildlife	Approximately 10 X10 kilometres centred on the development site	Approx. 30 Jan 2019
Protected Matters Search Tool (DEE)	10 kilometre radius around point in centre of Rangers Valley property.	30 March 2019
OEH Threatened Species Profile Database (TSPD)	Potential presence of vegetation class	Approx. 30 Jan 2019

Threatened species known to occur based on recorded sightings recorded on the OEH BioNet Species Sightings Database (Table 5-2 and Figure 5-1).

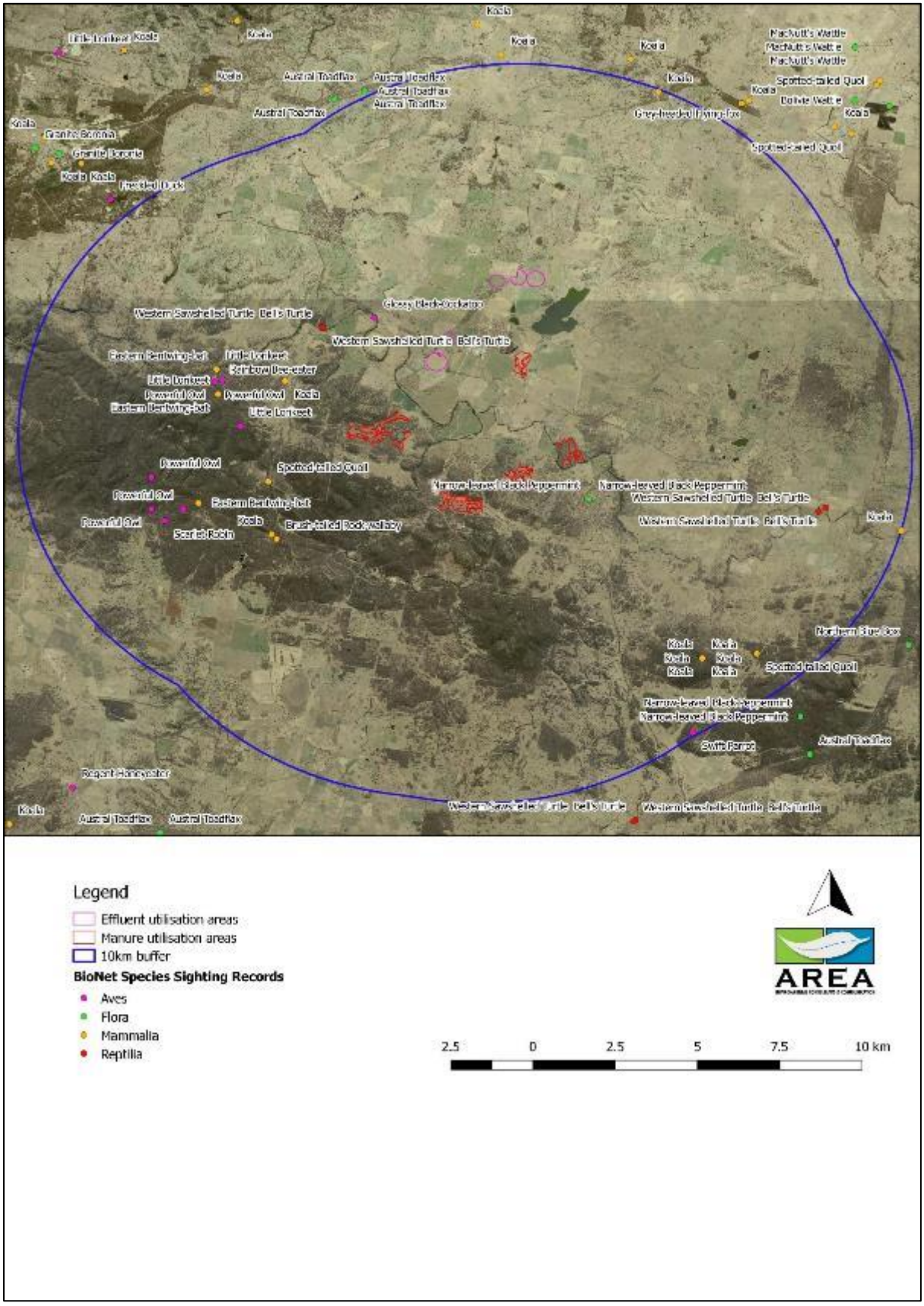
Table 5-2: Threatened species known within 10 kilometres of the development site (BioNet)

Kingdom Name	Class Name	Scientific Name	Common Name	NSW Status	Comm Status	Source	No of records
Fauna	Mammalia	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E1 P	V	BioNet	1
Fauna	Mammalia	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V P		BioNet	3
Fauna	Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V P 2		BioNet	1
Fauna	Mammalia	*Phascolarctos cinereus*	Koala	V P	V	BioNet	13
Fauna	Aves	*Glossopsitta pusilla*	Little Lorikeet	V P		BioNet	3
Fauna	Flora	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	BioNet	2
Fauna	Aves	*Ninox strenua*	Powerful Owl	V P 3		BioNet	5
Fauna	Aves	*Merops ornatus*	Rainbow Bee-eater	P	J	BioNet	2
Fauna	Aves	*Petroica boodang*	Scarlet Robin	V P		BioNet	3
Fauna	Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V P	E	BioNet	2
Fauna	Aves	*Lathamus discolor*	Swift Parrot	E1 P 3	CE	BioNet	1
Fauna	Reptilia	*Myuchelys bellii*	Western Sawshelled Turtle Bell's Turtle	E1 P	V	BioNet	4

E = Endangered
V = Vulnerable
P = Protected

J = Japan bilateral agreement

Figure 5-1: BioNet results within 10 kilometres of the proposal

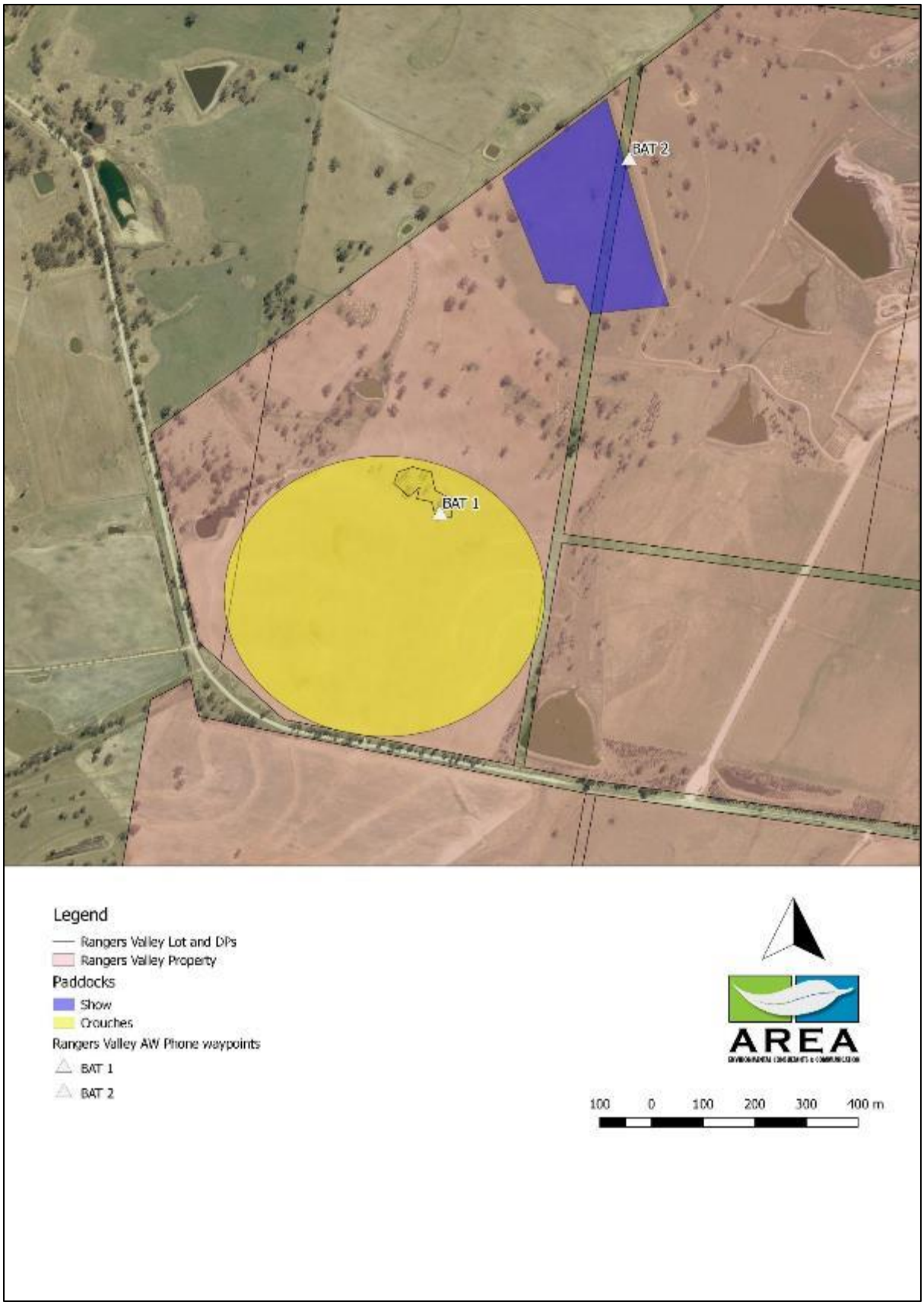

Legend
Effluent utilisation areas
Manure utilisation areas
10km buffer
BioNet Species Sighting Records
Aves
Flora
Mammalia
Reptilia
AREA
2.5
0
2.5
5
7.5
10 km

Bat recording was conducted at two locations over three nights to further seek to confirm the presence of threatened species in the development site (Table 5-3 and Figure 5-2).

Table 5-3: Bat recording data. # indicates threatened species.

		Machine: Bat 1			Machine: Bat 2		
Scientific name	Common name	Night 1	Night 2	Night 3	Night 1	Night 2	Night 3
Austronomus australis	White-striped Freetail Bat	x	x	x		x	
Chalinolobus gouldii	Gould's Wattled Bat	x	x	x	x	x	x
Chalinolobus morio	Chocolate Wattled Bat				x	x	x
Miniopterus orianae oceanensis #	Eastern Bent-winged Bat	x			x	x	x
Mormopterus planiceps	Southern Free-tailed Bat	x		x			x
Saccolaimus flaviventris #	Yellow-bellied sheath-tailed bat	x	x	x			
Scotorepens balstoni	Inland broad-nosed Bat					x	x
Vespadelus vulturnus	Little Forest Bat	x		x	x	x	x
Vespadelus darlingtoni	Large Forest Bat		x	x	x	x	
Vespadelus troughtoni #	Eastern Cave Bat		x	x	x		x
Vespadelus regulus	Southern Forest Bat	x	x		x		
Nyctophilus gouldi / geofroyii	Long-eared Bats					x	x
	Total calls	**158**	**164**	**108**	**88**	**102**	**612**

Figure 5-2: Bat monitoring device locations



5.1 Ecosystem credit species associated with PCTs on the development site as outlined in Section 6.2 of BAM

The BAMC assessment tool identified 23 threatened species reliably predicted to use the development site (Table 5-4). No surveys are required to confirm presence of these species. Ecosystem credits apply to these species as none of these have associated habitat constraints or geographical limitations provided by the BAMC.

5.1.1 List of ecosystem credit species derived

The derived ecosystem credit species as generated by the BAMC is provided in Table 5-4. This table also indicates which threatened species were identified in the BAMC paddock tree assessment – no additional species were identified. These species are subsequently assessed in conjunction with biodiversity values reported in Chapter 6 and potential impacts in Chapter 7.

Table 5-4: Threatened species reliably predicted to utilise PCT510 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion (Ecosystem species). Species highlighted in green are species also identified in the paddock tree BAM assessment. No additional species were identified in the paddock tree BAM assessment.

Scientific name	Common name	Habitat constraints	Sensitivity to gain class	NSW listing status	National listing status.
Anthochaera phrygia	Regent Honeyeater (Foraging)	N/A	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Chthonicola sagittata	Speckled Warbler	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Daphoenositta chrysoptera	Varied Sittella	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Dasyurus maculatus	Spotted-tailed Quoll	N/A	High Sensitivity to Potential Gain	Vulnerable	Endangered
Falsistrellus tasmaniensis	Eastern False Pipistrelle	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Glossopsitta pusilla	Little Lorikeet	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle (Foraging)	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Lathamus discolor	Swift Parrot (Foraging)	N/A	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
Lophoictinia isura	Square-tailed Kite (Foraging)	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed

Scientific name	Common name	Habitat constraints	Sensitivity to gain class	NSW listing status	National listing status.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Neophema pulchella	Turquoise Parrot	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox connivens	Barking Owl (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Petroica boodang	Scarlet Robin	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Petroica phoenicea	Flame Robin	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Phascolarctos cinereus	Koala (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Stagonopleura guttata	Diamond Firetail	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed

5.1.2 Justification for exclusion of any ecosystem credit species predicted

No ecosystem credit species were excluded from this assessment.

5.2 Identify species credit species in the development site

This section has BAMC outputs showing which species credit species are predicted by the BAMC in the development site. The full list of 18 candidate species is provided in Table 5-6. This list includes one species in addition to those listed by the BAMC. This species is the Eastern Cave Bat, *Vespadeuls troughtoni,* which was recorded by the bat monitors used for this assessment.

After the field assessment this list of species credit species was reviewed and exclusions from the BAMC candidate species list were made as appropriate.

5.2.1 Justification for exclusion of any species credit species predicted

Species credit species listed in Table 5-5 were excluded because survey confirmed the species was:

- Not present or
- Unlikely to be present or
- Unlikely to use the suitable habitat in the development site

Nine species have been excluded from further assessment. This is justified in Table 5-5.

Table 5-5: Species credit species excluded from further survey

Species credit species excluded		Reason			Explanation
Scientific name	Common name	Species not present	Species unlikely to be present	Unlikely to use the suitable habitat	
Adelotus brevis - endangered population	Tusked Frog population in the Nandewar and New England Tableland Bioregions		X		No suitable wet habitat un the development site. This proposal avoids waterways. Further, areas within the proposal are not moist or cryptic areas and are cropped or grazed.
Anthochaera phrygia	Regent Honeyeater (Breeding)		X		The proposal is not in an area of mapped Regent Honeyeater Breeding areas (OEH pers com 2019). There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region.
Dichanthium setosum	Bluegrass	X			Transects walked across all grassed areas in the proposal and species was not found. Unlikely to be present in grazed, cropped or pasture improved sites.
Diuris pedunculata	Small Snake Orchid		X		No suitable habitat as the area. This species requires moist areas which are often peaty soils and amongst boulders. Areas within the development site are in flat open country which is grazed or cropped.
Eucalyptus magnificata	Northern Blue Box		X		Not recorded in development sites and unlikely to have been missed during the assessment.
Eucalyptus nicholii	Narrow-leaved Black Peppermint		X		Not recorded in development sites and unlikely to have been missed during the assessment.
Lathamus discolor	Swift Parrot (Breeding)		X	X	Breeds in Tasmania. The vegetation within the proposal does not constitute high quality foraging habitat. Foraging in habitat within the development site is addressed in Ecosystem Credits.
Lophoictinia isura	Square-tailed Kite			X	Square-tailed Kites nest on horizontal branches in mature living trees, especially eucalypts, often near water, and they need extensive areas of forest or woodland surrounding or nearby. Square-tailed Kites would be more likely to nest in the adjacent woodland, and less likely to nest in the development site.

Species credit species excluded		Reason			Explanation
Scientific name	Common name	Species not present	Species unlikely to be present	Unlikely to use the suitable habitat	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)		X		Roosting habitat for this species is primarily caves, as well as derelict mines, storm-water tunnels, buildings or other man-made structures.
Ninox connivens	Barking Owl (Breeding)		X		Breeding is commonly in areas of dense shady foliage/ dense tall midstratum vegetation, which is not present in the development site. Sometimes in heavily cleared landscapes, the species can breed along timbered waterways – also not within the development site.
Phascolarctos cinereus	Koala (Breeding)		X	X	Koalas are unlikely to be breeding in trees in the proposal are located within semi-cleared landscape where trees are in low density. Koalas are particularly unlikely to be breeding in habitat trees to be removed by the proposal as they are removed from substantial tree cover.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)		X		Breeding areas for this species are commonly in vegetation with a dense canopy which is not present within the development site.
Thesium australe	Austral toadflax		X		Recorded during the assessment, outside the development site. No suitable habitat in the development site. Areas within the proposal are outside buffers around waterways and are either grazed or cropped or managed for improved pasture.

5.2.2 List of candidate species

17 species credit species were identified by the BAMC as having potential to use habitat in the development site. One other species, Eastern Cave Bat, *Vespadeuls troughtoni,* was added to this list as it was recorded at the site during the assessment. The highlighted species have been included in the species credit calculations.

Table 5-6: Candidate species credit species (BAMC)

Scientific name	Common name	Sensitivity to gain class	NSW listing status	National listing status.
Adelotus brevis - endangered population	Tusked Frog population in the Nandewar and New England Tableland Bioregions	Very High Sensitivity to Potential Gain	Endangered Population	Not Listed
Anthochaera phrygia	Regent Honeyeater (Breeding)	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Dichanthium setosum	Bluegrass	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Diuris pedunculata	Small Snake Orchid	High Sensitivity to Potential Gain	Endangered	Endangered
Eucalyptus magnificata	Northern Blue Box	High Sensitivity to Potential Gain	Endangered	Not Listed
Eucalyptus nicholii	Narrow-leaved Black Peppermint	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle (Breeding)	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hoplocephalus bitorquatus	Pale-headed Snake	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Lathamus discolor	Swift Parrot (Breeding)	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
Lophoictinia isura	Square-tailed Kite (Breeding)	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)	Very High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox connivens	Barking Owl (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Phascolarctos cinereus	Koala (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Thesium australe	Austral Toadflax	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Vespadelus troughtoni	Eastern Cave Bat	Very High Sensitivity to Potential Gain	Vulnerable	Not Listed

5.2.3 Indication of listed flora or fauna presence based on targeted survey or expert report

Bat recording devices confirmed the presence of three threatened microbat species:

- *Miniopterus orianae oceanensis* – Eastern Bent-winged Bat
- *Saccolaimus flaviventris* - Yellow-bellied sheath-tailed Bat
- *Vespadelus troughtoni* – Eastern Cave Bat

5.2.4 Details of targeted survey technique, effort, timing and weather

Terrestrial flora surveys

Targeted flora surveys occurred during 4 to 8 February at the Rangers Valley property During this time BAM vegetation plots were completed, and threatened species search transects were conducted.

Targeted flora surveys in the development site were undertaken for all identified candidate flora species following the methods described in *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft* (DEC 2004) and the *NSW Guide to Surveying for Threatened Plants* (OEH 2016). A combination of 10m to 20m transects in impact footprints, floristic plot surveys (per BAM 2017) and random meander surveys (Cropper 1993) further afield were undertaken to identify, search and record any candidate species.

Threatened species transects were less systematic in the effluent utilisation areas which were more isolated from patches of vegetation, consisted of a homogeneous cropped ground cover or were the subject of intensive grazing or other agricultural management.

While tracks cannot be seen in Figure 5.4 in Show, this area was the subject of threatened species transects.

Figure 5-3 to Figure 5-6 show survey transects as tracks, BAM plot locations and bat recording device locations.

Figure 5-3: Proposal survey effort – Figure 1 of 3. Plot location and search tracks

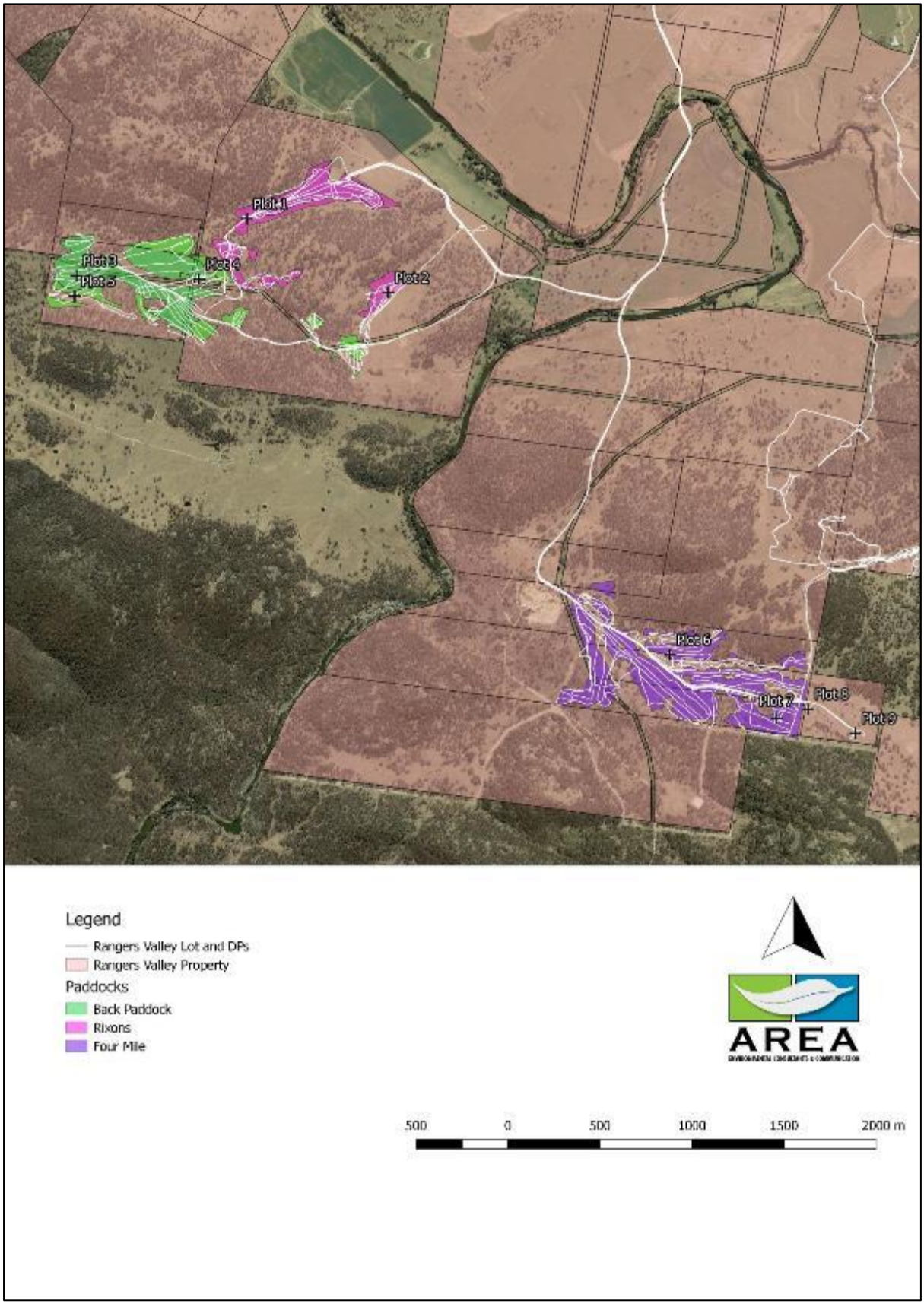


Figure 5-4: Proposal survey effort – Figure 2 of 3. Plot location and search tracks

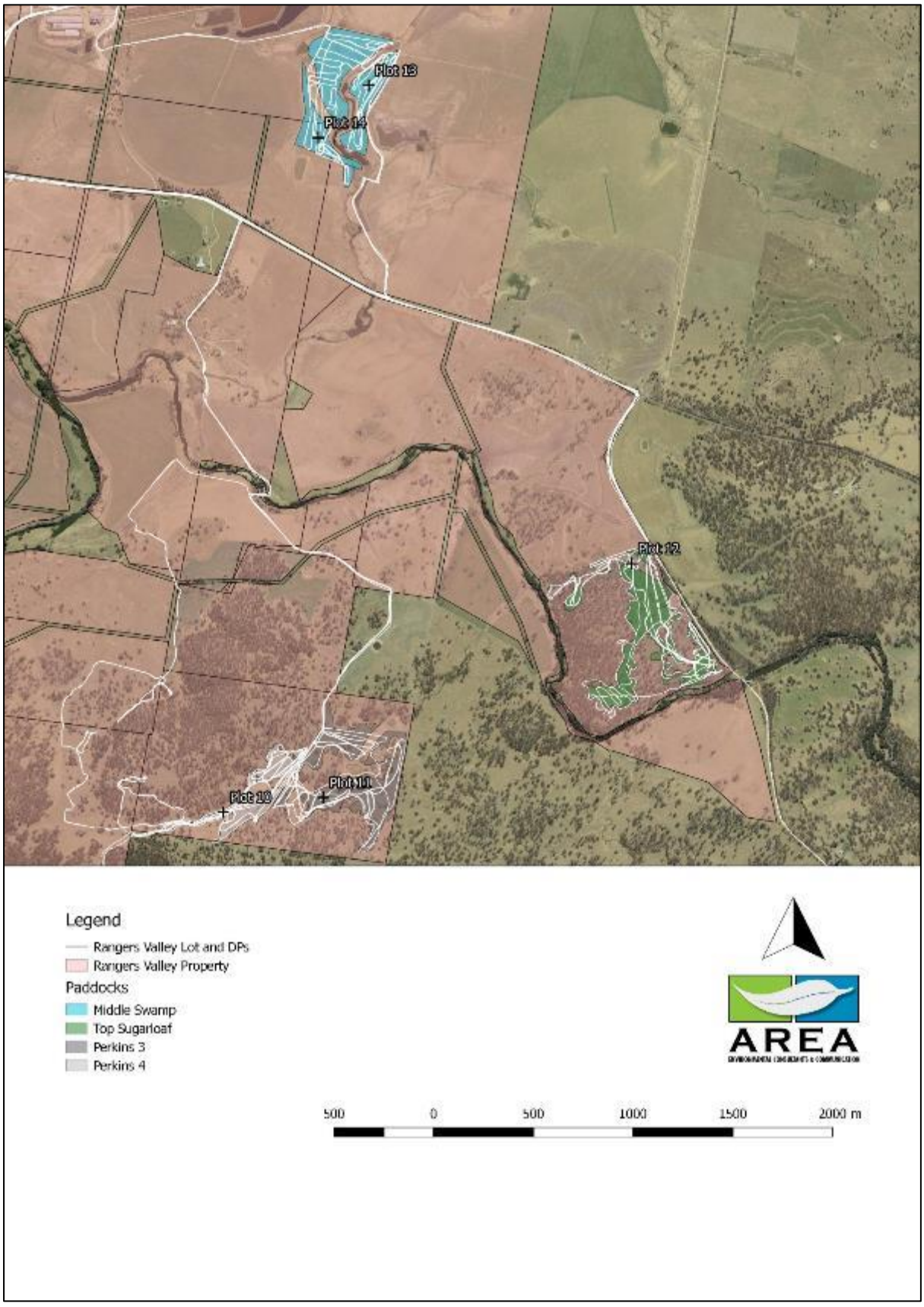


Figure 5-5: Proposal survey effort – Figure 3 of 3. Plot location and search tracks

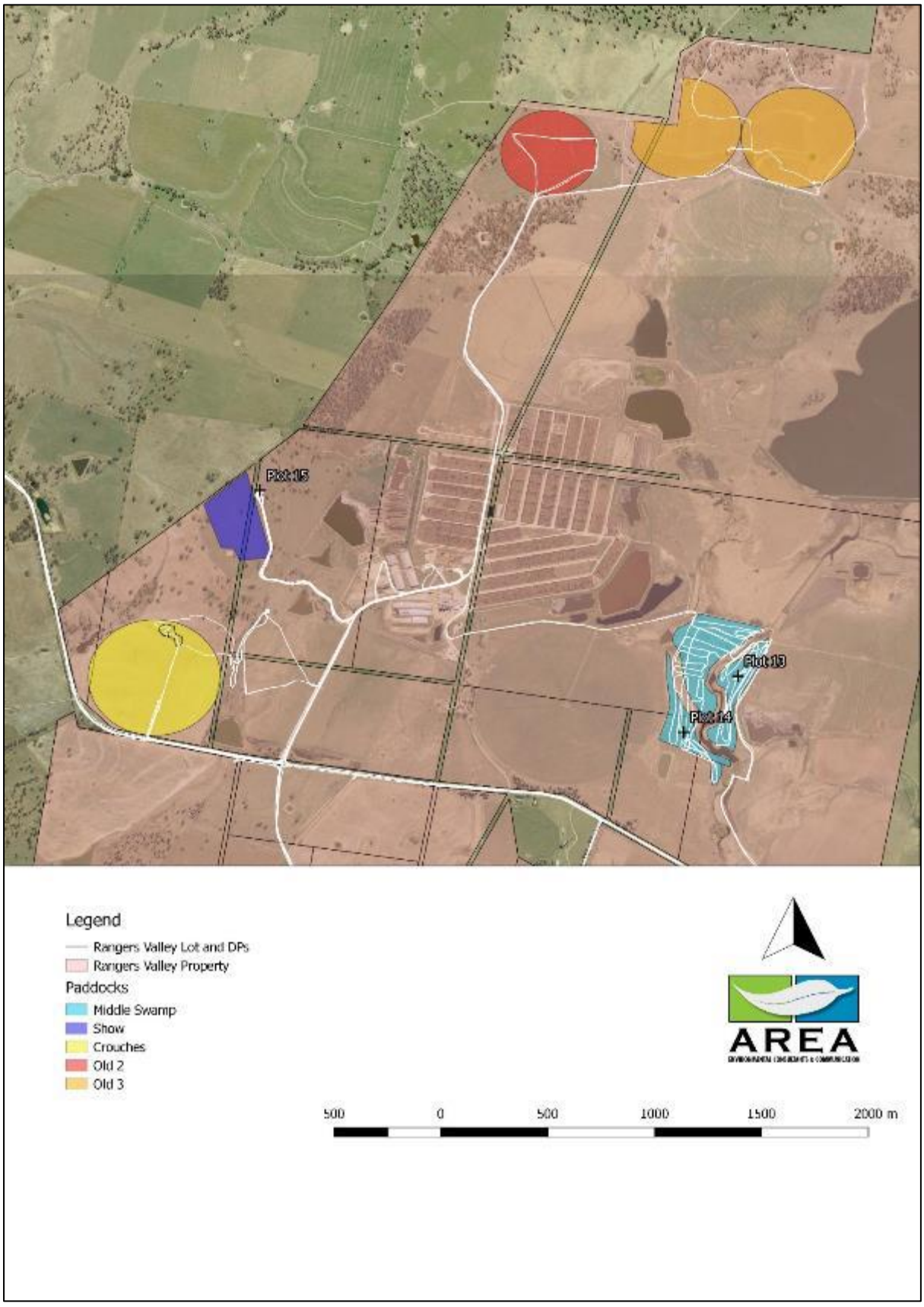
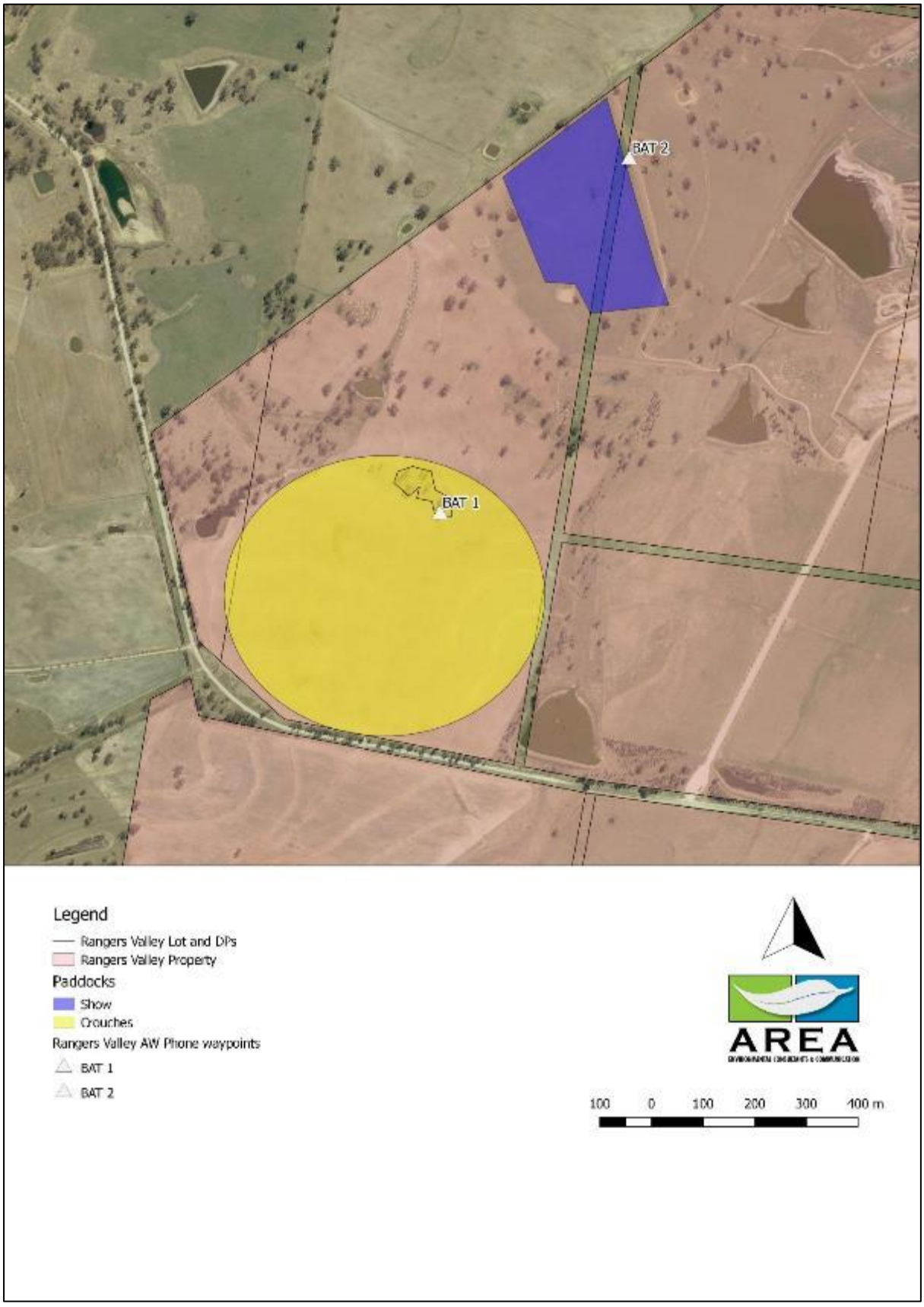


Figure 5-6:Proposal survey effort – Microbat monitoring. Survey nights of 5, 6 and 7 February 2019



5.2.5 Species polygons

The species in Table 5-7 have been identified in the BAMC and have potential to occur in the development site.

Table 5-7: Threatened species requiring a species polygon

Scientific name	Common name	Sensitivity to gain class	NSW listing status	National listing status.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle (Breeding)	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hoplocephalus bitorquatus	Pale-headed Snake	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Vespadelus troughtoni	Eastern Cave Bat	Very High Sensitivity to Potential Gain	Vulnerable	Not Listed

Individual species habitat polygons requested by BAM have been provided in Figure 5-7 to Figure 5-11.

Figure 5-7: Species polygons for Glossy Black-Cockatoo (breeding)

Large living or dead trees with hollows greater than 15cm which will be removed by the proposal.

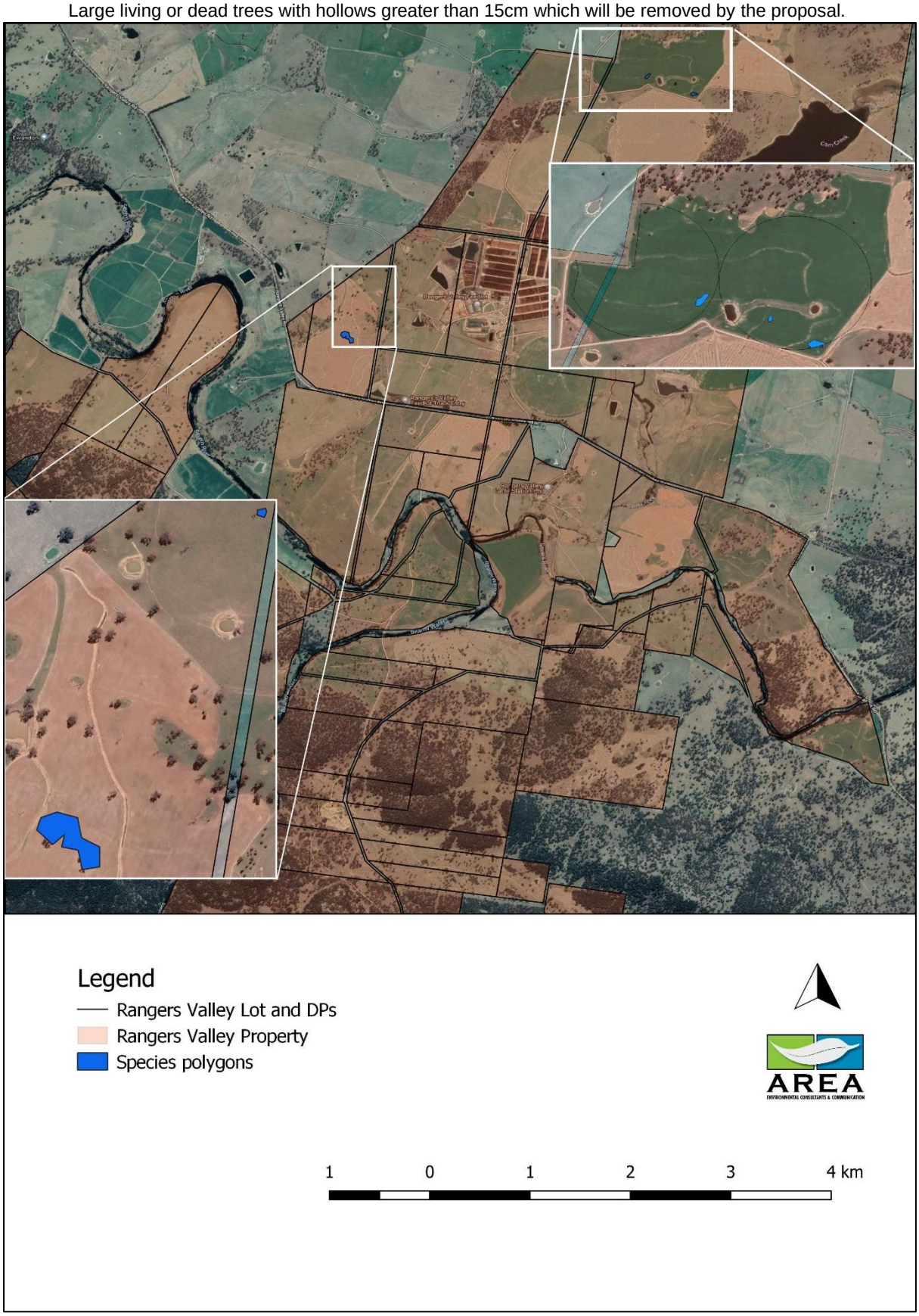


Figure 5-8: Species polygons for White-bellied Sea Eagle (breeding)

Development site where trees occur within 1km of a major waterway (Severn River, Beardy Waters and Rangers Valley Dam) and trees to be removed within 500m of this area.

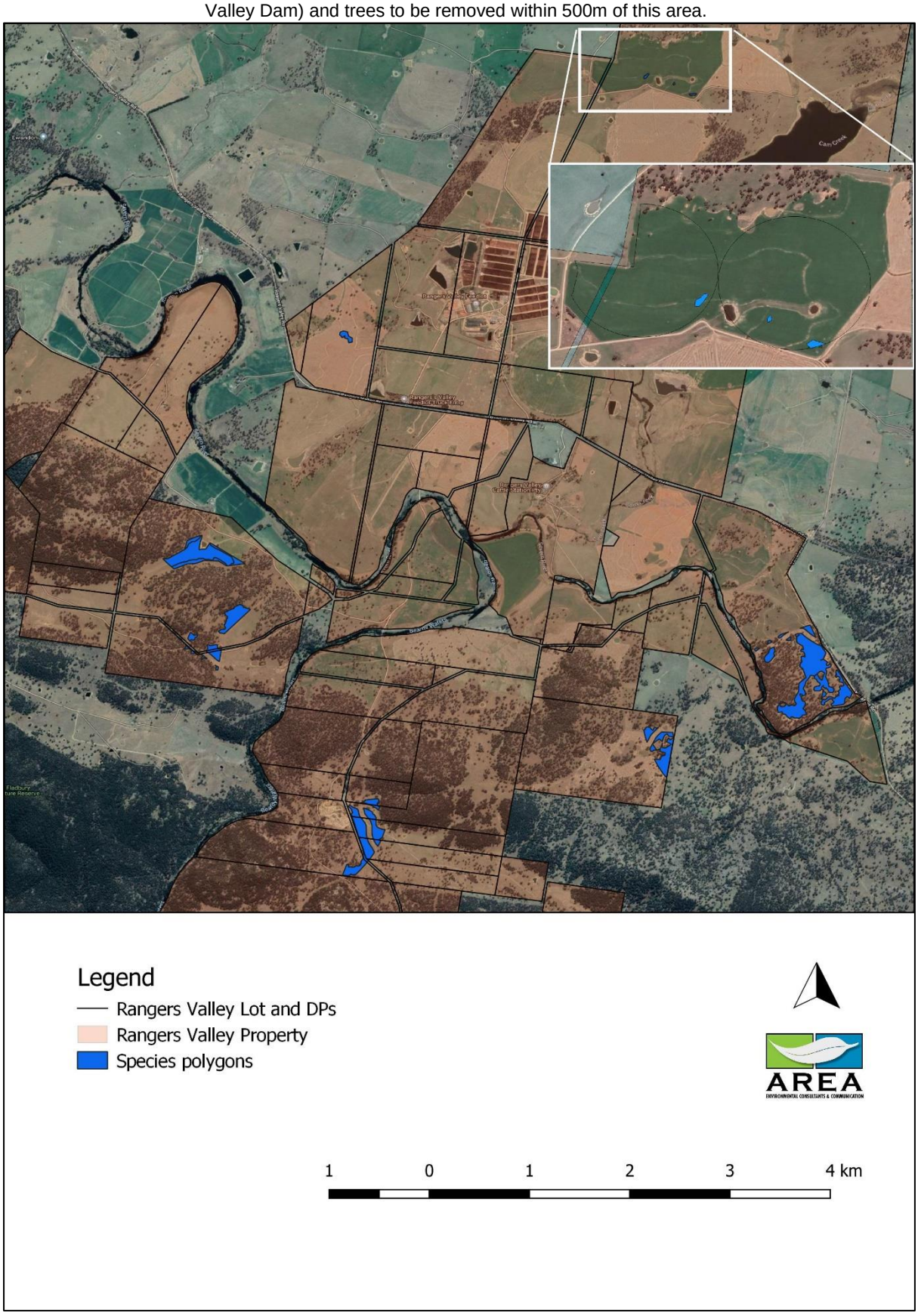


Figure 5-9: Species polygons for Little Eagle (breeding)

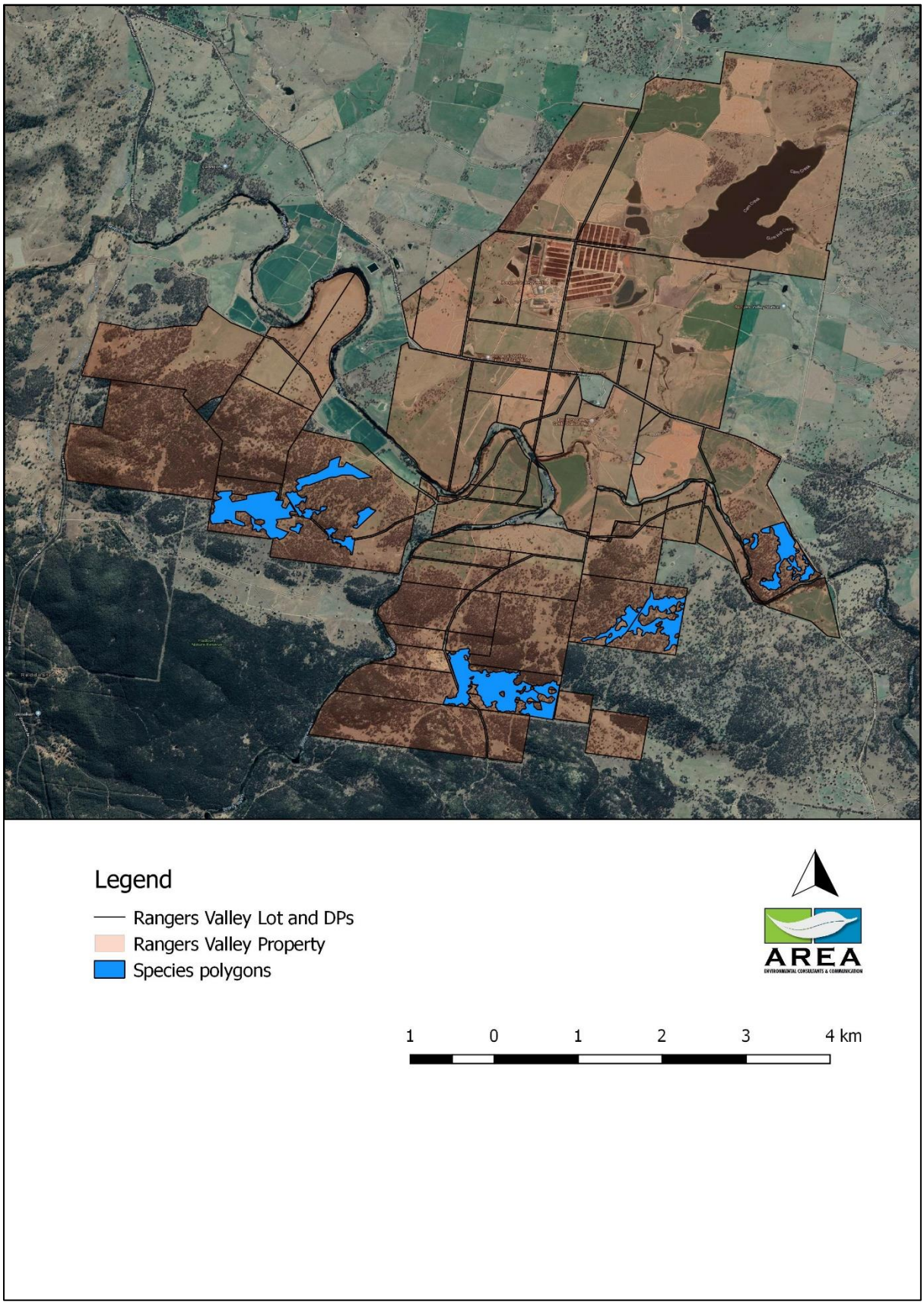


Figure 5-10: Species polygons for Pale-headed Snake

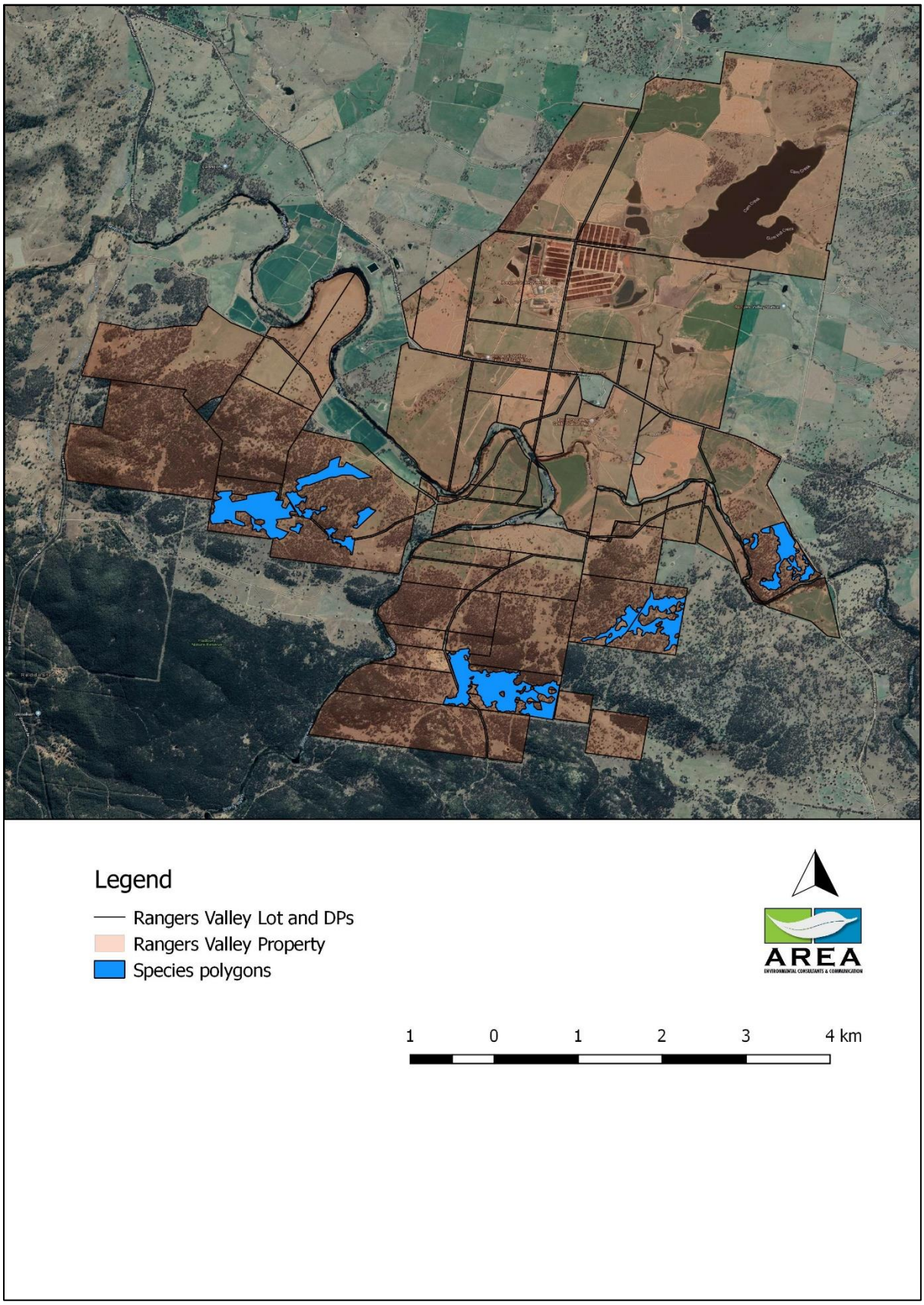
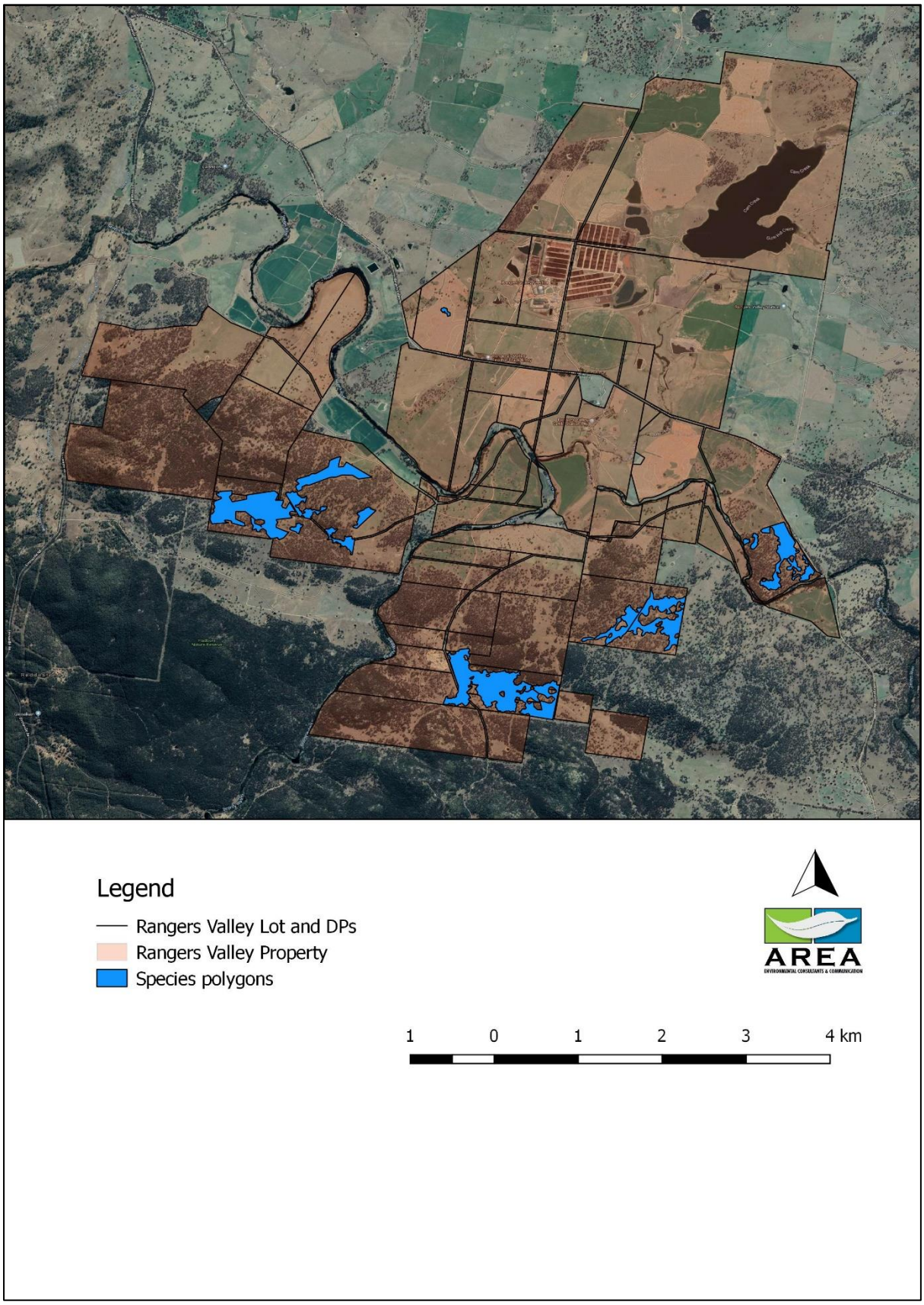


Figure 5-11: Species polygons for Eastern Cave Bat.



5.2.6 Biodiversity risk weighting for the species

The biodiversity risk weighting is based on the combination of two components: sensitivity to loss score and sensitivity to potential gain score using the criteria listed in Appendix 7 of BAM (2017). Sensitivity to potential gain considers the ability of a species to respond to improvements in habitat condition at an offset site.

Risk weighting for each species listed as affected by the proposal has been provided in Table 5-8

Table 5-8: Sensitivity to Potential Gain for species that may be affected by the proposal (source BAM Calculator)

Scientific name	Common name	Biodiversity risk	Sensitivity to gain	Biodiversity risk weighting
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	High	High Sensitivity to Potential Gain	2
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	High	High Sensitivity to Potential Gain	2
Hieraaetus morphnoides	Little Eagle (Breeding)	Moderate	Moderate Sensitivity to Potential Gain	1.5
Hoplocephalus bitorquatus	Pale-headed Snake	High	High Sensitivity to Potential Gain	2
Vespadelus troughtoni	Eastern Cave Bat	Very High	Very High Sensitivity to Potential Gain	3

5.2.7

5.2.8 Threatened species survey

The targeted threatened species assessment focused on listed species precited to occur in PCT510 following all requisite guidelines to detect these species in the proposal. Local experience, previous survey of the region, preliminary reporting and information held on government databases and archives were also used to inform the assessment.

Assessment in the development site occurred over five days in February 2019.

Where assessment was not sufficient to confirm the absence of species, the species was assumed to be present.

5.3 Use of local data

No local data were used in this BDAR.

5.3.1 How is this local data relevant to the development site?

No local data were used in this

5.4 Were expert reports used in place of targeted survey?

No expert reports were used in this BDAR.

STAGE 2 BAM: IMPACT TO BIODIVERSITY VALUES

6 Matters of National Environmental Significance (MNES)

6.1 Threatened species

There are 33 MNES listed threatened species, 11 listed migratory and 18 listed marine species with potential to occur in the development site (Table 6-1, Appendix D).

Table 6-1: MNES summary

MNES	Result	Comment
World Heritage Properties	None	
National Heritage Places	None	
Wetlands of International Importance	3	All are located more than 1100 kilometres from the development site
Great Barrier Marine Park	None	
Commonwealth Marine Area	None	
Listed Threatened Ecological Communities	3	One occurs in the development site
Listed Threatened Species	33	22 are not identified by NSW searches
Listed Migratory Species	11	Birds that will not be affected by the proposal
Commonwealth Land	None	
Commonwealth Heritage Places	None	
Listed Marine Species	18	Birds that will not be affected by the proposal
Whales and other Cetaceans	None	
Critical Habitats	None	
Australian Marine Parks	None	
Commonwealth Reserves Terrestrial	None	
State and Territory Reserves	1	Fladbury Nature Reserve is located approximately 1 kilometre from the development site at the closest point
Forest Regional Agreements	1	North East NSW RFA
Invasive Species	23	
Nationally Important Wetlands	None	
Key Ecological Features (Marine)	None	

Twenty-two species are highlighted in the MNES report that are not listed under NSW legislation and the BAMC generated list of threatened species. These include;

- Five birds
- One fish
- Four mammals
- Ten plants
- Two reptiles

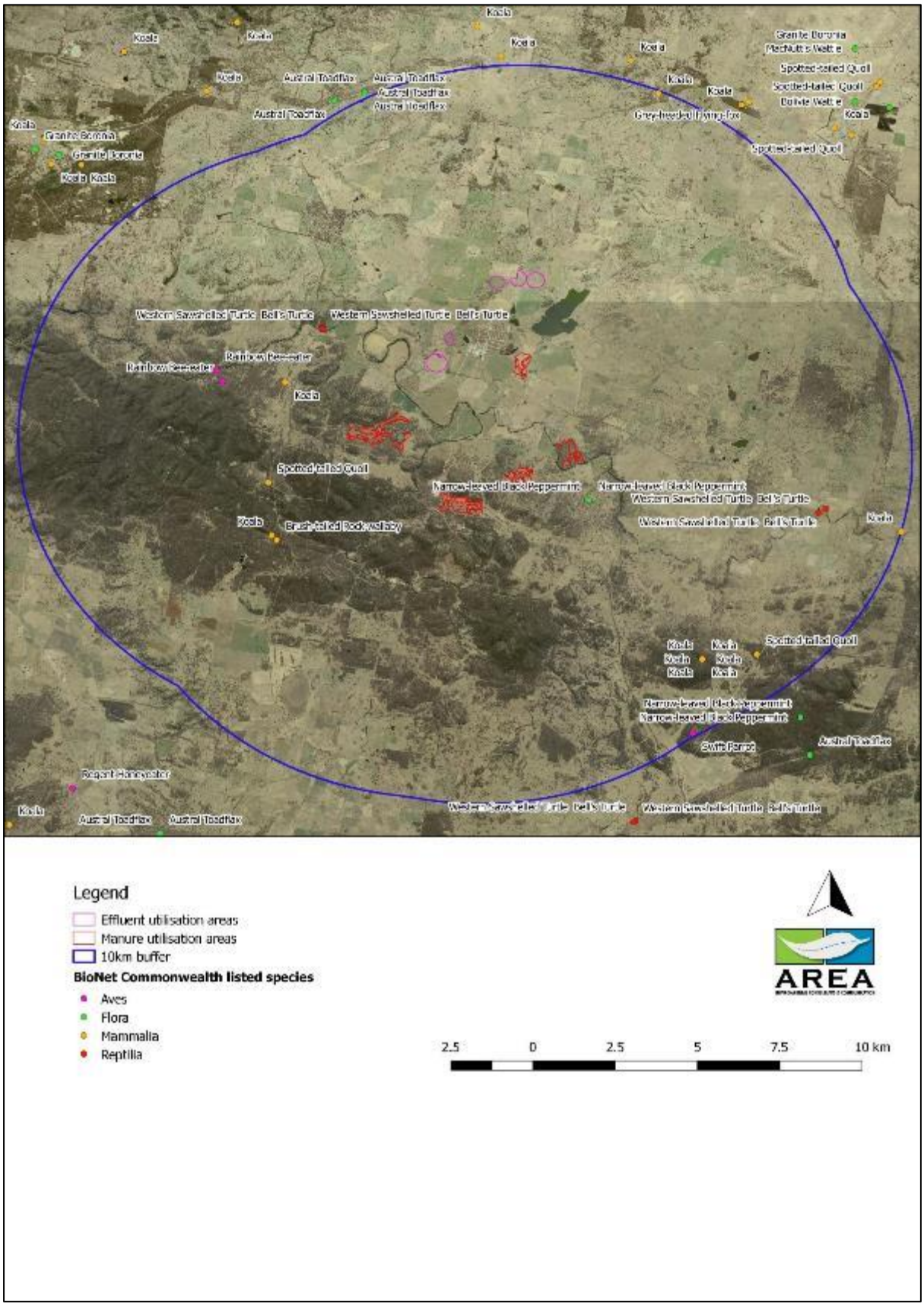
Seven species of Commonwealth listed fauna or flora are known to occur within 10 kilometres from the development site (Table 6-2 and Figure 6-1). Three Commonwealth listed threatened species have been recorded within 1500 metres of the development site.

Table 6-2: Commonwealth listed flora and fauna within 10 kilometres. Green highlight indicates species previously recorded within 1500m on BioNet.

Kingdom Name	Scientific Name	Common Name	NSW Status	Comm Status
Fauna	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V
Fauna	*Phascolarctos cinereus*	Koala	V	V
Flora	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V
Fauna	*Merops ornatus*	Rainbow Bee-eater	P	J
Fauna	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E
Fauna	*Lathamus discolor*	Swift Parrot	E	CE
Fauna	*Myuchelys bellii*	Western Sawshelled Turtle/ Bell's Turtle	E	V

CE=Critically Endangered, E = Endangered, V= vulnerable, P = Protected, J = Japan bilateral agreement.

Figure 6-1: Commonwealth listed species within 10 kilometres of the development site



6.2 Migratory species

Eleven migratory species listed under the EPBC Act may potentially occur within the development site. (EPBC Act Protected Matters Report). None of these are known to occur within 10 kilometres of the development site.

7 Minimise impacts

7.1 Demonstration of efforts to avoid and minimise impact on biodiversity values

This section has been completed in accordance with Chapter 8 of BAM (2017).

- The development site is 253.16 hectares
- 183.33 hectares are mapped as native vegetation
- 69.83 hectares are mapped as Not Native vegetation (cropped paddocks)
- One described Plant Community Types (PCT) occurs in the development site:
    - PCT510 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion This community is an endangered ecological community (White Box Yellow Box Blakely's Red Gum Woodland (Part)) under the BC At and a critically endangered ecological community (White Box Yellow Box Blakely's Red Gum Woodland (Part)) the EPBC Act.

Vegetation Zones are allocated based on a measurement of ground cover quality (percent native cover of total living ground cover):

- Zone 1 – Areas with more than 50 percent native ground cover
    - Manure utilisation areas - no tree removal required
- Zone 2 – Areas with between zero and 50 percent native ground cover.
    - Manure utilisation areas – no tree removal required
    - Effluent utilisation areas - removal of 24.44 hectares native vegetation
- Zone 3 – Areas with zero percent native ground cover - current cropped paddock
    - Effluent utilisation areas - removal of five living paddock trees and two dead paddock trees
- Zone 4 – Area with zero native ground cover - current cropped paddock
    - Effluent utilisation area – removal of 0.59 hectare patch of living trees (12 trees)

The vegetation and threatened species assessment occurred in February 2019. Based on the results of this assessment the following changes were made to the impact footprint to avoid and minimise impact to biodiversity values.

Avoidance of impacts:

- Clearing of native vegetation was originally more extensive in Show paddock. One BAM 2017 vegetation plot in this site demonstrated the ground cover was not native as greater than 50 percent of the cover was not native species. This site also contained 21 trees within the impact footprint and 20 of these being large trees for this PCT. Further, six had large hollows (>20 centimetres diameter), and ten had hollows <20 centimetres diameter. Six were dead trees.

  This area of this impact was significantly reduced such that three trees remain within the impact footprint all of which are dead. All are in the large tree class for this PCT and two have hollows and one has a large hollow.

- An area of approximately 1.61 hectares was included as part of the Perkins 4 site for biodiversity assessment. No plots were completed in this area however AREA ecologists informed the proponent that this area contained a predominantly native ground cover, habitat values including hollows, fallen timber and rocks occurred in the area. In addition, access to this area would require removal of more native vegetation, which was likely to require offsetting.
  This site was removed from the proposal.

- The area identified for clearing associated with the Crouches paddock was initially 38 hectares. Crouches paddock is a cropped paddock however the initial footprint included not only the trees in a group in the centre of the paddock which are part of the current proposal, but also a section of planted and regenerating native woodland to the east of the paddock. The vegetation was not assessed to confirm any additional information. Based on the advice from AREA ecologists, the proponent reduced the area to be cleared from the Crouches site to avoid all native vegetation outside the bounds of the paddock and reduce the number of trees to be removed within the paddock bounds.

Refer to the mitigation measures in Section 8.

7.2 Assessment of direct and indirect impacts unable to be avoided at the development site

This section has been completed in accordance with Sections 9.1 and 9.2 of BAM (2017). The assessment includes but is not limited to type, frequency, intensity, duration and consequence of impact.

7.2.1 Removal of native vegetation (residual impact)

Removal of vegetation impact will occur in the effluent utilisation areas only. Vegetation removal can also be described as:

- Crouches
  - 0.59 hectares of PCT510
  - **One dead paddock tree** (20 – 50 centimetres Diameter at Breast Height (DBH), with a hollow <20 centimetres diameter)
- Show
  - 8.55 hectares of PCT510
- Old 2
  - 15.89 hectares of PCT510
- Old 3
  - **Five living paddock trees** to be removed
    - One *Eucalyptus caliginosa* (20 – 50 centimetres DBH, with hollow <20 centimetres)
    - One *Eucalyptus bridgesiana* (>50 DBH, Hollow >20 centimetres)
    - Three *Eucalyptus melliodora* (two 20 – 50 centimetres DBH and one >50 centimetres DBH, all with hollows <20 centimetres diameter)
  - **One dead paddock tree** to be removed (>50 centimetres DBH with hollow <20 centimetres diameter)

The loss of PCT510 in the effluent utilisation area equates to 13.65 percent of the PCT510 mapped within the development site.

Residual impact to the manure utilisation areas will not include removal of trees and it is expected native ground cover will persist in the areas where it currently exists. Some native ground cover species such as Poa species, which also occur in low abundance in areas mapped as Zone 2 (less than 50% native vegetation ground cover) are also expected to persist and increase cover as a result of this proposal (Section 9.1.1).

PCT510 on this site represents a threatened ecological community as listed as an endangered ecological community under the BC Act and as critically endangered under the EPBC Act.

Table 7-1: Residual impact to native vegetation.

Zone	Formation	Class	Plant Community Type (PCT) Name	Type of impact	Hectares in development site
1	Grassy Woodlands	New England Grassy Woodlands	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	No native vegetation removed	86.99
2				Removal of 25.03 hectares of native vegetation	95.75
3	Cropped paddock	N/A	N/A Remnant paddock trees	Five living and two dead paddock trees removed	69.82
4	Grassy Woodlands	New England Grassy Woodlands	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Removal of 0.59 hectares of native vegetation	0.59

7.2.2 Removal of habitat for threatened fauna species

The potential impact to threatened fauna and their habitat would occur during clearing of habitat in the short-term and over the long-term through reduction in availability of habitat for sedentary and transient local populations, and possibly movements of species through the landscape.

In the effluent utilisation areas, the proposal would reduce the number of tree hollows and reduce the availability of perching/ resting/ shelter resources.

7.2.3 Loss of food resources

The clearing of trees in the effluent utilisation areas would result in a loss of habitat by reducing the availability of nectar resources and has low potential to affect threatened nectar feeding birds, microbats and birds of prey mostly associate with PCT510.

Woodland possesses different bark types and canopy structures of which are a source of multiple food resources such as seeds, lerps and gum / resin and attract a diversity of invertebrates, again mostly associated with PCT510.

Impact to this habitat by removing trees in the effluent utilisation areas would reduce foraging habitat for birds, microchiropteran bats, and raptors by reducing prey (ground-dwelling, arboreal mammals, birds and reptiles).

7.2.4 Loss of tree hollows and woody debris (sheltering and breeding habitat)

Trees with hollows will be removed in the effluent utilisation areas.

A total of seven paddock trees and 15 trees in PCT510 will be removed:

- In Crouches:
  - 12 trees as PCT510 – Four contain hollows <20 centimetres diameter at breast height
  - One dead paddock tree with no hollows.
- In Show
  - Three dead trees as PCT510 – Two have hollows <20 centimetres diameter at breast height; one has a hollow >20 centimetres diameter at breast height
- In Old 3

- Five living paddock trees – Four have hollows <20 centimetres diameter at breast height; One has a hollow >20 centimetres diameter at breast height
- One dead paddock tree – has a hollow <20 centimetres diameter at breast height

Loss of tree hollows is Key Threatening Process listed under the BC Act.

Ground logs benchmark for PCT510 is 26m. Given the agricultural landscape within which the proposal is situated, the presence of logs greater than 10 centimetres diameter is minimal. Such logs were only identified in four of the 15 plots and mostly in low metre counts. Plot 15 had 33 metres of logs on the ground – this area was subsequently removed from the development site.

7.2.5 Loss of dams (breeding and foraging habitat for wetland dependent species)

No dams or other waterways will be removed by the proposal,

Farm dams on the property had recently been cleaned out at the time of the assessment and were virtually dry.

Dams / water retention areas can seasonally provide shelter and food resources for wide-ranging and transient wetland and migratory bird species, and for sedentary wetland dependent fauna species as frogs. They may be used as important refuge or dispersal habitat for frogs or as a drought refuge for birds.

There is no 'critical habitat' as listed under the BC Act identified in the development site for threatened wetland dependent biota.

7.2.6 Removal of threatened plants

No threatened plants will be removed as part of this proposal.

7.3 Assessment of indirect impacts

7.3.1 Aquatic impacts

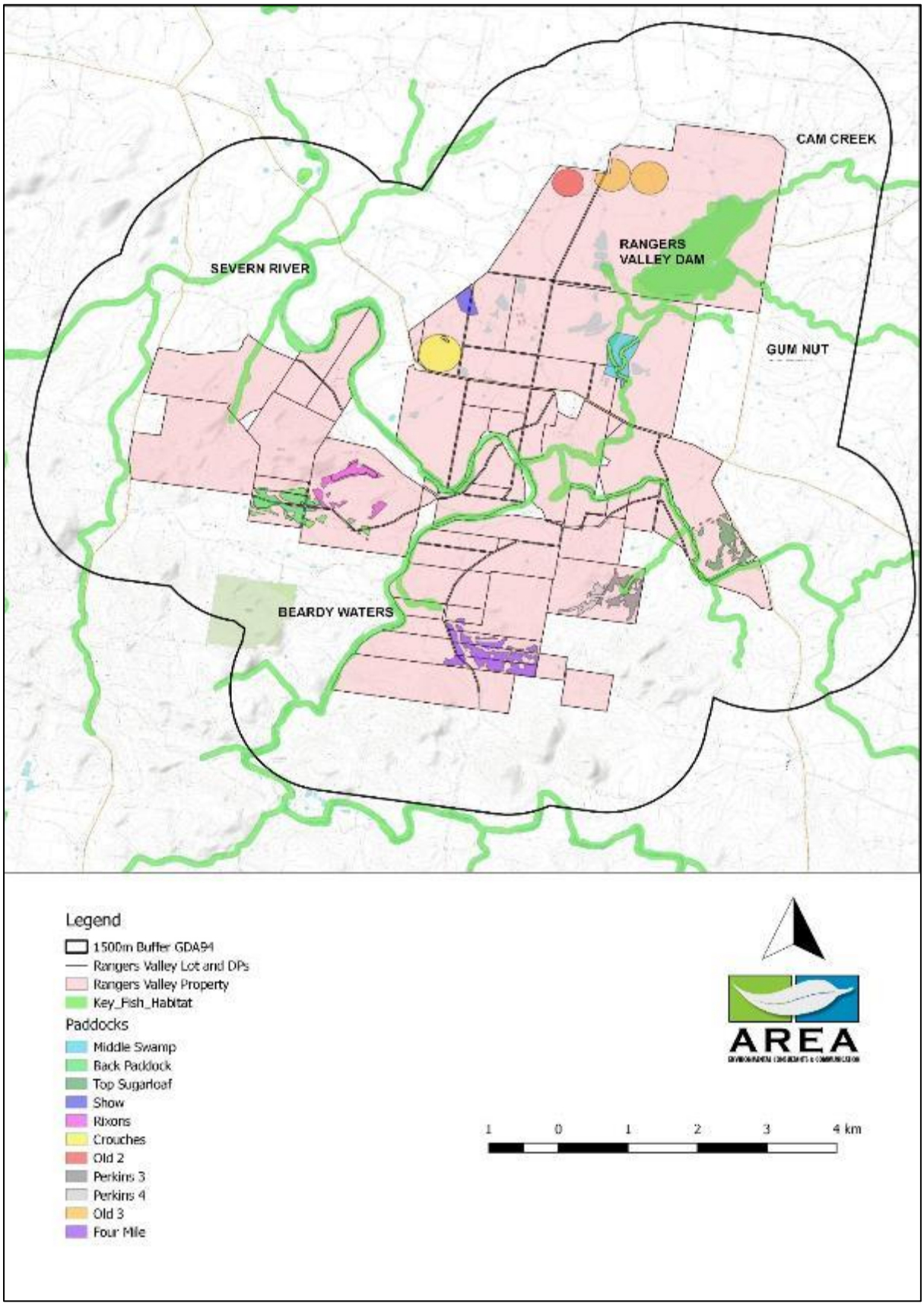
There are natural drainage lines in the development site, but operation of the proposal will not directly impact these.

The proposal traverses protected riparian buffers mapped as Key Fish Habitat (KFH). Buffers have been applied to all mapped drainage lines, including those area mapped as KFH to avoid contact with riparian zones. These buffers are the same as, or more than, is required based on the Strahler order buffers stipulated in Table 14 of the BAM.

This proposal will not involve the removal of vegetation or habitat features from waterways, dredging or otherwise obstructing fish passage, changes to surface water drainage lines or changes to the banks of waterways. The proposal does not require a permit for development with Key Fish Habitat. Manure utilisation areas within areas of Key Fish Habitat are currently grazed by cattle so processes associated with nutrients are existing in this environment.

With respect to water quality changing hydraulic chemistry, the NSW EPA is responsible for issuing an Environmental Protection Licence (EPL) to the proponent of the proposal. The proponent has an existing EPL which includes water monitoring requirements. Where monitoring triggers detects an exceedance of acceptable levels then a remediation order will be used to enact management measures to ensure water, quality is not affected. Standard safeguards within the EPL will protect all aquatic threatened species.

Figure 7-1: Key Fish Habitat



7.3.2 Groundwater dependent ecosystems

The desktop review identified groundwater dependent ecosystems on the development site. The proposal is not expected to impact or change groundwater flows.

7.3.3 Changes to hydrology

The proposal will result in negligible changes surface drainage. The proposal is unlikely to negatively impact on present surface or groundwater hydrology and surface topography is not being altered. Additional runoff as a result of tree removal is expected to be minimal and will not require any change of land management.

7.3.4 Fragmentation of identified biodiversity links and habitat corridors

Existing habitat will not be fragmented as connection through Rangers Valley will be maintained as residual native vegetation within PCT150. Habitat linkages surrounding the development site and some areas of habitat within the site will remain and may still be utilised by listed fauna.

7.3.5 Edge effects on adjacent native vegetation and habitat

Edge effects will occur within residual native vegetation on Rangers Valley, however the vegetation which will be removed is sparse and its removal will not increase the edge effects on adjacent native vegetation.

7.3.6 Injury and mortality of fauna

Clearing vegetation may result in fauna injury and /or mortality however operation of the proposed activity is unlikely to impact fauna species. The most at risk fauna of harm are those that have refuge habitat in hollow bearing trees e.g. microbats, reptiles and frogs and do not have a fine-tuned flight (fleeing / escaping) mechanism as seen in birds.

All other fauna would have a chance to evade vegetation clearing and would likely seek refuge in adjacent habitat.

7.3.7 Weeds of national significance

No weeds of national significance we identified in the development site.

7.3.8 Invasion and spread of pests

Animal pests, particularly deer, pigs, cats and foxes, already exist in the development site. Predation by feral cats and foxes has a high potential on site and is listed a Key Threatening Process under both the EPBC Act and the BC Act. Pests are managed through the existing Biodiversity Management Plan for the property.

7.3.9 Invasion and spread of pathogens and disease

In NSW, there are infectious pathogens with potential to impact on biodiversity. Any activities involving the movement of soil and equipment over large areas are a potential risk for spread and infection. Three pathogens are considered a negligible risk to the development site due to the low rainfall of the area. These are listed as key threatening processes under the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (EPBC Act and BC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act).
- Infection by Psittacine Circoviral (beak and feather) (EPBC Act and BC Act).

There is a low to negligible likelihood for the potential risk of pathogens on the development site during construction given its location and dry climate and they have not been detected on site. A Pathogen Management Plan is not needed.

Phytophthora (Phytophthora cinnamomi)
Phytophthora is soil-borne fungus causing tree death (dieback). It attacks the roots of a wide range of native plant species. Spores can be dispersed over relatively large distances by surface and sub-surface water flows. Infected soil/root material may be dispersed by vehicles (e.g. earth moving equipment).

Infection by Psittacine Circoviral (beak and feather)
Psittacine Circoviral (beak and feather) Disease (PCD) affects parrots and their allies (psittacines) and is often fatal. No other faunal species or groups are known to be susceptible to PCD (Murdoch University 1997). It is caused by a relatively simple virus that infects and kills the cells of the feather and beak, as well as cells of the immune system, leaving birds vulnerable to bacterial and other infections (Murdoch University 1997). The distribution of the disease and the factors involved in its spread are not well understood. The virus multiplies in the liver and can be transmitted orally or in faeces or feathers. Sulphur-crested Cockatoos affected by this disease were seen during the assessment.

Chytrid fungus (Batrachocytrium dendrobatidis)
Chytrid fungus is a fatal infectious disease affecting amphibians worldwide. It is a water-borne fungus that may be spread because of handling frogs or through cross contamination of water bodies by vehicles and workers.

7.3.10 Noise, light, dust and vibration

During the operation of the proposal, effects of increased noise, light, dust and vibration may result in indirect impact to biodiversity values.

Dust is likely to be the most obvious of these with the movement of farm machinery and the dust generated during the manure spreading process. The effects of machinery movement would be short lived and only occurring occasionally in association with this proposal. Dust generated by the manure or ground disturbed during the application of the manure will be short term until the ground cover has re-established in addition, the existing ground cover would not be removed during the operation of this proposal and all ground cover left in situ will reduce the dust production.

7.3.11 Cumulative impact

The Rangers Valley property is managed as a commercial cattle station. All areas within the proposal are currently, or may be at any time, grazed or cropped.

The manure utilisation areas are currently managed on a rotational basis such that the native and not native grass has opportunity to re-establish dense cover and replenish the soil seed bank.

This proposal aims to increase the potential and efficiency for this grass replenishment process to occur.

The effluent utilisation areas will require the removal of some native vegetation (trees). This will contribute to the level of clearing that has already occurred on the Rangers Valley property. The OEH Namoi VIS 4467 map identifies ‘not native’ as 54% of the property. Removal of trees in the effluent utilisation areas will not notable increase this value, in fact, the effluent utilisation areas are already mapped as not native in this map.

In summary, while the cumulative effect to areas of native vegetation and the associated habitat vales has worsened, the increase is small.

It is recommended the native vegetation is monitored to ensure the application rate of manure and effluent is consistent with the persistence of native species and cover to the current levels of above.

7.4 Areas not requiring assessment

Areas of not native vegetation (Zone 3 – corn and soybean crops) were not assessed using BAM plots and transects to the same extent as required for the native vegetation zones.

Most of the development site was assessed using requisite species credit species guidelines and BAM (2017). Areas of cropped or intensely managed agricultural land (Crouches, Old 2 and Old 3) were assessed for threatened species, however this was not in the form of 10 – 20 metre transects given the uniform and highly disturbed cropped nature of the vegetation.

7.5 Matters for further consideration (Species credit species)

No matters require further consideration.

7.6 Matters of National Environmental Significance (EPBC Act)

This chapter presents species identified by the Matters of National Environmental Significance.

7.6.1 Listed Threatened Species

Table 7-2: Threatened species identified in the MNES report

Common Name	Scientific Name	Commonwealth Status
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered
Red Goshawk	*Erythrotriorchis radiatus*	Vulnerable
Squatter Pigeon (southern)	*Geophaps scripta scripta*	Vulnerable
Painted Honeyeater	*Grantiella picta*	Vulnerable
Swift Parrot	*Lathamus discolor*	Critically Endangered
Australian Painted-snipe	*Rostratula australis*	Endangered
Murray Cod	*Maccullochella peelii*	Vulnerable
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Community likely to occur within area	New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands	Critically Endangered
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	Vulnerable
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (south eastern mainland population)	*Dasyurus maculatus maculatus* (SE mainland population)	Endangered
Corben's Long-eared Bat, South-eastern Long-eared Bat	*Nyctophilus corbeni*	Vulnerable
Greater Glider	*Petauroides volans*	Vulnerable
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Vulnerable
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	*Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT)	Vulnerable
New Holland Mouse, Pookila	*Pseudomys novaehollandiae*	Vulnerable
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable
Velvet Wattle	*Acacia pubifolia*	Vulnerable
Rupp's Wattle	*Acacia ruppii*	Endangered
Granite Boronia	*Boronia granitica*	Endangered
Ooline	*Cadellia pentastylis*	Vulnerable
-	*Callistemon pungens*	Vulnerable
bluegrass	*Dichanthium setosum*	Vulnerable
Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid	*Diuris pedunculata*	Endangered
McKie's Stringybark	*Eucalyptus mckieana*	Vulnerable
Narrow-leaved Peppermint, Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Vulnerable
Blackbutt Candlebark	*Eucalyptus rubida subsp. barbigerorum*	Vulnerable
Tall Velvet Sea-berry	*Haloragis exalata subsp. velutina*	Vulnerable
Wandering Pepper-cress	*Lepidium peregrinum*	Endangered
Heath Wrinklewort	*Rutidosis heterogama*	Vulnerable
Austral Toadflax, Toadflax	*Thesium australe*	Vulnerable
Adorned Delma, Collared Delma	*Delma torquata*	Vulnerable
Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko	*Uvidicolus sphyrurus*	Vulnerable
Bell's Turtle, Western Sawshelled Turtle, Namoi River Turtle, Bell's Saw-shelled Turtle	*Wollumbinia belli*	Vulnerable

7.7 Serious and Irreversible Impacts (SAII)

The BAMC Credit Summary Report (Appendix C) provides a column indicating Candidate SAIIs.

7.7.1 White Box Yellow Box Blakely's Red Gum Woodland

A review of this report demonstrated PCT510 is a candidate SAIIs (Appendix C). This PCT is present in Zone 1, 2 and 4 and as remnant paddock trees in Zone 3 which are components of White Box Yellow Box Blakely's Red Gum Woodland which is an Endangered Ecological Community under the BC Act and a Critically Endangered Community under the EBPC Act.

This EEC is nominated under Principle 1 – species or ecological community currently in a rapid rate of decline and Principle 2 – species or ecological communities with very small population size.

Principle 1 - Rapid rate of decline for an ecological community means the ecological community should have been observed, estimated, inferred, or reasonably suspected to have undergone, or be projected to undergo, a very large reduction in distribution, being:

- *≥ 90% reduction where the reduction is measured since 1750 (historical decline), or*
- *≥ 80% reduction where the reduction is over a 50-year period, either in the past, future, or any part of the past, present and future.*

The period of decline for an ecological community can be assessed as recent decline, current decline or projected future decline which is liable to continue unless remedial measures are taken, or alternatively, as historical decline.

Principle 2 – species or ecological communities with very small population size. Species that have a very small population size are species with a known population size that is either:
• fewer than 50 mature individuals independent of whether there are any threats, or
• fewer than 250 mature individuals and the species has an observed, estimated or projected continuing decline:
o of at least 25% in three years or one generation (whichever is longer) OR
o where the number of mature individuals in each subpopulation is <50 OR
o the percentage of mature individuals in one subpopulation is 90-100% OR
o the population is subject to extreme fluctuations4 in the number of individuals (IUCN 2017).

PCT510 occurs in Zone 1, 2 and 4 and as remnant paddock trees in Zone 3.

- Zone 1 – No vegetation will be removed
- Zone 2 – 24.44 hectares of PCT510 will be removed
- Zone 3 – Living paddock trees (five) and dead paddock trees (two) will be removed
- Zone 4 – 0.59 hectares of PCT510 with a not-native – corn crop ground cover will be removed.

Manure application is not expected to reduce the continuation or quality of the native ground cover and not to impact the tree stratum. In Zone 4, 0.59 hectares of PCT510 will be removed as part of this proposal (Plate 2-3: Example of Zone 3 - proposed effluent utilisation area with paddock trees only (Soybean crop - Old 3)Plate 2-3). This area of Zone 4 has a not native ground cover which is currently a corn crop. No native ground cover species were observed.

Zone 1 and part of Zone 2 are manure utilisation areas, this means manure application is proposed after it has been stored for 12 months then screened (for rocks, woodchip etc.) and powdered for application will be spread using farm machinery on the site. This process will replace application of inorganic fertiliser (urea, superphosphate) on these paddocks. Section 2.3.3 provides a list of scientific papers discussing this topic which, as well as observations made during this assessment (Plot 8 and 9 – Appendix A) have informed the opinion that:

- those native and exotic species that respond to fertiliser such as Qld Bluegrass and Poa species will grow well and increase their biomass
- application of manure is also not expected to negatively reduce the richness or cover of forb species
- if the grazing regime is strategic, the native vegetation composition and structure can be maintained. Areas of native grasslands should be left fallow periodically, and when setting seed which will enable maintenance of the soil seedbank.

A SAII is not considered likely for PCT510 in this proposal however environmental safeguards are recommended in the report and monitoring is recommended which will inform future management actions to remediate effects on the quality of this EEC.

7.7.2 Regent Honeyeater

A potential Serious and Irreversible Impact was identified by the BAMC for Regent Honeyeater. The Regent Honeyeater is nominated under Principle 1. Principle 1 – species or ecological community currently in a rapid rate of decline.

Principle 1 concerns *species and ecological communities that have undergone large reductions or are likely to undergo large reductions in the future are considered to be at greater risk of extinction than those that have undergone or are likely to undergo smaller reductions (NSW Scientific Committee 2014).*

Potential SAII entities listed under this principle have already undergone, currently are in, or are projected to undergo, a rapid rate of decline. Criteria used to identify these entities include the following:

- ***Entities listed as critically endangered under the BC Act*** *The principle would generally capture entities listed as critically endangered under the BC Act where the reason for that listing is a very large reduction in population size.*
- ***Rapid rate of decline for species*** *The species has an observed, estimated, inferred, suspected or projected population reduction of ≥80% in 10 years or three generations (whichever is longer).*

  'Generation' means the average age of parents of the current cohort (i.e. newborn individuals in the population). Generation therefore reflects the turnover rate of breeding individuals in a population (IUCN 2017).

  The period of decline can be assessed as recent decline, current decline or projected future decline which is liable to continue.

This proposed impact includes removal of a 0.59 a patch of vegetation with a corn crop ground cover, five living paddock trees and five dead paddock trees. Removal of vegetation is confined to areas which are already highly fragmented and amongst cropped paddocks.

Other impact to native vegetation cover and assemblage is not expected to reduce the vegetation integrity score. No trees will be removed in the manure utilisation areas.

Further, large areas of established forested vegetation is found surrounding the development site.

Potential impact to this species is small, and unlikely to increase the rate of decline for this species and as such, the author does not consider this proposal to be an SAII for this species.

7.7.3 Eastern Cave Bat

The Eastern Cave Bat is nominated under Principle 4. Principle 4 – species or ecological community that is unlikely to respond to management and is therefore irreplaceable

The consideration of whether an entity is unlikely to respond to management encompasses two key elements.
The first is based on the best current ecological knowledge of the life history traits and characteristics of a species. There are some threatened species that are known to display particular life history traits that severely limit the species' ability to increase in abundance.
The second element considers whether there are any key threatening processes affecting the species or ecological community that cannot be effectively managed.

Species or ecological community that cannot be offset because the entity is unlikely to respond to management
These are species or ecological communities with:

1. life history traits and/or ecology which is known, but the ability to control key threats at the site-scale is negligible. In general, these are species significantly threatened by uncontrollable disease (e.g. frogs highly threatened by chytrid fungus)

2. known reproductive characteristics that severely limit their ability to increase the existing population on, or occupy new habitat at, a stewardship site. In general, these are plants that are sterile or largely clonal with no or very limited capacity to increase in number through seed production and recruitment.

Irreplaceable
The consideration of whether an impact on an entity irreplaceable takes into account two factors. The first factor is the likely success in achieving gain in condition, abundance or habitat area. For potential species that are identified in criteria 1 and 2 above, the likelihood of achieving an offset gain is extremely low or highly uncertain.

The second factor takes into account consideration of impacts on habitat components that cannot readily be re-created. In general, these are impacts on essential habitat such as caves or cliff lines that are used by threatened species.

The Eastern Cave Bat was detected by the remote sensing bat monitoring equipment used for this assessment. This species is a cave-roosting species. While features such as rocky outcrops, cliffs or rocky overhangs are present in the vicinity of the proposal, the proposal will not disturb any of these features. The proposal will remove paddock trees which may constitute a link in the food web for this species. Forested areas and other small patches of treed vegetation exist in close proximity to the proposal which will continue to support the food web for this species. Further, the cropped land may also support food resources for this species.

It is recommended that the Eastern Cave Bat does not constitute an SAII in this case.

7.8 Impact summary

This section summarises all anticipated impacts requiring assessment under the BAM and other impacts not covered in BAM (refer Table 7-10). A summary of proposed mitigation is also included to demonstrate how impacts intend to be mitigated, with further details on mitigation provided in Chapter 8.

Table 7-3: Summary of impacts and proposed mitigation

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
Removal of native vegetation	Removal of 22 trees, 13 of which have at least one hollow.	Direct	Site based	Long term	• Loss of hollow-bearing trees (BC Act) • Clearing of native vegetation (BC Act) • Removal of dead wood and dead trees (BC Act)	• Retain in other areas around facility.	Yes, as paddock trees and PCT510.
Removal of threatened fauna species habitat and habitat features	Hollow bearing trees and dead standing trees: • Microbats • Woodland birds	Direct	Site based	Long term	• Clearing of native vegetation (BC Act) • Land clearance (EPBC Act) • Loss of hollow-bearing trees (BC Act) • Removal of dead wood and dead trees (BC Act)	• No significant modification to landscaping is required for the remainder of the site. • Salvage and relocate trees hollows during removal	Yes, as paddock trees
Application of manure and effluent	Application rate will be maintained at a level such that biodiversity values will not be reduced.	Direct	Site based	Long term	• Loss of native vegetation	• Monitor native vegetation and maintain application rate and grazing management/ rest opportunity is also managed relative to manure application rates.	Yes – Future integrity scores have been adjusted to reflect the no loss in biodiversity. One credit is required.
Removal of threatened plants	None	N/A	N/A	N/A	• N/A	• N/A	No
Aquatic impacts	None	N/A	N/A	N/A	• N/A	• N/A	No
Groundwater dependent ecosystems	None	N/A	N/A	N/A	• N/A	• N/A	No
Changes to hydrology	None	N/A	N/A	N/A	• N/A	• N/A	No
Fragmentation of identified biodiversity links and habitat	Paddock trees within cropped paddocks will be removed.	Direct	Site based	Long term	• Clearing of native vegetation (BC Act) • Removal of dead wood and dead trees (BC Act)	• N/A	Yes, as paddock trees

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
corridors							
Edge effects on adjacent native vegetation and habitat	Plant Community Types	Indirect	Local	Short term	N/A	• Tree removal will not increase edge effects.	No
Injury and mortality of fauna	Birds, bats frogs, reptiles that can use tree hollows	Direct / Indirect	Local	Short term / pre, during or post construction	N/A	• Pre-clearing and clearing process to minimise impacts to fauna	No
Invasion and spread of weeds	Disturbed soils	Indirect	Site	Short term / pre, during or post construction	• Invasion of native plant communities by exotic perennial grasses (BC Act)	• Weed control ongoing as part of farm standard operation.	No
Invasion and spread of pests	PCTs and native fauna	Indirect	Site	Long term	• Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) (BC Act) • Predation and hybridisation of feral dogs (*Canis lupus familiaris*) (BC Act) • Predation by the European red fox (*Vulpes vulpes*) (BC Act) • Predation by the feral cat (*Felis catus*) (BC Act) • Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki*) (BC Act) • Predation, habitat • degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (BC Act)	• Pest control during operation already implemented • Vegetation monitoring program	No
Invasion and spread of pathogens and disease	None	N/A	N/A	N/A	• N/A	• N/A	No

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
Noise, light and vibration	PCTs and native fauna	Direct/ indirect	Site	Short term / during spreading of manure from farm machinery	• N/A	• Operation during daylight hours only	No

8 Mitigation measures

Mitigation measures are required to further avoid and minimise impacts to biodiversity. These measures have been designed to address the potential negligible impacts identified in Chapter 7 being:

- Loss of vegetation and habitat for threatened species.
- Potential fauna mortality during construction.
- Edge effects and weed invasion.

A list of recommended mitigation measures is summarised in **Table 8-1**. These are designed to provide guidance on recommended measures to further avoid and mitigate impact to biodiversity.

Table 8-1: Recommended mitigation measures

Item	Timing	Recommended mitigation measures
Site personnel induction	Pre-construction	Ensure all construction staff working on the proposal are inducted on: • Site environmental procedures (i.e. vegetation management, sediment and erosion control, protective fencing, noxious weeds, hygiene protocols, ethical procedures for handling fauna displaced on the site). • What to do in case of environmental emergency (chemical spills, fire, injured fauna). • Key contacts in case of environmental emergency.
Site planning	Pre-construction	• Locate temporary infrastructure (set down areas, access tracks etc.) in cleared areas away from vegetation to minimise vegetation removal and indirect effects.
Identification of clearing limits	Pre-construction	• Accurately and clearly mark out the limits of clearing (where appropriate) and the vegetation to be retained outside of the construction footprint and / or used for post landscaping. • Regular inspections should be undertaken to ensure all retained vegetation/fauna habitat is clearly marked and that fencing is in place, where appropriate. • Only clear each stage of the proposal as required so that vegetation will be retained in the buffer area until future stages commence.

Protection of fauna during clearing of vegetation	Pre-construction and during clearing works	• Avoid clearing native vegetation in Spring.
		• Salvage and relocate tree hollows from trees cleared as part of the proposal. Salvaging and relocating hollows and large wooden debris can increase the biodiversity and habitat values.
		  ○ Lengths of tree trunk or branches containing hollow, particularly large established hollows, should not be woodchipped and instead should be placed in an area of native vegetation outside the clearing area.
		  ○ Depending on the equipment and budget available, tree trucks can be trimmed, transported and positioned in an alternate location.
		  ○ The entire tree does not need to be relocated – just the section containing the hollow, and as much length as feasible.
		  ○ Salvaged hollows can be placed on the ground or if equipment is available, longer tree trunk lengths can be rested against a tree so the salvaged hollow is off the ground.
		  ○ Trees can be trimmed using large machinery or chainsaws.
		  ○ Trees can be transported and positioned using trucks, excavators and cranes as available.

Management of erosion and sediment control	Pre-and during construction	• Provide sediment and erosion controls to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways, vegetation and fauna habitat. • Clearly identify stockpile and storage locations and provide erosion and sediment controls around stockpiles.

Item	Timing	Recommended mitigation measures
Wetland areas including gilgais	Pre-and during construction	• Minimise the area of disturbance in and near drainage lines, gilgai or dams, clearly mark out work zones in these areas, where appropriate. • Ensure all work within proximity to aquatic habitats have adequate sediment and erosion control. • Do not infill or remove gilgai
Weed management	Pre-and during construction	• Ensure that any machinery arriving on site be inspected for any foreign soil or plant matter/weed material and be washed down before entering the site. • Weeds should be controlled within the work area according to the requirements of the *Biosecurity Act 2016* • Any noxious weeds which are identified as part of the proposal must be disposed of appropriately.
Impacts from introduction and spread of pathogen and diseases	Operation	• As parrots are attracted to the feedlot to consume spilt grain, control and spread of a disease is needed. Develop a process where effective detection and management (Legal culling) of parrot's effected by psittacine circoviral (beak and feather) disease occurs. A Permit from NSW OEH will be required as part of this plan.
Revegetation and landscaping	Operation	• Minor landscaping around drains, embankments and ponds may be required. Where this occurs, all species planted for any purpose should be consistent with those Plant Community Types described in this report.
Loss of hollow bearing trees	Pre-and during construction	• The pre-clearing work is recommended to salvage and relocate tree hollows affected by the proposal. This process will also address other threatened species mitigation requirements for listed microbats.
Monitor and review	All stages	• A review of mitigation measures (including a checklist) should be developed to ensure that all measures proposed have been undertaken. • Review of the impact of this proposal to the native vegetation would be useful to justify continuation of the activity, and to inform future applications of this nature.

9 Biodiversity offsets

9.1 BAMC offsetting requirement

As the proposal seeks approval under Part 4 of the NSW EPA Act the need for offsetting has been considered.

The BAMC has been used to determine the offsetting requirements for the proposal. BAMC outputs area provided in Appendix C.

The BAMC has been used in four components:

- Full BAM assessment
  - Zone 1 – No trees to be removed
  - Zone 2 – 24.44 hectares of PCT510 to be removed
  - Zone 4 – 0.59 hectares of PCT to be removed (#3 in the BAMC output)
- Streamlined assessment for removal of paddock trees (remnants of PCT510)
  - Zone 3 – Living paddock trees (five) to be removed (and two dead trees)

Removal of the dead paddock trees in Zone 3 has been considered in the assessment for candidate species.

Table 9-1: Current vegetation integrity scores

Zone	BAM item number	Area (ha)	Composition condition score	Structure condition score	Function condition score	Vegetation integrity (VI) score
1	1	86.99	10.5	54.2	15	20.4
2	2	95.75	5	5.7	15	7.5
4	3	0.59	10.3	0.6	38.2	6.1

Table 9-2: Ecosystem credit summary from BAMC

Zone	BAM item number	Matter requiring offsetting	Number of credits
1	1	Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion	1
2	2	Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion	0
4	3	Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion	0
		Total	1

Table 9-3: Species credit summary from BAMC

Scientific name	Common name	Number of credits
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	3
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	3
Hieraaetus morphnoides	Little Eagle (Breeding)	2
Hoplocephalus bitorquatus	Pale-headed Snake	3
Vespadelus troughtoni	Eastern Cave Bat	4
	Total	15

BAMC credits generated for paddock trees is provided in Table 9-4. The two dead trees were assumed to be *Eucalyptus melliodora* for the purposes of the calculation as the BAMC requires a species to be allocated to dead trees included in the paddock tree assessment, and this species is prevalent in the surrounding area.

Table 9-4: Paddock tree credit summary from BAMC

Number of trees	Species	DBHOB category	Contains hollows	Tree class	Number of credits
1	*Eucalyptus caliginosa*	>=20 and <50	Yes	2	1
2	*Eucalyptus melliodora*	>=20 and <50	Yes	2	2
2 *	*Eucalyptus melliodora*	>50	Yes	3	2
1	*Eucalyptus bridgesiana*	>50	Yes	3	1
1 *	*Eucalyptus melliodora*	>=20 and <50	No	2	1
				Total	7

* One dead tree recorded in this category

9.1.1 Future integrity scores

Details of the BAMC offsetting requirement provided in section 9.1 above indicates one credit is generated for impact to Zone 1. Zero credit requirement is generated for Zones 2 and 4 as these Zones do not exceed the offsetting threshold.

Zone 1 generates a low credit requirement due to the high future mean scores entered into the BAMC. Justification for high future mean scores is provided below.

During the field assessment, AREA completed two BAM 2017 vegetation plots in a paddock, not within the current proposal, but which had undergone treatment with inorganic fertilisers previously. Results from these two plots had a higher vegetation integrity score than paddocks of in Zone 1 or Zone 2.

AREA sought the insight of a qualified and experienced agronomist to analyse the data and information available, including peer-reviewed published papers, assessment of management practices and manure analysis results from Rangers Valley, data collected by AREA and personal expert experience and provide this response regarding likely vegetation changes as

a result of manure application at Rangers Valley. The report generated by Dr Stephen Wiedemann is provided as Appendix B. Table 9-5 to Table 9-7 provides a comparison between current mean for attributes of Zone 1 and Zone 2, current mean for plots 8 an 9 which are not within the development site and the expected future mean resulting from Dr Wiedemann's analysis.

The results form Dr Wiedemann's analysis were used to population the future mean section of the BAMC. Where the expected future mean is greater than allowable in BAMC the maximum allowable was used.

Table 9-5: Species richness/ composition - Count

	Trees	Shrubs	Grass or grass like	Forbs	Ferns	Other
Good condition areas	0	0	3.8	2	0	0
Moderate condition areas	0	0	2.4	2.2	0	0
Area previously fertilised (Plot 8 and 9)	0	0.5	3.5	8	0	0
Expected future mean	0	0	3.8	2	0	0

Table 9-6: Cover/ structure - Percent

	Trees	Shrubs	Grass or grass like	Forbs	Ferns	Other
Good condition areas	0	0	39.1	2.9	0	0
Moderate condition areas	0	0	7.5	6.4	0	0
Area previously fertilised (Plot 8 and 9)	0	0.1	85.3	4.7	0	0
Expected future mean	0	0	85	2.9	0	0

Table 9-7: Habitat features/ function

	Number of large trees	Litter cover (percent cover)	Coarse woody debris (m)	Stem size class (number of)	Regeneration stems <5cm DBH (0=absent/ 1=present)	High threat weed cover percent cover
Good condition areas	0	51.8	0.3	0	0	11
Moderate condition areas	0	35.4	0.2	0	0	10.5
Area previously fertilised (Plot 8 and 9)	0	41.5	0.2	0	1	6
Expected future mean	0	40	0.2	0	0	12.5

A future vegetation integrity score of zero has been used for Zone 2 and Zone 4 where PCT510 will be removed.

Table 9-8:Future vegetation integrity score

Zone	BAM item number	Area (ha)	Composition condition score	Structure condition score	Function condition score	Vegetation integrity (VI) score	Change in VI score	Total Change in VI score
1	1	86.99	10.5	54.3	15	20.5	0	0
2	2	71.31	4.6	1.7	15	4.9	-2.6	-3.9
		24.44	0	0	0	0	-7.5	
4	3	0.59	0	0	0	0	-6.1	-6.1

9.2 Biodiversity Stewardship Site

No Biodiversity Stewardship Site has been identified to supply the required credits for this proposal

10 Conclusions and recommendations

10.1 Conclusions

The Biodiversity Assessment Report (BDAR) has been prepared to meet the requirements of the Biodiversity Assessment Method (OEH 2017) and the *NSW Biodiversity Conservation Act 2017.* This has involved an assessment of the landscape values on the site and surrounding assessment area, the vegetation communities present and their condition relative to benchmark scores, and the known or potential presence of threatened flora or fauna species.

The development site was selected to avoid impacts to remnant vegetation as much as possible. Despite this, the proposal would result in some loss of remnant vegetation and impacts are described in the BDAR along with measures to further avoid and mitigate potential impacts to biodiversity.

The development site is generally within grassed, grazed or cropped land with some remnant trees.

The native vegetation was mapped as PCT510 in all areas of native vegetation. Manure utilisation areas do not require vegetation removal and the effluent utilisation areas require removal of 25.03 hectares of PCT510 and the removal of five living and two dead remnant paddock trees.

Impact to native vegetation communities mapped as PCT510 requires offsetting of one ecosystem credit.

Removal of the seven paddock trees requires offsetting with seven ecosystem credits.

PCT510 is an example of the Endangered Ecological Community -White Box Yellow Box Blakely's Red Gum Woodland. The BAMC highlighted this community as a potential Serious and Irreversible Impact (SAII). This report asserts given the size and type of impact proposed, it is not an SAII in this case.

Nine threatened species were determined to have habitat within the development site and have a potential to be present in the development site. A species credit requirement has been generated for these species totalling 19 (plus that for one species which is to be confirmed by OEH).

Two threatened species were identified by the BAMC as potential SAII species. These are the Regent Honeyeater and the Eastern Cave Bat. This report asserts given the size and type of impact proposed it is not an SAII for these species.

10.2 Recommendations

In summary, the following recommendations are made regarding the proposal:

- Implement mitigation measures recommended on Table 8-1.
- Salvage tree hollows, as discussed in Table 8-1. It is recommended any salvaged timber with hollows is placed in vegetated areas around the feedlot. For example, the patch of vegetation to the south of Old 2 – Effluent utilisation area.
- Impact of the proposal in manure utilisation areas will not remove native vegetation. It is anticipated however that there will be some change in the vegetation assemblage as native ground cover which is more tolerant to changes in nutrient levels will thrive in preference to those that are more sensitive. Section 9.1.1.

It is recommended vegetation, especially ground cover, monitoring occurs to strategically map the vegetation change as a result of this proposal to enable adaptive management.

- Monitoring will be conducted to alert the proponent if the proposal is altering the vegetation in the manure utilisation areas such that there is a risk it will cease to represent the Threatened Ecological Community or the PCT.
- It is recommended this monitoring occurs every two years for six years (three monitoring events) and then evidence based thereafter.

11 References

Australia, B. (2016). *Find a Bird (online)*. Retrieved from Birdlife Australia: http://www.birdsaustralia.com.au/search/birds

Benson, J. (2009). New South Wales Vegetation Classification and Assessment, NSWVCA batabase. Sydney: NSW DEC.

Bueau of Meteorology. (2018). *Climate Statistics for Australian Locations: Walgett Council Depot*. Retrieved from http://www.bom.gov.au/climate/averages/tables/cw_052026.shtml

Cropper, S. (1993). *Management of endangered plants.* Melbourne: CSIRO Publications.

Department of Environment and Conservation. (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities.* Sydney, NSW: NSW Government Department of Environment and Conservation.

Department of Environment and Conservation. (2009). *Biobanking Assessment Methodology and Credict Calculator Operation Manual .* Sydney: Department of Environment and Climate Change.

Department of Environment and Climate Change. (2009). *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians.* Sydney: Department of Environment and Climate Change.

Department of Environment and Conservation . (2004). *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft).* Hurstville: Department of Environment and Conservation .

Department of Environment, Water, Heritage and the Arts . (2010b). *Survey Guidelines for Australia's Threatened Birds.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts . (2011a). *Survey Guidelines for Australia's Threatened Reptiles.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts . (2011b). *Survey Guidelines for Australia's Threatened Mammals.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts. (2010a). *Survey Guidelines for Australia's Threatened Bats.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts.

Department of Environment, Water, Heritage and the Arts. (2010c). *Survey Guidelines for Australia's Threatened Frogs.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts.

Department of Primary Industries . (2017b). *Listed threatened species, populations and ecological communities (online).* Retrieved from Listed threatened species, populations and ecological communities (online).: http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what-current#Key- threatening-processes

Department of Primary Industries. (2017). *Threatened & protected species - records viewer (online)*. Retrieved from Threatened & protected species - records viewer (online): http://www.dpi.nsw.gov.au/fisheries/species-protection/records/viewer

Department of the Environment. (2013). *Commonwealth Significant Impact guidelines.* ACT: Commonwealth Government.

Department of the Environment. (2013). Matters of National Environmental Significance -

Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment. Canberra, ACT: Commonwealth of Australia . Retrieved April 2015, from http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of the Environment. (2017). *Protected Matters Search Tool (online)*. Retrieved from http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-

Department of the Environment. (2017). *Species Profiles and Threats Database (SPRAT), (online)*. Retrieved from Species Profiles and Threats Database (SPRAT), (online): http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Environment Australia 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and Development of Version 5.0 - Summary Report. Department of Environment and Heritage, Canberra.

Environment Australia. (2001). A Directory of Important Wetlands in Australia, Third Edition. ACT: Environment Australia.

Fairfull, S. a. (2003). Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. Cronulla: NSW Fisheries.

Kuginis L., Byrne G., Serov P, Williams J.P. (2012). Risk assessment guidelines for groundwater dependent ecosystems, Volume 3 – Identification of high probability groundwater dependent ecosystems on the coastal plains of NSW and their ecological value. Sydney: NSW Department of Primary Industries, Office of Water.

NSW Department of Primary Industries. (2017a). *NSW WeedWise (online)*. Retrieved from NSW WeedWise (online): http://weeds.dpi.nsw.gov.au/

Office of Environment and Heritage. (2014). *Framework for Biodiversity Assessment.* Sydney: NSW Government.

Office of Environment and Heritage. (2014). *Major Projects Offsets Policy.* Sydney: NSW Government.

Office of Environment and Heritage. (2017). *Atlas of NSW Wildlife (online)*. Retrieved from Atlas of NSW Wildlife (online): http://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ReturnUrl=%2fAtlasApp%2fDefault.aspx

Office of Environment and Heritage. (2017). *Threatened Species Profile Database (online)*. Retrieved from Threatened Species Profile Database (online): http://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ForceLogin=1

Office of Environment and Heritage. (2017). *Vegetation Information System (online)*. Retrieved from Vegetation Information System (online): http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx

Resource and Conservation Division. (2001). Comprehensive Regional Assessment Floristic Types Information (CRAFTI).

Royal Botanic Gardens and Domain Trust, Sydney (online). (2017). *PlantNET (The NSW Plant Information Network System)*. Retrieved from PlantNET (The NSW Plant Information Network System): http://plantnet.rbgsyd.nsw.gov.au

Thackway, R. a. (1995). An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.0. ACT: Australian Nature Conservation Agency.

Wiedemann, S., 2019, *Assessment of Biodiversity Impacts Associated with Proposed Manure Application at Rangers Valley Cattle Station*, Unpublished.

Appendix A: BAM Fieldwork data sheets

BAM (2017) Plot sheets

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	1	Phil Cameron, Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
05 02 19	56				1

Easting	Northing	Plot Dimensions (e.g. 20 x 20 to 20 x 50)	Orientation of midline from the 0 m point.
374291	6732279		310 Magnetic

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	3
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	75.1
	Forbs	0.2
	Ferns	0
	Other	0
High Threat Weed cover %		10

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	—	—	0
50 – 79 cm	—	—	
30 – 49 cm	—	—	Hollows 20cm+
20 – 29 cm	—	—	0
10 – 19 cm	—	—	
5 – 9 cm	—	—	
< 5 cm	—	—	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	30	40	50	30	30	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0
Average of the 5 subplots	36 %																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	2	R
Soil erosion	1	R
Firewood / CWD removal	–	–
Grazing (identify native/stock)	2	R
Fire damage	–	–
Storm damage	–	–
Weediness	2	O
Other	–	–

Free Text Section for brief site description

Paddock is mostly not native. Boundary drawn c GPS using vehicle along Native/not Native boundary. Historically cleared, pasture improved, super phosphate, rotational ploughing 3-5 yrs. Grasses have seed heads (mostly) Thick leaf litter (dead grass thatch)

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 5 Feb 19.	Rungers Valley	1	Phil Cameron & Jody Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Eriochloa crebra	Tall Cupgrass.	N	70	1000	L	–	0.4
		2	Paspalum dilatatum	Paspalum	HTE	10	100	L	–	0.3
GG	g	3	Poa labillardierei	Tussock Poa	N	5	20	L	–	0.4
		4	Plantago lanceolata	Ribwort	E	1	20	L	–	0.2
FG	f	5	Rumex brownii	slender dock	N	0.2	10	L	–	0.2
		6	Crepis capillaris	Smooth hawksbeard	E	0.1	20	L	–	0.1
GG	v	7	Juncus flavidus		N	0.1	10	L	–	0.3
		8								
		9		n	abundance					
		10	GG	3	75.1					
		11	FG	1	0.2					
		12								
		13								
		14								
		15								
		16								
		17								
		18								
		19								
		20								
		21								
		22								
		23								
		24								
		25								
		26								
		27								
		28								
		29								
		30								
		31								
		32								
		33								
		34								
		35								
		36								
		37								
		38								
		39								
		40								

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
RANGERS VALLEY	2	Phil CAMERON Addy WATSON

Date	Zone	Datum	IBRA region	Photo #	Zone ID
05 02 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
375065	6731829		10

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	3
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	90.1
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover %		0.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	0	0	
5 – 9 cm	0	0	
< 5 cm	0	0	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 55 55 70 50	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	52%	0	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	0
Cultivation (inc. pasture)	2	0
Soil erosion	0	0
Firewood / CWD removal	0	0
Grazing (identify native/stock)	2	0(S)
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

Paddock historically cleared of mid + upper stratum. Not ploughed. Pasture improved. Super phosphate applied historically. Very dense Tussock Poa + leaf litter (thatch).

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	375086	6731872

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

28.4 °C
46% humidity wind 6.7 km/hr

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 5 Feb 2019	Rangers Valley	2	Phil Cameron / Andy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Poa labillardieri — Tussock Poa	N	70	1000	L		0.5
GG	g	2	Poa sieberiana var. s... — Snow Grass	N	20	200	L		0.2
		3	Phalaris aquatica	E	5	50	L		0.3
FG	f	4	Rumex brownii — Slender Dock	N	0.1	20	L		0.3
GG	g	5	Eriochloa crebra — Tall Cup Grass	N	0.3	20	L		0.3
	g	6	Crepis capillaris — Smooth hawksbeard	E	0.1	10	L		0.2
		7	Paspalum dilatatum	HTE	0.2	5	L		0.3
		8	Conyza bonariensis — Tall fleabane	E	0.1	1	L		0.4

	n	%
GG	3	90.1
FG	1	0.1

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Ranges Valley	3	Phil Cameron Hedley Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
5 Feb 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 m;20 x 50)	Orientation of midline from the 0 m point.
373368	6731916		10

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	5
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	20
	Forbs	0.3
	Ferns	0
	Other	0
High Threat Weed cover %		2.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	0	0	
5 – 9 cm	—	—	
< 5 cm	—	—	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	75 50 65 65 55	5 25 10 20 5	0 0 0 0 0	0 0 0 0-5 0
Average of the 5 subplots	62%			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	O
Soil erosion	1	O
Firewood / CWD removal	—	—
Grazing (identify native/stock)	2	R
Fire damage	—	—
Storm damage	—	—
Weediness	—	—
Other	—	—

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

Historically clrared + ploughed Pasture improved. Location of Plot selected to be representative ie some areas are better + some far worse.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	373361	6731961

28.8°C
27.4% humidity
Wind: 19.5 km/h

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 5 Feb 19	Rangers Valley	3	Phil Cameron Adele Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Eriochloa crebra	Tall Cupgrass	N	5	60	L		0.4
GG	g	2	Poa labillardieri	Tussock Poa	N	10	150	L		0.4
		3	Paspalum dilatatum	Paspalum	HTE	2	20	L		0.3
		4	Bromus hordaeceus	Soft Brome	E	2	40	L		0.2
		5	Phalaris aquatica	Phalaris	E	2	30	L		0.3
GG	g	6	Poa sieberiana v.s...	Snow Grass.	N	3	50	L		0.3
		7	Digitaria sanguinalis	Summer Grass	E	5	60	L		0.1
GG	g	8	Dactyloctenium radulans	Button Grass	N	1.	20	L		0.1
FG	f	9	Polygonum aviculare	wireweed	E	1	20	L		0.1
		10	Conyza bonaris	Tall fleabane	E	1	20	L		0.3
		11	Xanthium spinosum	Bathurst Burr	HTE	0.2	8	L		0.2
		12	Prairie Grass	Bromus carthariticus	E	5	100	L		0.2
		13	Modiola caroliniana	Red flowered Mallow	E	2	15	L		0.1
GG	v	14	Juncus spp. flavidus		N	1.	15	L		0.3
		15	Crepis capilaris	Smooth Hawksbeard	E	0.2	10	L		0.2
		16	Petrorhagia dubia	Proliferous Pink	E	0.2	15	L		0.1
		17	Cirsium vulgare	Black Spear Thistle	E	0.2	10	L		0.1
FG	f	18	Portulaca oleracea	Pigweed	N	0.3	10	L		0.1
		19								
		20								
		21								
		22								
		23								
		24								
		25								
		26								
		27								
		28								
		29								
		30								
		31								
		32								
		33								
		34								
		35								
		36								
		37								
		38								
		39								
		40								

Native cover : 17.3
Exotic cover : 23.6
40.9% Cover

(17.3 ÷ 40.9) × 100 = 42.3% native

	h	%
GG	5	20
FG	1	0.3

DO NOT A PCT

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	4	Phil Cameron / Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
06/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
374036	6731902		350

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	Ø
	Shrubs	Ø
	Grasses etc.	4
	Forbs	1
	Ferns	Ø
	Other	Ø
Sum of Cover of native vascular plants by growth form group	Trees	Ø
	Shrubs	Ø
	Grasses etc.	17.1
	Forbs	5
	Ferns	Ø
	Other	Ø
High Threat Weed cover %		50.1

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	Ø	Ø	Ø
50 – 79 cm	Ø	Ø	
30 – 49 cm	Ø	Ø	Hollows 20cm+
20 – 29 cm	0	0	Ø
10 – 19 cm	—	—	
5 – 9 cm	—	—	
< 5 cm	—	—	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Ø		total Ø

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	60	25	75	70	65	5	55	10	10	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	59%					18					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	O
Soil erosion	1	O
Firewood / CWD removal	—	—
Grazing (identify native/stock)	2	R
Fire damage	—	—
Storm damage	—	—
Weediness	—	—
Other	—	—

Free Text Section for brief site description

Plot selected to demonstrate / prove the area mapped is or is not native vegetation. Initially thought to be native but plot data elsewhere showed otherwise. This plot randomly selected and will be used as evidence for mapping.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	374030	6731955

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

wind: 11.4km/hr
22°C temp
62.5% humidity

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 06/02/19	Rangers Valley	Plot 4	Phil Cameron / Andy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Eriochloa crebra	Tall Cup Grass	N	10	60	L		0.8
GG	g	2	Poa labillardierei	Tussock Poa	N	5	15	L		0.3
		3	Cirsium vulgare	Black Spear Grass	E	1	10	L		0.1
		4	Paspalum dilatatum	Paspalum	HTE	50	>1000	L		0.1
		5	Medicargo sp		E	1	20	L		0.1
GG	g	6	Poa sieberiana		N	2	40	L		0.2
		7	Petrorhagia dubia	Proliferous pink	E	0.1	20	L		0.2
		8	Bromus hordaeceus	Soft brome	E	5	100	L		0.2
GG		9	Lomandra sp		N	0.1	1	L		0.1
		10	Xanthium spinosum	Bathurst Burr	HTE	0.1	20	L		0.2
		11	Cynodon nlemfuensis*	Bermuda Grass	E	5	200	L		0.1
FG	F	12	Malva preissiana	Australian Hollyhock	N	1	10	L		0.1
		13	Digitaria sanguinalis	Summer Grass	E	5	80	L		0.1
		14	Phalaris aquatica	Phalaris Grass	E	10	250	L		0.1
		15	Modiola carliniana	Red flowered Mallow	E	1	5	L		0.1
		16	Bromus carthartieus	Prairie Grass	E	5	200	L		0.2
		17	Crepis capilaris	Smooth Hawksbeard	E	1	10	L		0.1

Native cover : 18.1
Exotic cover : 83.2
101.3

18.1 ÷ 101.3 x 100 = 17.86% native cover
∴ not native.

* NV 350 Grasses of S.A.
NN 36 Grasses of NSW.

	n	%
GG	4	17.1
FG	1	5

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	5	Phil Cameron Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
6 2 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
373360	6731788		350° Magnetic

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: Y Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	–
	Shrubs	–
	Grasses etc.	5
	Forbs	Ø
	Ferns	–
	Other	–
Sum of Cover of native vascular plants by growth form group	Trees	–
	Shrubs	–
	Grasses etc.	68.2
	Forbs	Ø
	Ferns	–
	Other	–
High Threat Weed cover %		20

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	Ø	Ø	Ø
50 – 79 cm	Ø	Ø	
30 – 49 cm	Ø	Ø	Hollows 20cm+
20 – 29 cm	Ø	Ø	Ø
10 – 19 cm	–	–	
5 – 9 cm	–	–	
< 5 cm	–	–	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Ø		total Ø

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	75	85	60	70	70	Ø	Ø	20	0	0	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Average of the 5 subplots	72%					4%					Ø									

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	R
Soil erosion	1	NR
Firewood / CWD removal	–	–
Grazing (identify native/stock)	2	R
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

Polygon cleared, ploughed, pasture improved + super phosphate added. This plot selected as an example of high quality native grassland that can survive under previous disturbance. This area is dominated by Tall cup grass but most other similar areas have Tussock Poa.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 06/02/19	Rangers Valley	5	Phil Cameron / Addy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Eriochloa crebra Tall Cupgrass	N	65	>1000	L		0.4
	g	2	Paspalum dilatatum Paspalum	HTE	20	400	L		0.1
GG	g	3	Poa labillardieri Tussock Poa	N	2	15	L		0.4
GG	g	4	Poa sieberiana Snow Grass	N	1	15	L		0.1
GG	g	5	Dactyloctenium radulans Button Grass	N	0.1	10	L		0.1
	g	6	Bromus hordaceus Soft Brome	E	1	100	L		0.2
GG	v	7	Juncus flavidus	N	0.1	1	L		0.2
←		8	Cirsium vulgare Black Spear Thistle	E	0.1	5	L		0.2
		9	Conyza bonariensis Tall Fleabane	E	0.1	5	L		0.2
		10	Crepis capillaris Smooth Hawksbeard	E	0.1	10	L		0.2
		11							
		12							
		13							
		14							
		15							
		16							
		17							
		18							
		19							
		20							
		21							
		22							
		23							
		24							
		25							
		26							
		27							
		28							
		29							
		30							
		31							
		32							
		33							
		34							
		35							
		36							
		37							
		38							
		39							
		40							

^	%
GG 5	68.2
Not native	21.3
	89.5 % cover

(68.2 ÷ 89.5) x 100 = 76.2 %

i.e. Native community / PCT.

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	6	Phil CAMERON Addy WATSON

Date	Zone	Datum	IBRA region	Photo #	Zone ID
07 02 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
376621	6729596		0° N.

		Confidence: H M L
Likely Vegetation Class		
Plant Community Type	PCT 510. EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	4
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	55
	Forbs	7
	Ferns	0
	Other	0
High Threat Weed cover %		10

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	Euc*	Non Euc	Stem Classes and Hollows: Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	–	–	
5 – 9 cm	–	–	
< 5 cm	–	–	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	70 55 55 25 60	20 10 5 35 10	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	53%	16%	–	–

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	NR
Soil erosion	1	NR
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	R
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

Polygon cleared, ploughed + super phosphate added on rotation. Possibly pasture improved but at a glance seems less likely than other areas assessed. Plot randomly selected as representative of broader polygon.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	376628	6729331

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 07/02/19	Rangers Valley	6	Phil Cameron / Addy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Eriochloa crebra	Tall Cupgrass	N	15	500	L		0.4
FG	F	2	Rumex brownii	Slender dock	N	2	20	L		0.2
		3	Conyza bonariis	Tall fleabane	E	0.1	20	L		0.2
GG	g	4	Poa sieberiana var sieberiana	Snow Grass	N	15	120	L		0-3
GG	g	5	Poa labillardierei	Tussock Poa	N	15	80	L		0.3
		6	Plantago varia	Variable Plantain	N	0.2	20	L		0-1
		7	Bromus hordaceus	Soft Brome	E	1	100	L		0.2
		8	Phalaris aquatica	Phalaris	E	5	50	L		0.1
		9	Cynodon nlemfuensis	Bermuda Grass	E	10	50	L		0.1
GG	v	10	Juncus flavidus		N	10	100	L		0.3
		11	Medicago sp.	Clover	E	5	50	L		0.1
		12	Lepedium bonariense	Shepards Purse	E	2	20	L		0.2
		13	Modiola cuniniana	Red flowered Mallow	E	2	15	L		0.1
FG	c	14	Dysphania melanocarpa	Black Crumb weed	N	5	200	L		0.1
		15	Paspalum dilatatum	Paspalum	HTE	10	80	L		0.1

Native ground cover % = 62%
exotic ground cover % = ~~37~~ 37.3%
99.3

(62 ÷ 99.3) x 100 = 62%

∴ PCT ✓

	n	%
GG	4	55
FG	2	7

4

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	7	Phil CAMERON, Addy WATSON

Date	Zone	Datum	IBRA region	Photo #	Zone ID
07 02 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
377204	6729207		180° (S)

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	4
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	57.1
	Forbs	7.1
	Ferns	0
	Other	0
High Threat Weed cover %		15

64.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	–	–	
5 – 9 cm	–	–	
< 5 cm	–	–	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	1.6		total 1.6

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	50 50 45 40 45	5 20 5 20 5	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	46%	11%	—	—

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	2	NR
Soil erosion	1	NR
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	R
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

Cleared, Ploughed, Superphosphate added, possibly pasture improved (Rotationally ie every few years.) More Poa Tussock than other area in same polygon assessed. Representative of this end of the polygon.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	377194	6729151

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 7/02/19	Rangers Valley	7	Phil Cameron, Addy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Poa sieberiana v sieberiana Snow Grass	N	35				
GG	g	2	Poa labillardierei Tussock Poa	N	20				
		3	Cirsium vulgare Black Spear Thistle	E	2				
		4	Paspalum dilatatum Paspalum	HTE	15				
		5	Crepis capilaris Smooth Hawkesbill	E	1				
FG	f	6	Plantago varia Variable Plantain	N	1				
FG	f	7	Oxalis chnoodes Oxalis	N	1				
		8	Medicago sp	E	0.5				
		9	Lepidium bonariense Shepards Purse	E	0.5				
		10	Petrorhagia dubia Proliferous Pink	E	0.5				
		11	Sisymbrium sp (mustard weed)	E	0.1				
GG	v	12	Lomandra ~~filiformis~~ multiflora Lomandra	N	0.1				
FG	f	13	Alternanthera denticulata Hairy Jo Weed	N	0.1				
		14	Conyza bonariis Tall fleabane	E	0.1				
		15	Bromus hordaceus Soft Brome	E	5				
GG	v	16	Juncus flavidus	N	2				
		17	Salvia Verbenaca Wild Sage	E	1				
FG	f	18	Portulaca oleracea Pigweed	N	2				
FG	f	19	Dysphonia melanocarpa Black crumbweed	N	2				
FG	f	20	Enidina nutans subsp nutans Climbing Saltbush	N	1				
		21							
		22							
		23							
		24							
		25							
		26							
		27							
		28							
		29							
		30							
		31							
		32							
		33							
		34							
		35							
		36							
		37							
		38							
		39							
		40							

	%
native cover	64.2
exotic cover	25.7
Total	89.9

(64.2 ÷ 89.9) ×100 = 71.4 %
PCT ✓

	n	%
GG	4	57.1
FG	6	7.1

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rungis Valley	Plot 8 Control	Phil Cameron / Ady Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
7/02/19					

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
377375	6729267		180° (S)

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510.	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	3
	Forbs	8
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0.1
	Grasses etc.	80.4
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover %		10

81.8

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	
10 – 19 cm	tick	tick	0
5 – 9 cm	tick	tick	
< 5 cm	✓	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 45 70 45 55	0 5 1 0 0	0 0 0 0 0	0 0 1 1 0
Average of the 5 subplots	49%	1.2	0	0.4

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	2	R
Soil erosion	–	–
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	NR
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

This polygon is an existing fertilisation area. Plot randomly placed in polygon to measure effect of manure to biodiversity.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	377371	6729215

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 7/02/19	Rangers Valley	Plot 8 Control	Phil Cameron / Addy Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Poa Sieberiana var sieberiana	Snow Grass	N	80	500	L		0.3
"	"	2	Paspalum dilatatum	Paspalum	HTE	10	100	L		0.1
—	—	3	Cirsium vulgare	Black Spear Thistle	E	0.1	50	L		0.4
—	—	4	Crepis capillaris	Smooth Hawksbeard	E	0.1	50	L		0.1
—	—	5	Conyza bonariensis	Tall Fleabane	E	0.1	20	L		0.2
FG	f	6	Portulaca oleracea	Pigweed	N	0.1	20	L		0.1
—	—	7	Lepidium bonariense	Shepherds Purse	E	0.1	50	L		0.2
FG	f	8	Plantago varia	Variable plantain	N	0.2	50	L		0.2
GG	v	9	Lomandra longifolia		N	0.2	10	L		0.3
FG	f	10	Calotis scabiosifolia	Rough Burr-daisy	N	0.1	10	L		0.1
GG	v	11	Juncus flavidus		N	0.2	10	L		0.2
FG	f	12	Rumex brownii	Slender Dock	N	0.2	20	L		0.2
FG	f	13	Euphorbia drummondii	Caustic weed	N	0.1	50	L		0.1
FG	f	14	Malva preissiana	Australian hollyhock	N	0.2	20	L		0.1
—	—	15	Setaria pumila	Whorled pidgeon Grass	E	0.2	10	L		0.2
FG	f	16	Oxalis chnoodes	Oxalis	N	0.2	50	L		0.1
FG	f	17	Dysphania melanocarpa	Black Crumbweed	N	0.2	50	L		0.1
SG	s	18	Atriplex spl		N	0.1	1	M		0.1
—	—	19	Bromus hordaceus	Soft Brome	E	1	20	L		0.1
		20								
		21								
		22								
		23								
		24								
		25								
		26								
		27								
		28								
		29								
		30								
		31								
		32								
		33								
		34								
		35								
		36								
		37								
		38								
		39								
		40								

	%
Native cover	91.4
Exotic cover	11.6
Total	112.0

(91.4 ÷ 112) x 100 = 81.6%

PCT ✓

	n	%
GG	3	80.4
FG	8	1.3
SG	1	0.1

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	T Control	Phil CAMERON, Addy WATSON

Date	Zone	Datum	IBRA region	Photo #	Zone ID
07 02 19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
377634	6729119		210°(S)

		Confidence: H M L
Likely Vegetation Class		
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	4
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	90.1
	Forbs	5.7
	Ferns	0
	Other	0
High Threat Weed cover %		2

98.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	–	–	
5 – 9 cm	–	–	
< 5 cm	✓	–	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0.4 m		total 0.4 m

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	25	50	30	20	45	25	1	1	1	5	0	0	0	0	0	0	0	1	0	0
Average of the 5 subplots	34 %																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	2	R
Soil erosion	–	–
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	NR
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Free Text Section for brief site description

Polygon selected for data as its a current fertilisation area.
Location of plot randomly selected.
Direct drilled / scarified annually? (or every other year). Fertilizer applied annually

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

⊗ Ragwort double up.

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 7/02/18	Rungers Valley	9 Control	Phil Cameron / Holly Watson

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
GG	g	1	Poa labillardierei Tussock Poa	N	10	20	L		0.4
GG	g	2	Poa sieberiana v sieberiana Snow Grass	N	75	500	L		0.3
GG	v	3	Juncus flavidus	N	5	50	L		0.3
		4	Cirsium vulgare Black Spearthistle	E	2	30	L		0.3
		5	Paspalum dilatatum Paspalum.	HTE	2	20	L		0.1
FG	f	6	Dysphania melanocarpa Black Crumbweed	N	2	20	L		0.1
		7	Crepis capilaris Smooth Hawksbill	E	1	50	L		0.2
		8	Plantago lanceolata Ribwort	E	1	50	L		0.2
FG	f	9	Plantago varia Variable Plantain	N	1	50	L		0.1
FG	f	10	Tricoryne elatior Yellow Rush Lily	N	0.1	5	L		0.1
~~FG~~	~~f~~	~~11~~	~~Dysphania melanocarpa Blackcrumb Weed~~	~~N~~	~~2~~	~~20~~	~~L~~		~~0.1~~
		12	Bromus hordaeceus Soft Brome	E	1	25	L		0.2
GG	v	13	Juncus sp 1	N	0.1	30	L		0.1
~~GG~~	~~v~~	~~14~~	~~Juncus flavidus (Double)~~	~~N~~					
FG	f	15	Daucus glochidatus Native carrot	N	1	15	L		0.2
		16	medicago sp	E	1	30	L		0.1
FG	f	17	Alternanthera denticulata Lesser Joyweed	N	0.5	10	L		0.1
		18	Polygonum aviculare wireweed	E	0.5	20	L		0.1
FG	f	19	Hypericum gramineum St Johns Wort	N	1	10	L		0.2
FG	f	20	Patersonia sp (glabrata?)	N	0.1	5	L		0.2
		21							
		22							
		23	Native cover 95.8						
		24	exotic cover 10.5						
		25	106.3						
		26							
		27	(95.8 ÷ 106.3) x 100 = 90.1						
		28	PCT ✓						
		29							
		30							
		31	GG | 4 | 90.1						
		32	FG | 7 | 5.7						
		33							
		34							
		35							
		36							
		37							
		38							
		39							
		40							

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	Plot 10	Phil Cameron + Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
7/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 or 20 x 50)	Orientation of midline from the 0 m point.
377952	6730267		230°

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	6
	Grasses etc.	2
	Forbs	3
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	0.2
	Forbs	20.1
	Ferns	0
	Other	0
High Threat Weed cover %		0

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	–	–	
5 – 9 cm	–	–	
< 5 cm	–	–	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	1.6		total 1.1

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	10	40	30	20	35	50	40	30	50	35	0	0	0	0	0	1	2	2	1	15
Average of the 5 subplots	27																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	R
Soil erosion	1	NR
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	NR
Fire damage	–	–
Storm damage	–	–
Weediness	–	–
Other	–	–

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

This polygon was ID'd during reconnoitre as Not Native. The plot collects data to prove this. fertilizer has been applied to this paddock. Ploughed etc.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	377915	6730238

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 7/2/19	Rangers Valley	10	Phil Cameron

BAM Code	GF Code	ID	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
G		1	Digitaria ciliaris Summer Grass	E	70	500	L		0.1
FG	f	2	Dysphania melanocarpa Black crumbweed	N	10	100	L		0.2
=		3	Plantago lanceolata Ribwort	E	2	100	L		0.2
FG	f	4	Portulaca oleracea Pigweed	N	10	200	L		0.1
		5	Eleusine tristachya Goose Grass	E	10	200	L		0.1
		6	Bromus catharticus Prairie Grass	E	5	50	L		0.2
FG	f	7	Einadia nutans subsp nutans	N	0.1	1	L		0.2
GG	g	8	Poa labillardieiei Tussock Poa	N	0.1	2	L		0.1
GG	g	9	Poa sieberiana v sieberiana Snow Grass	N	0.1	5	L		0.1
		10	Lolium perenne Perennial Ryegrass	E	0.1	5	L		0.2
		11	Bromus hordaceus Soft Brome	E	0.1	5	L		0.2
		12	Cynodon dactylon* Bermuda Grass	E	1	15	L		0.2
		13							
		14							
		15							
		16							
		17	* N 350 Grasses of NSW						
		18	P 34 Grasses of NSW						
		19							
		20							
		21	native cover : 20.3%						
		22	exotic cover : 88.2%						
		23	108.5						
		24							
		25							
		26	(20.3% / 108.5) x 100 = 18.7%						
		27	NOT A PCT						
		28							
		29							
		30							
		31							
		32	GG = 2 n / 0.2 %						
		33	FG = 3 n / 20.1 %						
		34							
		35							
		36							
		37							
		38							
		39							
		40							

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	11	Phil Cameron / Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
7/2/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
378452	6736357	20 x 20 in 20 x 50	250° Magnetic °

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	Ø
	Shrubs	Ø
	Grasses etc.	1
	Forbs	3
	Ferns	Ø
	Other	Ø
Sum of Cover of native vascular plants by growth form group	Trees	Ø
	Shrubs	Ø
	Grasses etc.	0.1
	Forbs	0.3
	Ferns	0
	Other	0
High Threat Weed cover %		Ø

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	Ø	Ø	Ø
50 – 79 cm	Ø	Ø	
30 – 49 cm	Ø	Ø	Hollows 20cm+
20 – 29 cm	Ø	Ø	Ø
10 – 19 cm	tick	tick	
5 – 9 cm	tick	tick	
< 5 cm	tick	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Ø		total Ø

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	2	5	1	1	1	30	30	25	30	30	0	0	0	0	0	0	0.5	0.5	0.5	0.5
Average of the 5 subplots	2																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	R
Soil erosion	–	–
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	NR
Fire damage	–	–
Storm damage	–	–

Free Text Section for brief site description

Polygon cleared and ploughed historically. Pasture improved + fertilizer spread. Location of plot randomly selected to be representative of wider area.

Leaf Litter and end point GPS		
ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 7/2/19	Rungis Valley	11	*Phil Eamegai / Addy Watson

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	—	—	Digitaria ciliaris Summer Grass	E	90	>1000	L		0.1
2	GG	g	Poa sieberiana v sieberana Snow Grass	N	0.1	4	L		0.2
3	FG	f	Plantago varia Variable Plantain	N	0.1	20	L		0.2
4	FG	f	Portulaca oleracea Pigweed	N	0.1	20	L		0.1
5	—	—	Eleusine tristachya Goose Grass	E	2	40	L		0.1
6	—	—	Setaria pumila Pidgeon Grass	E	2	10	L		0.2
7	—	—	Plantago lanceolata Ribwort	E	0.1	10	L		0.2
8	—	—	Lolium perenne Perennial Ryegrass	E	0.1	10	L		0.2
9	FG	f	Malva pressiana Australian Hollyhock	N	0.1	1	L		0.1
10	—	—	Cynodon nlemfuensis Bermuda Grass	E	0.5	15	L		0.1
11	—	—	Bromus carthariticus Prairie Grass	E	0.1	15	L		0.1
12	—	—	Eleusine indica Crowsfoot Grass	E	0.1	10.	L		0.1
13									
14									
15									
16			native cover: 0.4						
17			exotic cover: 94.9						
18			95.3						
19									
20									
21			(0.4 ÷ 95.3) x100 = 99.6%						
22			∴ Not native						
23									
24									
25			GG: n = 1, % = 0.1						
26			FG: n = 3, % = 0.3						
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	12	Phil Cameron, Addy Watson.

Date	Zone	Datum	IBRA region	Photo #	Zone ID
07/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
379984	6731715	20 x 20 in 20 x 50	225 Magnetic °

Likely Vegetation Class	Confidence: H M L	EEC:	Confidence: H M L
Plant Community Type: PCT 510			

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	0
	Forbs	3
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	0
	Forbs	6.1
	Ferns	0
	Other	0
High Threat Weed cover %		0

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	tick	tick	
5 – 9 cm	tick	tick	
< 5 cm	tick	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	55	20	20	20	20	20	65	50	60	60	0	0	0	0	0	0	0.5	1	0	0
Average of the 5 subplots	27 %																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	2	O
Cultivation (inc. pasture)	3	R
Soil erosion	–	–
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	NR
Fire damage	1	O
Storm damage	–	–

Free Text Section for brief site description

Polygon has retained mature trees but all understory removed, ploughed regularly, sown c improved pasture + fertilised treated cyclically c Super phosphate. Plot represents understory / ground stratum.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	379942	6731682

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 7/2/19	Rangers Valley	12 Sugarloaf	Phil Cameron / Addy Watkin

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	—	—	Digitaria cillaris Summer Grass	E	40	>1000	L		0.1
2	—	—	Bromus hordaceus Soft Brome	E	20	500	L		0.2
3	—	—	Bromus carthuticus Prairie Grass	E	20	500	L		0.2
4	FG	f	Portulaca oleracea Pigweed	N	5	100	L		0.1
5	FG	f	Malva pressiana Aust. Hollyhock	N	1	5	L		0.1
6	—	—	Eleusine tristachya Goose Grass	E	1	5	L		0.1
7	FG	f	Enicdinia nutans subsp/Nutans	N	0.1	1	L		0.1
8	—	—	Echinochloa colonum Awnless Barnyard	E	0.1	1	L		0.1
9									
10									
11			native cover = 6.1%						
12			exotic cover = 80.2						
13			86.2						
14									
15									
16			(6.1 ÷ 86.2) x100 = 7.6%						
17			NOT NATIVE						
18									
19									
20			~~Gth~~ n / %						
21			FG = 3 / 6.1						
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	13	Phil CAMERON Addy WATSON

Date	Zone	Datum	IBRA region	Photo #	Zone ID
28/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
378636	6734441	20 x 20 in 20 x 50	180° Magnetic °

Likely Vegetation Class		Confidence: H M L
Plant Community Type	510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	5
	Forbs	3
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	58.3
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover %		2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	Euc*	Non Euc	Stem Classes and Hollows: Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	tick	tick	
5 – 9 cm	tick	tick	
< 5 cm	tick	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	15 15 20 50 20	0 25 0 5 1	— — — — —	0 0 0 0 0
Average of the 5 subplots	24 +/-			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	O
Soil erosion	1	NR
Firewood / CWD removal	—	—
Grazing (identify native/stock)	1	R
Fire damage	—	—
Storm damage	—	—

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

Polygon historically cleared ie upon settlement - close to homestead broad flat valley. No trees remain but those further afield indicate what parent PCT was here. Ground compacted (vermin hard). Plot selected to measure area dominated by Tall Cyp grass ie the native part of the polygon.

Leaf Litter and end point GPS

ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	378611	6734401

400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	08 / 02 / 19	Rangers Valley	13	Phil Cameron Addy Watson

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	GG	g	Eriochloa crebra Tall Cup Grass	N	55	>1000	L		0.4
2	GG	g	Chloris truncata Short Windmill Grass	N	1	50	L		0.2
3	—		Cynodon incompletus Bermuda Grass	E	40	>1000	L		0.1
4	GG	g	Enteropogon acicularis Curly Windmill	N	2	50	L		0.2
5	—		Phalaris aquatica phalaris	E	5	50	L		0.4
6	—		Cirsium vulgare Black Spear Grass	E	1	20	L		0.4
7	FG	f	Enidinia nutans subsp.	N	0.1	2	L		0.2
8	—		Cichorium intybus Chicory	E	1	20	L		0.3
9	—		Lactuca serriola Prickly Lettuce	E	0.1	10	L		0.2
10	—		Paspalum dilatatum Paspalum	HTE	2	40	L		0.3
11	—		Lolium perenne Perennial Rye Grass	E	1	10	L		0.1
12	—		Polygonum aviculare Wireweed	E	3	100	L		0.1
13	—		Lepidium bonariense Shepherds Purse	E	0.1	50	L		0.1
14	—		Bromus catharticus Prairie Grass	E	0.1	10	L		0.1
15	—		Plantago lanceolata Ribwort	E	1	50	L		0.2
16	—		Sonchus Tall Sowthistle	E	0.1	10	L		0.2
17	GG	g	Poa sieberiana v sieberiana Silky Wallaby Grass	N	0.2	20	L		0.2
18	FG	f	Plantago varia Variable Plantain	N	0.2	50	L		0.1
19	—		Bromus hordaceus Soft Brome	E	1	50	L		0.2
20	—		Medicago sp.	E	0.1	50	L		0.1
21	GG	g	Rytidosperma (racemosum?) Wallaby Grass	N	0.1	2	L		0.2
22	FG	f	Galium murale (new?) Small bedstraw	E	0.1	20	L		0.2
23									
24			native % cover = 59.5						
25			exotic % cover = 55.6						
26			115.1						
27									
28			(59.5 ÷ 115.1) x100 = 51 %						
29									
30			∴ Native PCT ✓						
31									
32			NOTE: The dominance reflects						
33			areas of cup grass &						
34			more disturbed area ∴ Bermuda						
35			Grass.						
36			n | %						
37			GG | 5 | 58.3						
38			FG | 3 | 1.3						
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Ranger Valley	Plot 14	Phil Cameron, Addy Watson.

Date	Zone	Datum	IBRA region	Photo #	Zone ID
08/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.
378586	6734138	20 x 20 in 20 x 50	350° (N) Magnetic °

Likely Vegetation Class		Confidence: H M L
Plant Community Type	PCT 510	EEC: / Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	3
	Forbs	3
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	85.5
	Forbs	0.8
	Ferns	0
	Other	0
High Threat Weed cover %		2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	Euc*	Non Euc	Stem Classes and Hollows: Hollows†
80 + cm	0	0	0
50 – 79 cm	0	0	
30 – 49 cm	0	0	Hollows 20cm+
20 – 29 cm	0	0	0
10 – 19 cm	tick	tick	
5 – 9 cm	tick	tick	
< 5 cm	tick	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	70	50	50	30	50	5	5	5	5	2										
Average of the 5 subplots	50%																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	O/NR
Soil erosion	1	NR
Firewood / CWD removal	–	–
Grazing (identify native/stock)	1	R
Fire damage	–	–
Storm damage	–	–

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

Polygon cleared historically when it was selected (Broad valley floor Permanent / semi permanent water). No trees now but would have been PCT 510 84. Location of plot selected to show Snow Grass / Tall Cup Grass dominance in this part of the Polygon.

Leaf Litter and end point GPS	ID	Easting	Northing
	5m		
	15m		
	25m		
	35m		
	45m		
	End point	378379	6734190

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 08/02/19	Rangers Valley	14	Phil Cameron / Addy Watson

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	GG	g	Eriochloa crebra Tall Cup Grass	N	20	200	L		0.4
2	GG	g	Poa sieberiana v. sieberiana Snow Grass	N	65	>1000	L		0.3
3	—	—	Polygonum aviculare Wireweed	E	2	50	L		0.1
4	—	—	Paspalum dilatatum Paspalum	HTE	2	20	L		0.2
5	—	—	Lepidium bonariense Shepherds Purse	E	1	20	L		0.1
6	FG	f	Plantago varia Variable Plantain	N	0.5	20	L		0.1
7	GG	v	Juncus flavidus	N	0.5	20	L		0.2
8	FG	f	Rumex brownii Slender dock	N	0.1	10	L		0.2
9	FG	f	Portulaca oleracrae Pigweed	N	0.2	15	L		0.1
10	—	—	Modiola caroliniana Red flowered Mallow	E	G1	5	L		0.1
11	—	—	Heterotheca sp or Hawkbill sp?	E	0.1	5	L		0.2
12	—	—	Tolpis barbata Yellow Hawkweed	E	0.1	5	L		0.2
13									
14									
15			% Native cover = 86.3						
16			% exotic cover 5.3						
17			91.6						
18									
19			(86.3 ÷ 91.6) x 100 = 94.2 %						
20									
21			n %						
22			GG 3 85.5						
23			FG 3 8.8						
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

PCT

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no:

Survey Name	Plot Identifier	Recorders
Rangers Valley	15	Phil Cameron, Addy Watson

Date	Zone	Datum	IBRA region	Photo #	Zone ID
08/02/19	56				

Easting	Northing	Plot Dimensions (e.g. 20 x 20 in 20 x 50)	Orientation of midline from the 0 m point.	
376390	6735410	20 x 20 in 20 x 50	175	Magnetic °

		Confidence: H M L
Likely Vegetation Class		
Plant Community Type	PCT 510 (Yellow Box Dominated) EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	Ø
	Grasses etc.	Ø
	Forbs	2
	Ferns	Ø
	Other	Ø
Sum of Cover of native vascular plants by growth form group	Trees	10
	Shrubs	Ø
	Grasses etc.	Ø
	Forbs	7
	Ferns	Ø
	Other	Ø
High Threat Weed cover %		Ø

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	1,1 (2)	—	0
50 – 79 cm	—	—	
30 – 49 cm	—	—	Hollows 20cm+
20 – 29 cm	—	—	2
10 – 19 cm	tick —	tick	
5 – 9 cm	tick —	tick	
< 5 cm	tick —	tick	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	33		total 33

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	15	25	30	45	70	30	30	30	15	30	0	0	10	0	0	0	0	0	0	0
Average of the 5 subplots	37					27					2					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	O
Cultivation (inc. pasture)	3	O
Soil erosion	2	O
Firewood / CWD removal	—	—
Grazing (identify native/stock)	2	R
Fire damage	—	—
Storm damage	—	—

Free Text Section for brief site description

measuring tapes not left on ground as cows were trying to eat them. Just pegs as per BAM layout. Polygon mostly cleared at selection & residual large native trees left on land that couldn't be ploughed at that time (rocks etc). As >3 residual trees are in 50m we have assessed this as a PCT.

Leaf Litter and end point GPS		
ID	Easting	Northing
5m		
15m		
25m		
35m		
45m		
End point	376400	6735364

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 8/2/19	Rangers Valley	15 Show Paddock	Phil Cameron / Ashley Watson

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	TG	t	Eucalyptus melliodora	Yellow Box	N	10	2	U	–	10
2	—	—		White horehound	E	5	100	L		0.3
3	FG	f	Malva pessina	Australian hollyhock	N	2	50	L		0.2
4	FG	f	Urtica Tall	Stinging Nettle	N	5	100	L		0.3
5	—	—	Sisymbrium officinale	Hedge Mustard	E	5	500	L		0.3
6	—	—	Bromus carthaticus	Prairie Grass	E	5	100	L		0.2
7	—	—	Cynodon nlemfuensis	Bermuda Grass	E	5	100	L		0.1
8	—	—	Lolium perene	Perennial Rye Grass	E	5	100	L		0.2
9	—	—	Bidens bidens	Cobblers Peg	E	5	100	L		0.1
10	—	—	Chenopodium album	White Goosefoot	E	20	200	L		0.3
11										
12										
13			native ground cover : 7							
14			exotic cover : 45							
15			52							
16										
17			(7 ÷ 52) × 100 = 13.46%							
18										
19				∴ Not native						
20				ground cover.						
21										
22				n / %						
23			TG :	1 / 10						
24			FG	2 / 17						
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Appendix B: Integrity Ag & Environment

INTEGRITY AG
& Environment

Assessment of Biodiversity Impacts Associated with Proposed Manure Application at Rangers Valley Cattle Station

Prepared for: RDC Engineers, Highfields, Queensland.

Dr Stephen Wiedemann
Integrity Ag and Environment
14th August, 2019
Stephen.wiedemann@integrityag.net.au

Version Control

Document Title: Assessment of Biodiversity Impacts associated with proposed manure applications at Rangers Valley Cattle Station.

Client: RDC Engineers Pty Ltd

Project Title: Biodiversity Assessment of manure application areas

Version	Date	Author
1	06-08-19	SGW
2	14-08-19	SGW

Notes:
Version 1: Draft provided for review to AREA consultants.
Version 2: Final report incorporating comments from AREA consultants.

About the Author

Dr Stephen Wiedemann is an Agricultural Research Scientist with 14 years of research and consulting specialising in environmental assessment of intensive and extensive livestock. Having completed undergraduate research with Honours (1st class) in Rural Science and the University of New England and a Ph.D in integrated environmental impacts from livestock systems at Charles Sturt University. Dr Wiedemann has completed industry research for Meat and Livestock Australia (MLA), Australian Pork Limited (APL), Australian Eggs Limited (AEL) and the AgriFutures Meat Chicken Program specialising in manure management and nutrient interactions in soils of manure and effluent application areas. Steve has more than 30 peer reviewed publications covering topics including soil nutrient dynamics resulting from manure application and legume pasture production in the New England region. A full CV is available on request and a list of projects and publications can be found at www.integrityag.net.au/publications. Integrity Ag and Environment currently provide consulting services to Rangers Valley regarding environmental monitoring at the site and key staff have provided environmental advice at this site over the last 10 years.

Disclaimer

Disclaimer: This publication was produced by Integrity Ag & Environment Pty Ltd, ABN 86 627 505 980 (Integrity Ag & Environment). This disclaimer governs the use of this publication. While professional care has been taken to ensure the accuracy of all the information provided, you must not rely on the information in the publication as an alternative to professional advice from an appropriately qualified professional. If you have specific questions about any data or suggestions contained in the report you should consult an appropriately qualified professional. Results from specific parameter analyses, such as soil testing, must be understood to vary with seasonal and natural conditions, sometimes resulting in large variations over short distances. Claims will not be considered relating to the application of specific soil interpretations to areas beyond the sampling point. Integrity Ag and Environment does not represent, warrant, undertake or guarantee that the use of guidance in the publication will lead to any particular outcome or result. We will not be liable to you in respect to any business or personal losses, including without limitation: loss of or damage to profits, income, revenue, use, production, anticipated savings, business, contracts, commercial opportunities or goodwill. This report is presented solely for informational purposes.

Without prior written consent of Integrity Ag & Environment, no part, nor the whole of the publication are to be reproduced.

Table of Contents

List of Tables

1 Background

Rangers Valley Cattle Station Pty Ltd wish to expand their beef cattle feedlot known as Rangers Valley Feedlot, located about 28 kilometres north of Glen Innes on the central New England Tablelands, New South Wales. The purpose of this proposal is to increase the productivity of the land by increasing the nutrients in the soil to support the swift and strong growth of the ground cover. AREA was engaged by Rangers Valley Cattle Station Pty Ltd to assess the potential environmental impact associated with application of manure or effluent to proposed utilisation areas.

Integrity Ag & Environment was commissioned by AREA Environmental Consultants & Communication (AREA) to provide an expert opinion (this report) regarding likely vegetation changes as a result of a manure application proposal on Rangers Valley Cattle Station.

AREA will use this report to determine the future vegetation integrity score, calculated in the Biodiversity Assessment Method Calculator. This report focuses on the application of manure on the Rangers Valley Cattle Station and does not consider effluent application.

Fifteen BAM (2017) vegetation plots were completed as part of AREA's assessment. These plots defined the vegetation using structure, composition and function data and confirmed the ground cover in the proposal area consists of native and not native vegetation. Two of these plots were conducted in a paddock outside the proposal area and to which inorganic fertiliser had previously been applied. AREA addressed the proposed manure utilisation areas in two groups; Good condition areas (with greater than 50 percent of the living ground cover being native) and Moderate condition areas (with less than 50 percent of the living ground cover being native). AREA provided Integrity Ag & Environment with the plot data and a summary of the data collected.

In this report, Integrity Ag & Environment has drawn from peer-reviewed published papers, assessment of management practices and manure analysis results from Rangers Valley, data collected by AREA and personal expert experience to provide this response regarding likely vegetation changes as a result of manure application at Rangers Valley.

2 Proposed Management of Manure Utilisation Areas at Rangers Valley

Manure utilisation areas at Rangers Valley are typically managed with a three-year rotation of manure applications. Manure analysis results from regular environmental monitoring (April 2019) are reported in Table 1. Environmental soil sampling is conducted at a three yearly interval immediately prior to manure application at long-term monitoring sites, and application rates are determined according to soil nutrient levels and pasture or crop requirements. Typically, soils in the existing perennial pasture manure application areas at Rangers Valley exhibit low to moderate nitrate-N levels at the time of annual sampling (April), which is the end of the native perennial grass growing season. Soil phosphorus levels have been observed to increase following manure applications and are typically maintained at a level that is not limiting to pasture grasses. Manure applications vary depending on paddock requirements, however initial application rates exceeding 25 t ha^{-1} may be expected in the identified areas. Higher manure application rates may be used to increase soil fertility and pasture production initially, followed by maintenance level application rates in subsequent years.

Table 1. Analysis of feedlot manure at Rangers Valley and nutrient application levels at common application rates

Screened Manure Analysis – April 2019 (dry basis)			**Annual application rate when applied at 25 t (wet basis[1]) at three yearly intervals**		
Nitrogen	Phosphorus	Organic carbon	Nitrogen	Phosphorus	Organic carbon
1.93%	0.69%	24.6%	138kg	49kg	5295kg

[1] Recorded manure moisture content was 13.9%.

2.1 The manure application process

Manure application is a non-invasive process where manure is spread from a truck or tractor drawn spreader onto the surface of the soil. In perennial pastures, manure is not mechanically incorporated into the soil at Rangers Valley. Incorporation of manure nutrients occurs slowly following rainfall events. This process leads to a very low level of soil disturbance. Manure nutrients become available to pastures slowly, because of the time required for the physical process of manure being washed into the soil by rainfall, and secondly by the chemical processes required to release organically bound nutrients from the manure, which occurs over time after manure nutrients enter the soil matrix. As a result of these processes, even large applications of manure are slowly assimilated into the soil mix, reducing the 'shock' effect of nutrient applications.

3 Assessment of the Impact of Manure Application of Biodiversity Outcomes in the Proposed Manure Application Areas at Rangers Valley

3.1 Potential factors influencing ecosystem disturbance

In their seminal paper, Hobbs & Huenneke (1992) outline six major factors that cause disturbance in natural grassland ecosystems: fire, grazing, soil disturbances, nutrient inputs, trampling and fragmentation. At the Rangers Valley site, fragmentation, grazing, trampling and nutrient inputs have been a consistent feature of the native grassland areas since the introduction of grazing animals, clearing of native vegetation and pasture improvement were initiated historically. With respect to the application of manure, the major disturbance factor to be considered relates to nutrient inputs, which could be expected to increase following manure application compared to historic use of synthetic fertiliser. Consistent with current management, manure application was assumed to involve surface spreading without the need for tillage, therefore soil disturbance was not considered as a disturbance factor.

Based on the site survey assessment which showed that the species abundance of trees, shrubs, ferns and "other" was negligible in the proposed manure management application areas, the assessment focused on potential changes in species abundance of native grasses and forbs.

3.2 Disturbance of grassland as a result of proposed manure application

Field surveys at the site identified native and introduced species within the proposed manure application areas. The prolific native grasses identified in these areas included *Poa labillardieri*, *Poa sieberiana* and *Dichanthium sericeum*. Additionally, several species of native forbs were identified.

A review of the literature revealed no specific research evaluating the impact of manure application on native grasses. Consequently, the following assessment was based on the changes that could be expected from two major factors; i) elevated soil phosphorus and nitrogen levels as a result of manure applications, and ii) elevated soil organic carbon resulting in improved soil structure and moisture retention, as a result of manure application.

Nutrient increases, and specifically nitrogen or phosphorus applications, have been implicated as the cause of a change in species in native grasslands (Hobbs and Huenneke, 1992). However, the impact is species dependent, and research on native grasses including *Austrodanthonia bipartita*, *Microlaena stipoides* and *Themeda triandra* showed that varying the rate of phosphorus fertiliser applications from zero to 'high' application rates (equivalent to 105.5 kg P ha^{-1}) had no impact on plant survival or tiller density, noting that species competition was not taken into account (Nie, Zollinger and Jacobs, 2009).

For specific grass species present at the Rangers Valley site, some have been found to respond positively to fertiliser applications in native pasture swards. Robinson & Archer (1988) found that native species including Snow grass (*P. seiberana*) were highly productive in grazing swards when compared to introduced grasses. Similarly, Simpson (1993) reported that *P. labillardieri* has been found to increase in dominance when soil fertility is improved, with similar outcomes from *P. sieberiana*. These findings have been supported by Clements et al. (2003) who also indicated that *Poa* can persist and dominate native pasture swards when soil fertility increases on the southern NSW tablelands.

Similarly, Bluegrass (*D. sericeum*) yields have been observed to respond positively to nitrogen fertiliser, resulting in substantial yield increases (Bishop, 1977; Lodge and Whalley, 1981); though responses to phosphorus in the same studies were not evident. McGufficke (2003) observed similar levels of *D. sericeum* in fertilised and unfertilised, grazed pastures at a location less than 50km west of Rangers

Valley, while Lodge & Roberts (1979) reported no impact from a range of P and S application rates at a site on the north-west slopes of NSW. *D. sericeum* has been shown to dominate in soils that were previously cultivated (Lewis *et al.*, 2008) suggesting that this grass type adapts to disturbance. The common use of bluegrass in pastures confirms the adaptability of this grass type.

It is noted that aggressive introduced species can alter species composition in grasslands. Groves et al. (2003) found that aggressive introduced perennial species (*Lolium perenne* and *Dactylis glomerata*) outcompeted some native grasses including *P. labillardieri* under increased soil fertility conditions and grazing, indicating that the presence of competitive introduced grasses in conjunction with elevated soil fertility can combine to result in reduced competitiveness of native grasses. However, no aggressive introduced species were observed in the proposed manure application areas, and the assessment of future grassland composition assumed that aggressive grasses would not be sown.

Manure application can result in elevated soil carbon levels (Sommerfeldt, Chang and Entz, 1988; Slattery *et al.*, 2002), as a result of organic carbon inputs with manure. Feedlot manure at Rangers Valley typically has 25-40% organic carbon, resulting in inputs of 5-8 t ha with each application. Organic carbon levels in soil are associated with improved soil structure, porosity, water infiltration, cation exchange capacity and moisture retention, resulting in better growing conditions for crops and pastures. While this effect is difficult to quantify, it is expected to result in higher pasture yield and ground cover.

3.3 Evaluation of changes in pasture grasses at Rangers Valley in response to manure application

It is not possible to definitively predict the outcome of manure application in a grassland area in absolute terms, because other non-related factors such as long-term seasonal impacts (i.e. drought) and grazing management have a significant influence on grasslands composition. However, based on the research cited, increased nutrient levels in the absence of substantial soil disturbance or introduction of competitive grass species have led to an increase in the abundance and herbage production of *Poa* spp. and *D. sericeum* in other grazing pastures. This supports the plot comparison analysis in the present study that showed higher species abundance of *Poa spp.* in areas that have received manure applications previously (i.e. plot 8, plot 9). Based on this evidence, manure application is expected to result in equivalent species richness/composition counts to the 'good condition areas' and to result in an improvement in the 'moderate condition' areas in response to nutrient and organic matter inputs.

As these grass species are responsive to N and/or P fertilisers, it is anticipated that dry matter production will increase, resulting in higher levels of ground cover for grasses, equivalent to the fertilised areas surveyed at the site. No evidence was found to clearly support a change in the abundance or ground cover for forbs, and consequently these were considered to be equivalent to the "good condition" areas.

This evaluation has been based on manure applications at rates in the order of 25 t ha^{-1} applied in a three year rotation, with higher initial applications potentially being applied to improve soil fertility. These conclusions also assume similar grazing routines are maintained. Manure applications are monitored to maintain soil nutrient levels below threshold levels as part of the original EIS conditions. With this management program in place, it is expected that the above evaluation will be valid over the long-term.

Species richness/ composition - Count

	Trees	Shrubs	Grass or grass like	Forbs	Ferns	Other
Good condition areas	0	0	3.8	2	0	0
Moderate condition areas	0	0	2.4	2.2	0	0
Area previously fertilised	0	0.5	3.5	8	0	0
Manure application areas[1]	0	0	3.8	2	0	0

[1] Based on the available research and site conditions, it is expected that these scores are suitable for both the good condition areas and moderate condition areas, with the moderate condition areas improving slightly in response to improved fertility and soil health.

Cover/ structure - Percent

	Trees	Shrubs	Grass or grass like	Forbs	Ferns	Other
Good condition areas	0	0	39.1	2.9	0	0
Moderate condition areas	0	0	7.5	6.4	0	0
Area previously fertilised	0	0.1	85.3	4.7	0	0
Manure application areas[1]	0	0	85	2.9	0	0

[1] Based on the available research and site conditions, it is expected that these scores are suitable for both the good condition areas and moderate condition areas, with the moderate condition areas improving slightly in response to improved fertility and soil health.

Habitat features/ function

	Number of large trees	Litter cover (percent cover)	Coarse woody debris (m)	Stem size class (number of)	Regeneration stems <5cm DBH (0=absent/ 1=present)	High threat weed cover percent cover
Good condition areas	0	51.8	0.3	0	0	11
Moderate condition areas	0	35.4	0.2	0	0	10.5
Area previously fertilised	0	41.5	0.2	0	1	6
Manure application areas[1]	0	40	0.2	0	0	12.5

[1] Based on the available research and site conditions, it is expected that these scores are suitable for both the good condition areas and moderate condition areas, with the moderate condition areas improving slightly in response to improved fertility and soil health.

References

Bishop, H. G. (1977) 'The response to nitrogen and phosphorus fertilizer of native pasture on the Balbirini land system in north-west Queensland', *Tropical Grasslands*, 11(3), p. 257.

Clements, B. *et al.* (2003) 'Grazier's guide to pastures: sowing and managing profitable pastures in the Central and Southern Tablelands, Monaro and Upper South West Slopes of New South Wales'.

GROVES, R. H., AUSTIN, M. P. and KAYE, P. E. (2003) 'Competition between Australian native and introduced grasses along a nutrient gradient', *Austral Ecology*, 28(5), pp. 491–498. doi: 10.1046/j.1442-9993.2003.01305.x.

Hobbs, R. J. and Huenneke, L. F. (1992) 'Disturbance, Diversity, and Invasion: Implications for Conservation', *Conservation Biology*, 6(3), pp. 324–337. doi: 10.1046/j.1523-1739.1992.06030324.x.

Lewis, T. *et al.* (2008) 'Perennial grassland dynamics on fertile plains: Is coexistence mediated by disturbance?', *Austral Ecology*, 33(2), pp. 128–139. doi: 10.1111/j.1442-9993.2007.01801.x.

Lodge, G. M. and Roberts, E. A. (1979) 'The effects of phosphorus, sulphur and stocking rate on the yield, chemical and botanical composition of natural pastures, north-west slopes, new south wales', *Australian Journal of Experimental Agriculture*. doi: 10.1071/EA9790698.

Lodge, G. M. and Whalley, R. D. B. (1981) 'Establishment of warm and cool-season native perennial grasses on the north-west slopes of new south wales. I. dormancy and germination', *Australian Journal of Botany*, 29(2), pp. 111–119. doi: 10.1071/BT9810111.

McGufficke, B. R. (2003) 'Native grassland management: A botanical study of two native grassland management options on a commercial cattle property', *Rangeland Journal*, 25(1), pp. 37–46. doi: 10.1071/RJ03004.

Nie, Z. N., Zollinger, R. P. and Jacobs, J. L. (2009) 'Performance of 7 Australian native grasses from the temperate zone under a range of cutting and fertiliser regimes', *Crop and Pasture Science*, 60(10), pp. 943–953. doi: 10.1071/CP09067.

Robinson, G. G. and Archer, K. A. (1988) 'Agronomic potential of native grass species on the Northern Tablelands of New South Wales. I. Growth and herbage production', *Australian Journal of Agricultural Research*. doi: 10.1071/AR9880415.

Simpson, P. (1993) 'How to maintain or improve the productivity of native grass-based pastures in the tablelands', *Proceedings of the 8th Annual Conference, Grassland Society of NSW*, pp. 39–45.

Slattery, W. J. *et al.* (2002) 'Effects of composted feedlot manure on the chemical characteristics of duplex soils in north-eastern Victoria', *Australian Journal of Experimental Agriculture*, 42(3), p. 369. doi: 10.1071/EA00121.

Sommerfeldt, T. G., Chang, C. and Entz, T. (1988) 'Long-term Annual Manure Applications Increase Soil Organic Matter and Nitrogen, and Decrease Carbon to Nitrogen Ratio', *Soil Science Society of America Journal*, 52(6), p. 1668. doi: 10.2136/sssaj1988.03615995005200060030x.

Appendix C: BAMC Reports

PCT510 – BAM Outputs

BAM Vegetation Zones Report

Proposal Details

Assessment Id
00014946/BAAS18146/19/00014947

Assessment name
Rangers Valley manure and effluent utilisation

BAM data last updated *
30/08/2019

Assessor Name
Phillip Cameron

Report Created
20/09/2019

BAM Data version *
13

Assessor Number
BAAS17082

Assessment Type
Part 4 Developments (General)

BAM Case Status
Finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Assessment Revision
1

Date Finalised
20/09/2019

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	510_Gd_HighNativeGround	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Gd_HighNativeGround	86.99	5	Manure (86.99 ha)
2	510_Poor-LowNativeGround	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Poor-LowNativeGround	95.75	5	Manure (71.31 ha) Effluent (24.44 ha)

3	510_Poor_NoNativeGround	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Poor_NoNativeGround	0.59	1	Effluent (0.59 ha)

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014946/BAAS18146/19/00014947	Rangers Valley manure and effluent utilisation	30/08/2019
Assessor Name	**Report Created**	**BAM Data version ***
Phillip Cameron	20/09/2019	13
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17082	Part 4 Developments (General)	Finalised
	Assessment Revision	**Date Finalised**
	1	20/09/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Diamond Firetail	Stagonopleura guttata	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Eastern False Pipistrelle	Falsistrellus tasmaniensis	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Flame Robin	Petroica phoenicea	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

Grey-headed Flying-fox	Pteropus poliocephalus	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Koala	Phascolarctos cinereus	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Little Eagle	Hieraaetus morphnoides	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Little Lorikeet	Glossopsitta pusilla	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Regent Honeyeater	Anthochaera phrygia	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Scarlet Robin	Petroica boodang	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Speckled Warbler	Chthonicola sagittata	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Square-tailed Kite	Lophoictinia isura	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Swift Parrot	Lathamus discolor	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Turquoise Parrot	Neophema pulchella	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Varied Sittella	Daphoenositta chrysoptera	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

BAM Candidate Species Report

Proposal Details

Assessment Id 00014946/BAAS18146/19/00014947	Proposal Name Rangers Valley manure and effluent utilisation	BAM data last updated * 30/08/2019
Assessor Name Phillip Cameron	Report Created 20/09/2019	BAM Data version * 13
Assessor Number BAAS17082	Assessment Type Part 4 Developments (General)	BAM Case Status Finalised
	Assessment Revision 1	Date Finalised 20/09/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
Calyptorhynchus lathami Glossy Black-Cockatoo	Yes (assumed present)	**Mar** **Apr** **May** **Jun** **Jul** **Aug**
Hoplocephalus bitorquatus Pale-headed Snake	Yes (assumed present)	**Jan** **Feb** **Mar** **Nov** **Dec**
Hieraaetus morphnoides Little Eagle	Yes (assumed present)	**Aug** **Sep** **Oct**
Haliaeetus leucogaster White-bellied Sea-Eagle	Yes (assumed present)	**Jul** **Aug** **Sep** **Oct** **Nov** **Dec**
Vespadelus troughtoni Eastern Cave Bat	Yes (surveyed)	**Jan** **Nov** **Dec**

List of Species Not On Site

BAM Candidate Species Report

Name
Eucalyptus magnificata Northern Blue Box
Eucalyptus nicholii Narrow-leaved Black Peppermint
Dichanthium setosum Bluegrass
Diuris pedunculata Small Snake Orchid
Lathamus discolor Swift Parrot
Lophoictinia isura Square-tailed Kite
Thesium australe Austral Toadflax
Miniopterus schreibersii oceanensis Eastern Bentwing-bat
Ninox connivens Barking Owl
Phascolarctos cinereus Koala
Pteropus poliocephalus Grey-headed Flying-fox
Anthochaera phrygia Regent Honeyeater
Adelotus brevis - endangered population Tusked Frog population in the Nandewar and New England Tableland Bioregions

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014946/BAAS18146/19/00014947	Rangers Valley manure and effluent utilisation	30/08/2019
Assessor Name	Assessor Number	BAM Data version *
Phillip Cameron	BAAS17082	13
Proponent Names	Report Created	BAM Case Status
Rangers Valley	20/09/2019	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (General)	20/09/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

Species
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	183.3	1.00

510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	0.9	3.00
Haliaeetus leucogaster / White-bellied Sea-Eagle	45.7	3.00

Hieraaetus morphnoides / Little Eagle	66.9	2.00
Hoplocephalus bitorquatus / Pale-headed Snake	66.9	3.00
Vespadelus troughtoni / Eastern Cave Bat	66.9	4.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	510_Poor_NoNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	510_Poor-LowNativeGround	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Haliaeetus leucogaster/ White-bellied Sea-Eagle	510_Gd_HighNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Haliaeetus leucogaster/White-bellied Sea-Eagle	Any in NSW

Haliaeetus leucogaster/ White-bellied Sea-Eagle	510_Gd_HighNative Ground	
	510_Poor_NoNative Ground	**Like-for-like credit retirement options**
		Spp / IBRA region
		Haliaeetus leucogaster/White-bellied Sea-Eagle / Any in NSW
	510_Poor-LowNativeGround	**Like-for-like credit retirement options**
		Spp / IBRA region
		Haliaeetus leucogaster/White-bellied Sea-Eagle / Any in NSW
Hieraaetus morphnoides/ Little Eagle	510_Gd_HighNative Ground	**Like-for-like credit retirement options**
		Spp / IBRA region
		Hieraaetus morphnoides/Little Eagle / Any in NSW

Hieraaetus morphnoides/ Little Eagle	510_Poor_NoNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hieraaetus morphnoides/Little Eagle	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	510_Gd_HighNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	510_Poor_NoNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Vespadelus troughtoni/ Eastern Cave Bat	510_Gd_HighNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	510_Poor_NoNative Ground	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014946/BAAS18146/19/00014947	Rangers Valley manure and effluent utilisation	30/08/2019
Assessor Name	Assessor Number	BAM Data version *
Phillip Cameron	BAAS17082	13
Proponent Name(s)	Report Created	BAM Case Status
Rangers Valley	20/09/2019	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (General)	20/09/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

Species
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	183.3	1.00

510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Deepwater Downs,Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 3 or higher	Yes (including artificial)	IBRA Region: New England Tablelands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	0.9	3.00
Haliaeetus leucogaster / White-bellied Sea-Eagle	45.7	3.00
Hieraaetus morphnoides / Little Eagle	66.9	2.00
Hoplocephalus bitorquatus / Pale-headed Snake	66.9	3.00
Vespadelus troughtoni / Eastern Cave Bat	66.9	4.00

Calyptorhynchus lathami/
Glossy Black-Cockatoo

510_Poor_NoNative Ground

Like-for-like options

Spp	IBRA region
Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	510_Poor-LowNativeGround	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Haliaeetus leucogaster/ White-bellied Sea-Eagle	510_Gd_HighNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Haliaeetus leucogaster/White-bellied Sea-Eagle	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	510_Poor_NoNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Haliaeetus leucogaster/White-bellied Sea-Eagle	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	510_Poor-LowNativeGround	**Like-for-like options**		
		Spp	IBRA region	
		Haliaeetus leucogaster/White-bellied Sea-Eagle	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hieraaetus morphnoides/ Little Eagle	510_Gd_HighNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Hieraaetus morphnoides/Little Eagle	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hieraaetus morphnoides/ Little Eagle	510_Poor_NoNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Hieraaetus morphnoides/Little Eagle	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hoplocephalus bitorquatus/ Pale-headed Snake	510_Gd_HighNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	510_Poor_NoNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	510_Gd_HighNative Ground	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna		Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

<table>
<tr><td rowspan="6">Vespadelus troughtoni/ Eastern Cave Bat</td><td rowspan="6">510_Poor_NoNative Ground</td><td colspan="3">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td>IBRA region</td></tr>
<tr><td colspan="2">Vespadelus troughtoni/Eastern Cave Bat</td><td>Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Kingdom</td><td>Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
<tr><td>Fauna</td><td></td><td>Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
</table>

BAM Credit Summary Report

Proposal Details

Assessment Id
00014946/BAAS18146/19/00014947

Proposal Name
Rangers Valley manure and effluent utilisation

BAM data last updated *
30/08/2019

Assessor Name
Phillip Cameron

Report Created
20/09/2019

BAM Data version *
13

Assessor Number
BAAS17082

BAM Case Status
Finalised

Date Finalised
20/09/2019

Assessment Revision
1

Assessment Type
Part 4 Developments (General)

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion								
1	510_Gd_HighNativeGround	0.0	87.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	1

2	510_Poor-LowNativeGround	3.9	95.8	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
3	510_Poor_NoNativeGround	6.1	0.6	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
							Subtotal	**1**
							Total	**1**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
510_Poor_NoNativeGround	6.1	0.59	0.25	2	N/A	2
510_Poor-LowNativeGround	3.9	0.28	0.25	2	N/A	1
					Subtotal	**3**
Haliaeetus leucogaster / White-bellied Sea-Eagle (Fauna)						
510_Gd_HighNativeGround	0.0	44.89	0.25	2	N/A	1
510_Poor_NoNativeGround	6.1	0.59	0.25	2	N/A	2

510_Poor-LowNativeGround	3.9	0.23	0.25	2	N/A	0
					Subtotal	**3**
Hieraaetus morphnoides / Little Eagle (Fauna)						
510_Gd_HighNativeGround	0.0	66.3	0.25	1.5	N/A	1
510_Poor_NoNativeGround	6.1	0.59	0.25	1.5	N/A	1
					Subtotal	**2**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
510_Gd_HighNativeGround	0.0	66.3	0.25	2	False	1
510_Poor_NoNativeGround	6.1	0.59	0.25	2	False	2
					Subtotal	**3**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
510_Gd_HighNativeGround	0.0	66.3	0.25	3	True	1
510_Poor_NoNativeGround	6.1	0.59	0.25	3	True	3
					Subtotal	**4**

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00014946/BAAS18146/19/00014947	61	1	20/09/2019

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Phillip Cameron	BAAS17082	Rangers Valley manure and effluent utilisation	Finalised

Assessment Type	Date Finalised
Part 4 Developments (General)	20/09/2019

PCT list

Include	PCT common name	Credits
Yes	**510 -** Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	1

Species list

Include	Species	Credits
Yes	***Calyptorhynchus lathami*** (Glossy Black-Cockatoo)	3
Yes	***Hoplocephalus bitorquatus*** (Pale-headed Snake)	3
Yes	***Vespadelus troughtoni*** (Eastern Cave Bat)	4
Yes	***Hieraaetus morphnoides*** (Little Eagle)	2
Yes	***Haliaeetus leucogaster*** (White-bellied Sea-Eagle)	3

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Biodiversity payment summary report

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Deepwater Downs	**510 -** Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion **Warning: This PCT has NO trades recorded in Deepwater Downs**	$627.25	0.71782200	2.51860000	19.99%	$20.00	1.0000	$1,537.13	1	$1,537.13

Subtotal (excl. GST)	**$1,537.13**
GST	**$153.71**
Total ecosystem credits (incl. GST)	**$1,690.84**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10140	***Calyptorhynchus lathami*** (Glossy Black-Cockatoo)	Vulnerable	$506.66	19.9900%	$20.00	3	$1,883.82
10412	***Hoplocephalus bitorquatus*** (Pale-headed Snake)	Vulnerable	$434.47	19.9900%	$20.00	3	$1,623.96
10829	***Vespadelus troughtoni*** (Eastern Cave Bat)	Vulnerable	$725.00	19.9900%	$20.00	4	$3,559.71

Biodiversity payment summary report

20131	***Hieraaetus morphnoides*** (Little Eagle)	Vulnerable	$506.66	19.9900%	$20.00	2	$1,255.88
20322	***Haliaeetus leucogaster*** (White-bellied Sea-Eagle)	Vulnerable	$173.02	19.9900%	$20.00	3	$682.82

Subtotal (excl. GST)	**$9,006.19**
GST	**$900.62**
Total species credits (incl. GST)	**$9,906.81**
Grand total	**$11,597.65**

Paddock Trees BAM Output

Paddock Tree Report

Proposal Details

Assessment Id
00014946/BAAS17082/19/00015000

Assessment name
Rangers Valley

BAM data last updated *
04/07/2019

Assessor Name
Phillip Cameron

Report Created
14/08/2019

BAM Data version *
12

Assessor Number
BAAS17082

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Paddock Trees

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Paddock Trees

PCT code	PCT name	No. of trees	Species	DBHOB Category	Contain hollows	Class	Assessment required
510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	1	Eucalyptus caliginosa	>= 20cm and <50cm	True	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

Paddock Tree Report

510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	2	Eucalyptus melliodora	>= 20cm and <50cm	True	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species
510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	2	Eucalyptus melliodora	> 50cm	True	3	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species
510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	1	Eucalyptus bridgesiana	> 50cm	True	3	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species
510	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	1	Eucalyptus melliodora	>= 20cm and <50cm	False	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014946/BAAS17082/19/00015000	Rangers Valley	04/07/2019
Assessor Name	Report Created	BAM Data version *
Phillip Cameron	14/08/2019	12
Assessor Number	BAM Case Status	Date Finalised
BAAS17082	Open	To be finalised
Assessment Revision	Assessment Type	
0	Paddock Trees	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name
Barking Owl	Ninox connivens
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae
Eastern False Pipistrelle	Falsistrellus tasmaniensis
Flame Robin	Petroica phoenicea
Glossy Black-Cockatoo	Calyptorhynchus lathami
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata
Koala	Phascolarctos cinereus
Little Eagle	Hieraaetus morphnoides
Little Lorikeet	Glossopsitta pusilla
Scarlet Robin	Petroica boodang
Speckled Warbler	Chthonicola sagittata
Swift Parrot	Lathamus discolor
Varied Sittella	Daphoenositta chrysoptera
White-bellied Sea-Eagle	Haliaeetus leucogaster
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00014946/BAAS17082/19/00015000

Assessor Name
Phillip Cameron

Proponent Names

Assessment Revision
0

Proposal Name
Rangers Valley

Assessor Number
BAAS17082

Report Created
14/08/2019

Assessment Type
Paddock Trees

BAM data last updated *
04/07/2019

BAM Data version *
12

Date Finalised
To be finalised

BAM Case Status
Open

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Ecosystem Credit Summary

PCT	TEC	Credits
510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	7.00

Credit classes for 510	Like-for-like options			
	TEC	Trading group	HBT	IBRA region
	White Box Yellow Box Blakely's Red Gum Woodland	-	Yes	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00014946/BAAS17082/19/00015000

Proposal Name
Rangers Valley

BAM data last updated *
04/07/2019

Assessor Name
Phillip Cameron

Assessor Number
BAAS17082

BAM Data version *
12

Proponent Name(s)

Report Created
14/08/2019

Assessment Type
Paddock Trees

Date Finalised
To be finalised

Assessment Revision
0

BAM Case Status
Open

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Variations)

Ecosystem Credit Summary

PCT	TEC	Credits
510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	7.00

Credit classes for 510

Like-for-like options

TEC	Trading group	HBT	IBRA region
White Box Yellow Box Blakely's Red Gum Woodland	-	Yes	Deepwater Downs, Beardy River Hills, Binghi Plateau, Glenn Innes-Guyra Basalts, Northeast Forest Lands, Severn River Volcanics and Tenterfield Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	HBT	IBRA region
Grassy Woodlands	Tier 3	Yes (including artificial)	

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014946/BAAS17082/19/00015000	Rangers Valley	04/07/2019
Assessor Name	Report Created	BAM Data version *
Phillip Cameron	14/08/2019	12
Assessor Number	BAM Case Status	Date Finalised
BAAS17082	Open	To be finalised
Assessment Revision	Assessment Type	
0	Paddock Trees	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Paddock Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
510-Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion			
2	True	1.0	1
2	True	2.0	2
3	True	2.0	2
3	True	1.0	1
2	False	1.0	1
			7
			7

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00014946/BAAS17082/19/00015000	61	0	14/08/2019

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Phillip Cameron	BAAS17082	Rangers Valley	Open

Assessment Type	Date Finalised
Paddock Trees	To be finalised

PCT list

Include	PCT common name	Credits
Yes	**510 -** Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	7

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Deepwater Downs	**510 -** Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion **Warning: This PCT has NO trades recorded in Deepwater Downs**	$627.25	0.71782200	2.51860000	19.99%	$20.00	1.0000	$1,537.13	7	$10,759.93

Subtotal (excl. GST)	**$10,759.93**
GST	**$1,075.99**

Biodiversity payment summary report

Total credits (incl. GST)	**$11,835.92**

Appendix D: NSW and Commonwealth database search results

BC Act

Scientific name	Common name	NSW status	Commonwealth status
Litoria booroolongensis	Booroolong Frog	Endangered	Endangered
Ninox connivens	Barking Owl	Vulnerable	
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	
Poephila cincta cincta	Black-throated Finch (southern subspecies)	Presumed Extinct	Endangered
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	
Burhinus grallarius	Bush Stone-curlew	Endangered	
Stagonopleura guttata	Diamond Firetail	Vulnerable	
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	
Petroica phoenicea	Flame Robin	Vulnerable	
Stictonetta naevosa	Freckled Duck	Vulnerable	
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable	
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable	
Hieraaetus morphnoides	Little Eagle	Vulnerable	
Glossopsitta pusilla	Little Lorikeet	Vulnerable	
Tyto novaehollandiae	Masked Owl	Vulnerable	
Grantiella picta	Painted Honeyeater	Vulnerable	Vulnerable
Ninox strenua	Powerful Owl	Vulnerable	
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered
Petroica boodang	Scarlet Robin	Vulnerable	
Chthonicola sagittata	Speckled Warbler	Vulnerable	
Circus assimilis	Spotted Harrier	Vulnerable	
Lophoictinia isura	Square-tailed Kite	Vulnerable	
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	Critically Endangered	Vulnerable
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered
Neophema pulchella	Turquoise Parrot	Vulnerable	
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	
Carex Sedgeland of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions	Carex Sedgeland of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions	Endangered Ecological Community	
McKies Stringybark/Blackbutt Open Forest in the Nandewar and New England Tableland Bioregions	McKies Stringybark/Blackbutt Open Forest in the Nandewar and New England Tableland Bioregions	Endangered Ecological Community	
Ribbon Gumâ€"Mountain Gumâ€"Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	Ribbon Gumâ€"Mountain Gumâ€"Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	Endangered Ecological Community	
Upland Wetlands of the Drainage Divide of the New England Tableland	Upland Wetlands of the Drainage Divide of the New England Tableland	Endangered Ecological Community	Endangered

Scientific name	Common name	NSW status	Commonwealth status
Bioregion	Bioregion		
White Box Yellow Box Blakelyâ€™s Red Gum Woodland	White Box Yellow Box Blakelyâ€™s Red Gum Woodland	Endangered Ecological Community	Critically Endangered
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Vulnerable
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Chalinolobus nigrogriseus	Hoary Wattled Bat	Vulnerable	
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable
Mormopterus lumsdenae	Northern Free-tailed Bat	Vulnerable	
Aepyprymnus rufescens	Rufous Bettong	Vulnerable	
Myotis macropus	Southern Myotis	Vulnerable	
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered
Petaurus norfolcensis	Squirrel Glider	Vulnerable	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	
Callistemon pungens	Callistemon pungens	Not listed	Vulnerable
Hibbertia sp. B	Hibbertia sp. B	Not listed	
Prasophyllum sp. Wybong	Prasophyllum sp. Wybong	Not listed	Critically Endangered
Prostanthera staurophylla sensu stricto	Prostanthera staurophylla sensu stricto	Endangered	Vulnerable
Thesium australe	Austral Toadflax	Vulnerable	Vulnerable
Chiloglottis platyptera	Barrington Tops Ant Orchid	Vulnerable	
Eucalyptus rubida subsp. barbigerorum	Blackbutt Candlebark	Vulnerable	Vulnerable
Dichanthium setosum	Bluegrass	Vulnerable	Vulnerable
Boronia boliviensis	Bolivia Hill Boronia	Endangered	
Pimelea venosa	Bolivia Hill Pimelea	Endangered	Endangered
Homoranthus croftianus	Bolivia Homoranthus	Endangered	
Eucalyptus boliviana	Bolivia Stringybark	Vulnerable	
Boronia granitica	Granite Boronia	Vulnerable	Endangered
Arthraxon hispidus	Hairy Jointgrass	Vulnerable	Vulnerable
Picris evae	Hawkweed	Vulnerable	Vulnerable
Rutidosis heterogama	Heath Wrinklewort	Vulnerable	Vulnerable
Bothriochloa biloba	Lobed Bluegrass	Not listed	
Acacia macnuttiana	MacNutt's Wattle	Vulnerable	Vulnerable
Eucalyptus mckieana	McKie's Stringybark	Vulnerable	Vulnerable
Goodenia macbarronii	Narrow Goodenia	Not listed	
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Vulnerable	Vulnerable
Polygala linariifolia	Native Milkwort	Endangered	
New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion	New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion	Critically Endangered Ecological Community	Critically Endangered
Eucalyptus magnificata	Northern Blue Box	Endangered	
Eucalyptus caleyi subsp. ovendenii	Ovenden's Ironbark	Vulnerable	Vulnerable
Acacia acrionastes	Pindari Wattle	Endangered	

Scientific name	Common name	NSW status	Commonwealth status
Astrotricha roddii	Rodd's Star Hair	Endangered	Endangered
Pomaderris queenslandica	Scant Pomaderris	Endangered	
Muehlenbeckia costata	Scrambling Lignum	Vulnerable	
Micromyrtus grandis	Severn River Heath-myrtle	Endangered	Endangered
Swainsona sericea	Silky Swainson-pea	Vulnerable	
Diuris pedunculata	Small Snake Orchid	Endangered	Endangered
Almaleea cambagei	Torrington Pea	Endangered	Vulnerable
Acacia pubifolia	Velvet Wattle	Endangered	Vulnerable
Adelotus brevis - endangered population	Tusked Frog population in the Nandewar and New England Tableland Bioregions	Endangered Population	
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Vulnerable	Vulnerable
Hoplocephalus bitorquatus	Pale-headed Snake	Vulnerable	

EPBC – Matters of National Environmental Significance

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/03/19 05:32:38

No Image Available

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km

No Image Available

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	33
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	1100 - 1200km
Riverland	1100 - 1200km
The coorong, and lakes alexandrina and albert wetland	1300 - 1400km

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Acacia pubifolia Velvet Wattle [19799]	Vulnerable	Species or species habitat may occur within area
Acacia ruppii Rupp's Wattle [7559]	Endangered	Species or species habitat may occur within area
Boronia granitica Granite Boronia [18598]	Endangered	Species or species habitat may occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat may occur within area
Callistemon pungens [55581]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Diuris pedunculata Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid [18325]	Endangered	Species or species habitat likely to occur within area
Eucalyptus mckieana McKie's Stringybark [20199]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus nicholii Narrow-leaved Peppermint, Narrow-leaved Black Peppermint [20992]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus rubida subsp. barbigerorum Blackbutt Candlebark [64618]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Uvidicolus sphyrurus Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko [84578]	Vulnerable	Species or species habitat likely to occur within area
Wollumbinia belli Bell's Turtle, Western Sawshelled Turtle, Namoi River Turtle, Bell's Saw-shelled Turtle [86071]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Fladbury	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area

Name	Status	Type of Presence
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-29.52602 151.72754

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia
Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111