Travers

bushfire & ecology

Biodiversity Offset Strategy

Proposed Rezoning
Macquariedale Road,
Appin

February 2014
(Ref: A12097Bio)

Biodiversity Offset Strategy

Proposed Rezoning - Macquariedale Road, Appin

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

Travers bushfire & ecology has been engaged to prepare a Biodiversity Offset Strategy to mitigate against the impacts of the proposed rezoning at Macquariedale Road, Appin, within the Wollondilly LGA.

A full ecological survey report has been prepared for the proposed rezoning (*Travers bushfire & ecology 2014*). In addition to onsite mitigation measures, biodiversity offsets are recommended to offset the loss of:

- Cumberland Plain Woodland (CPW),
- Shale Sandstone Transition Forest (SSTF), and
- threatened species habitat.

We advise that it is current policy for offsets to be evaluated through the use of the biobanking credit calculator or using the biodiversity certification assessment methodology to satisfy NSW biodiversity offsetting principles, and the *EPBC Act* Environmental Offset Calculator to satisfy *EPBC Act* Environmental offsetting policy. Both offset calculators will need to demonstrate compliance with current policies at both the state and commonwealth assessment levels. The removal of EECs and known threatened species habitat are 'red flag' matters under the NSW biodiversity certification assessment process.

This report is based on an assessment of ecological impacts of the proposed rezoning at Macquariedale Road, Appin, findings of the Flora and Fauna Survey Report (*Travers bushfire & ecology 2014*) and the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). The proposed biodiversity offset sites have been surveyed to identify the existing vegetation communities using the biometric field data collection method as stipulated in the Biobanking Assessment Methodology (2008).

Outcomes of preliminary biodiversity certification assessment - maintain or improve test

The Preliminary Biodiversity Certification Assessment (*EcoLogical Australia 2014)* identifies that the proposed planning scheme can be offset using a minimum average offset ratio of approximately 3.2:1 (CPW and SSTF combined). *EcoLogical Australia* advises that based on the number of required credits a total biodiversity offset of 45-50ha consisting of the CPW (10ha) and SSTF (35-40ha).

For the purposes of this assessment a total 50ha biodiversity offset area has been chosen to ensure the planning proposal meets the biodiversity certification requirements. With the exception of approximately 5ha, the minimum offset requirements for SSTF are mostly met within the proposed E2 Zone. The remaining 5ha would need to be provided in the form of an offsite biodiversity offset.

Two sites have been selected for Biodiversity Offsetting purposes:

- Macquariedale Road, Appin - onsite conservation areas
- Elladale Road, Appin - offsite biodiversity offset

Travers bushfire & ecology notes that the Preliminary Biodiversity Certification Assessment includes an offset for the loss of <u>all</u> habitats within the Appin Bypass. However, the proponent is only utilising the first 20m of the bypass adjoining the R2 Zone for asset protection purposes.

Under the NSW Biodiversity Certification Assessment Methodology the loss of Cumberland Plain Land Snail (CPLS) habitat is treated as an ecosystem credit and is not required to have any further offsetting applied.

Additional offsets over and above the proposed CPW offset area at Elladale Rood Appin, are not offered for CPLS habitat under the planning proposal. Mitigation measures as discussed in the Flora and Fauna Survey Report (*Travers bushfire & ecology* 2014) are likely to include within site relocation of CPLS into adjoining habitat or the proposed Elladale offset site which supports higher quality snail habitat; partial restoration of habitat at Macquariedale Road and habitat enrichment measures.

As the method of protection determines the % of credits that can be claimed for biodiversity certification purposes, and given that the proposed offsets are most likely to be protected under a conservation agreement, 90% of the credit value can be claimed as a biodiversity offset. Therefore the target number of hectares should range between 50 and 55 hectares. The selected lots proposed for biodiversity offsets provides a total of 54.7ha.

Outcomes of EPBC ACT environmental offset calculator – EPBC Act requirements

Under the *EPBC Act,* CPLS is not a listed *Matter of National Environmental Significance* and is therefore not required to be offset. The loss of CPW is required to be offset under the *EPBC Act* Environmental Offsets Policy as it is part of a listed community 'Cumberland Plain Shale Woodland and Shale Gravel Transition Forest'. Shale/Sandstone Transition Forest (SSTF) is a listed *EPBC Act* matter and is also to be offset.

Under the *EPBC Act* Biodiversity Offsets Policy (2012) and using the *EPBC Act* environmental offsets calculator, a 10ha CPW environmental offset will achieve a 136 % of impact offset (a minimum 90% of impact offset is required). A 10ha CPW environmental offset is a 3.4:1 offset ratio.

A 40ha SSTF environmental offset will achieve a 245% of impact offset. Therefore the proposed SSTF offset does meets the 90% of impact offset requirement using the *EPBC Act* environmental offset calculator. A 40ha SSTF environmental offset results in a 4.4:1 offset ratio.

Therefore the expected offsets as proposed by *EcoLogical Australia* (2014) meet the environmental offset requirements under the *EPBC Act* Environmental Offset Policy (2012).

Proposed biodiversity offset sites

For the purposes of identifying offsets for the planning proposal a target 4.4:1 offset ratio has been applied for SSTF, 3.4:1 offset ratio has been applied for CPW to identify the target offsets for both communities. These offset ratios ensure that the proposed offsets achieve a maintain or improve outcome.

Table 1 provides a summary of the target offset areas for both CPW and SSTF using a proposed 4.4:1 offset ratio for SSTF, 3.4:1 offset ratio for CPW.

Taking into account the onsite conservation areas at Macquariedale Road (approximately 34.81ha of SSTF) the offsite biodiversity offsets to be achieved at Elladale Road are estimated at approximately 15ha consisting of 10ha of CPW and 5ha of SSTF. The total area of protection and restoration offsets to be provided is subject to the parcels selected

and the outcomes of the approval by Office of Environment & Heritage (OEH) and by Department of Environment (DoE) under the *EPBC Act*.

The proposed biodiversity offset areas as selected by *Travers bushfire & ecology* (54.7ha) include (Figure 1, 2 & 3):-

- 34.81ha (SSTF only) onsite conservation areas – Macquariedale Road, Appin
- 19.85ha (SSTF and CPW) offsite biodiversity offset – Elladale Road, Appin

A proposed SSTF/CPW transition revegetation area (0.7ha) within the conserved lands at Macquariedale Road is proposed to be enriched for CPLS through the installation of onground protection (*Euc. tereticornis* logs) and revegetation using an more desirable species mix dominated by CPW canopy species that provide higher quality foraging resources.

Travers bushfire & ecology has selected appropriately sized SSTF and CPW vegetation areas at Elladale Road as biodiversity offset sites to meet the target for each community. It includes the target vegetation communities with a minimum of 8.99ha of CPW and 7.98ha of SSTF and 1.62ha Sandstone Gully Forest (SGF). 1.26ha of CPW revegetation is also contained within the Elladale Road Offset site.

Table 1 - Summary of biodiversity offset targets for CPW and SSTF

Vegetation Community (Notes 1 to 5)	Total Area (ha) (note 5)	Area within onsite offset areas (ha)	Area within R2 Zone & APZ (ha)	% loss	Offset Ratio (Note 1)	Target Onsite and Offsite Offset Areas (ha) (Note 4)	Target Offsite Offset (ha) (Note 4)
Target Offset Ratios (3.4:1 CPW 6:1 SSTF)							
CPW	2.96	0.00	2.96	100%	3.4:1	10.06	10.06ha
SSTF	46.20	34.06	9.12 (Note 5)	19.7%	4.4:1(Note 6)	40.12	5.31 ha
Sub total	**49.16**	**34.06**	**12.08**	**24.5%**	**4.15:1**	**50.18**	**15.37ha**

Note 1:- The offset ratios are based on the preliminary Biodiversity Certification Assessment report by *EcoLogical Australia* (2014) and the EPBC Act Environmental Offsets Calculator. This approach ensures approval by State and Commonwealth agencies for biodiversity offsetting purposes.

Note 2:- CPW is a critically endangered ecology community and is a red flag matter when considering biodiversity offsets. A red flag variation report is required to enable an approval to remove this vegetation under biobanking or biodiversity certification.

Note 3:- Shale/Sandstone Transition Forest is an endangered ecology community and is a red flag matter when considering biodiversity offsets under the TSC Act. A red flag variation report is required to enable an approval to remove this vegetation under biobanking or biodiversity certification.

Note 4:- Offset targets do not include offsets for the future Appin bypass as RTA will be required to meet the biodiversity offset requirements for the bypass impacts. They do include offsets for the APZ impact within the bypass corridor which is caused by the proposed rezoning.

Note 5:- This figure excludes impacts caused by the future Appin bypass which is not caused by the planning proposal nor does it include any vegetation currently under a NVA Act Clearance approval. It does include the asset protection zone for the planning proposal which impacts the first 20m of the bypass corridor

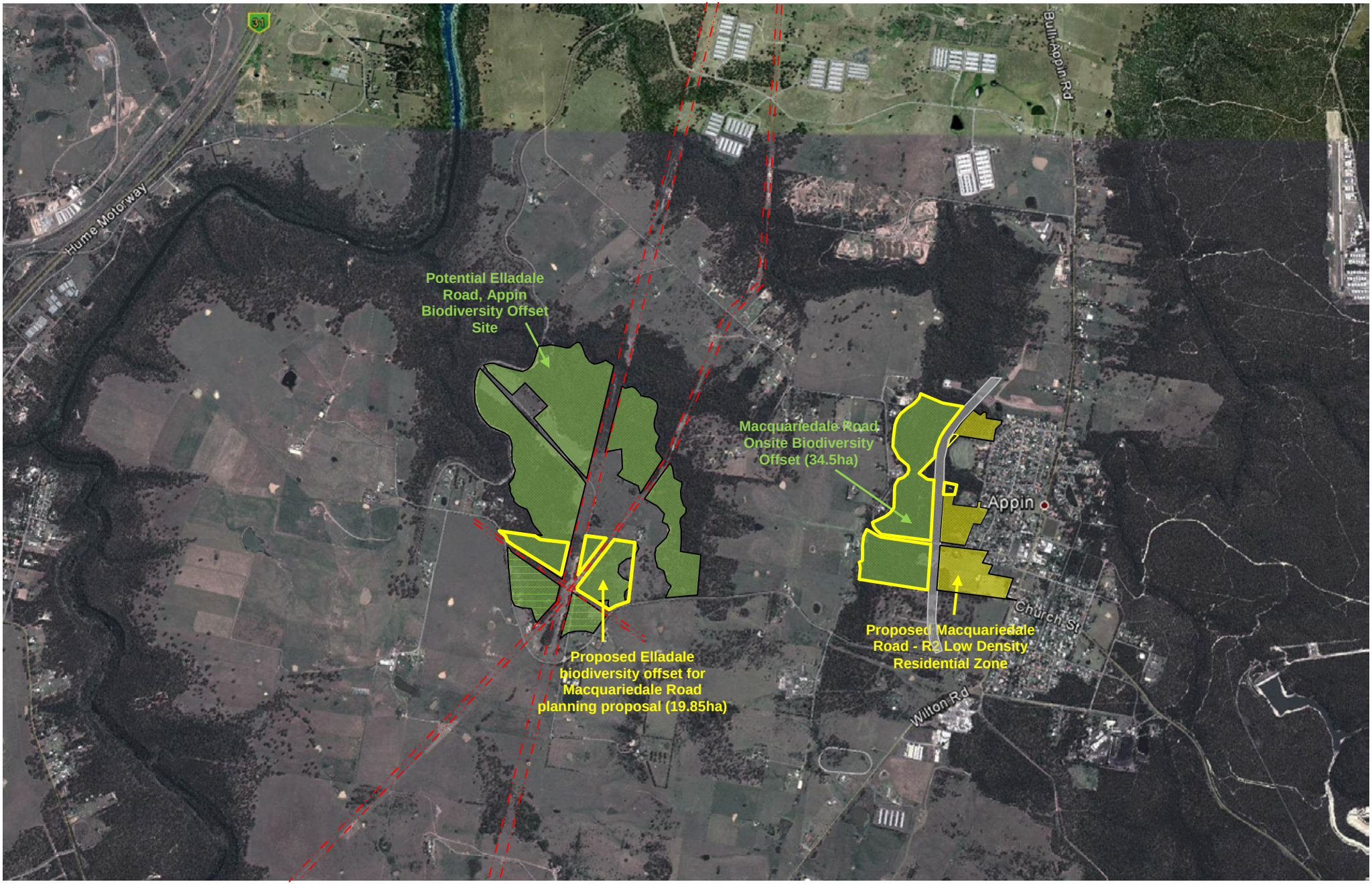

Figure 1 - Available offset sites as assessed by *EcoLogical Australia* (2014) and proposed biodiversity offset areas

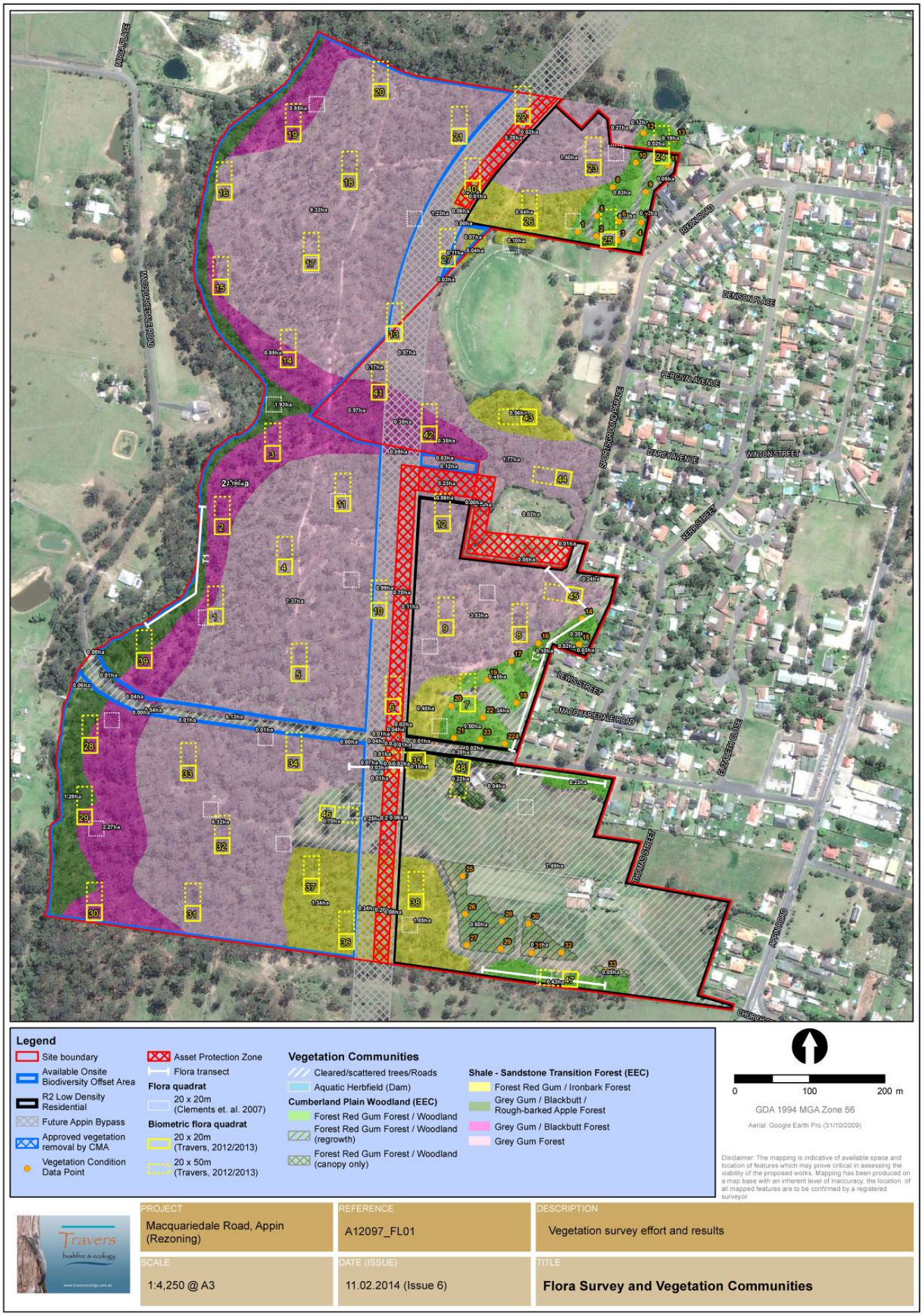

Figure 2 - Proposed onsite biodiversity protection offsets - Macquariedale Road, Appin

Figure 3 - Proposed off site biodiversity protection offset at Elladale Road, Appin

Offsite biodiversity offset outcomes

EEC offsets

Table 2 is a summary of the protection and restoration biodiversity offsets provided by the Elladale Road biodiversity offset site with respect to the direct loss of CPW and SSTF at Macquariedale Road, Appin. Table 2 demonstrates that the available offset lands exceed the expected offset requirements.

Table 2 - Available EEC offsets at proposed Elladale Road biodiversity offset site

Vegetation community	Area within onsite offset areas (ha)	Area within R2 Zone & APZ (ha) (Note 1)	Offset Ratio	Target on site and off site offset Areas (ha)	Target off site offset (ha)	Available offset at Elladale (ha)
Offset Ratios (3.4:1 CPW 4.4:1 SSTF)						
CPW	0.00	2.96	3.4:1	10.06	10.06	22.31
SSTF	34.06	9.12 (Note1)	4.4:1	40.12	5.31	80.65
Other Sandstone Vegetation (offset site only as mapped)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	13.68
Sub total	**34.06**	**12.08**	**4.15:1**	**50.18**	**15.37**	**116.64**

Note 1 – The area of CPW impacted by the R2 zone and APZ excludes portions of the Appin Bypass not impacted by the proposed asset protection zones. This differs from the Preliminary Biodiversity Certification Assessment prepared by *EcoLogical Australia* (2014) which includes all vegetation within the bypass as impacted habitat.

Table 3 - Biodiversity offset outcomes within proposed offset areas

Vegetation community	Habitat loss (ha)	Insitu conservation & restoration at Macquariedale Road (ha)	Elladale Road restoration & protection offsets (ha)	Total biodiversity offsets (ha)	Offset ratios
CPW	2.96	0.7	10.25	10.95	**3.7:1**
SSTF	9.12	34.06	7.98	42.04	**4.6:1**
				Overall EEC offset ratio	**4.4:1**

The available protection and biodiversity offsets for CPW and SSTF will achieve a maintain or improve outcome with an overall offset ratio of 4.4:1.

The offset ratio for CPW at 3.7:1 exceeds the minimum offset required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). However, the available lands are slightly larger in size based on lot boundaries and are a reasonable outcome for the planning proposal which impacts fragmented CPW vegetation.

The offset ratio for SSTF at 4.6:1 is slightly higher than required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). The proposed

offsets contain similar habitat attributes in close proximity to the study area and are identified as part of the priority conservation lands under the Cumberland Plain Recovery Plan (2010).

Cumberland Plain Land Snail habitat offset

Table 4 provides an estimate of direct loss of habitat for CPLS. The biodiversity offset gains for threatened species have been addressed as ecosystem offsets within the Preliminary Biodiversity Certification Assessment by *EcoLogical Australia* (2014). However a preliminary comparison of what can be accommodated in the proposed offset sites, has been undertaken by a direct comparison of the known population habitat, estimated losses and available habitat areas on the proposed offset sites. The offsets in combination with proposed mitigation measures are part of the biodiversity offset package to mitigate the EEC and habitat losses caused by the planning proposal.

Table 4 estimates the loss of CPLS habitat based on the CPLS Habitat Assessment (Figure 6).This table concludes that the proposed rezoning impacts 16.75ha of known CPLS habitat (52.5% loss).

Table 5 provides an estimate of the offset ratio for CPLS habitat due to the proposed protection and restoration offsets at Macquariedale Road and Elladale Road, Appin.

The offset ratio for CPLS habitat is also in a moderate to good range i.e. greater than a 2.2:1 offset ratio and is being offset using insitu and restored habitat at Macquariedale Road and Elladale Road. Mitigation measures are recommended within the flora and fauna survey report to support the existing populations' on site and to recover and relocate existing live snails into suitable habitat areas (*Travers bushfire & ecology* 2014).

Table 4 - Direct impacts on Cumberland Plain Land Snail habitat

CPLS habitat quality	Area within entire site (ha)	Conserved in E2 zone (ha)	Total loss due to R2, & APZ (ha)	% loss caused by R2& APZ (ha)	Total loss caused by R2 and bypass (ha)	% loss caused by R2 and bypass (ha)
High quality	5.81	0.91	4.33	74.53%	4.90	84.34%
Moderate quality	21.81	13.45	6.08	27.88%	8.36	38.33%
Low quality	4.29	0.80	3.31	77.16%	3.49	81.35%
Total area	**31.91**	**15.16**	**13.72**	**43.00%**	**16.75**	**52.49%**

Table 4 - Cumberland Plain Land Snail habitat proposed restoration and protection offsets

CPLS habitat quality	Conserved in E2 Zone (ha)	Total loss due to R2, & APZ (ha)	Potential on site (Macquariedale Road) restoration offsets (ha)	Available off site (Elladale) protection offset outcomes	Total habitat post restoration (ha)	Protection and restoration offset ratio
High Quality (note 1)	0.91	4.33	0	8.99	9.9	2.3:1
Moderate Quality (note 2)	13.45	6.08	0.7	4.13	17.58	2.9:1
Low Quality (note 3)	0.80	3.31	0	2.00	2.8	0.85:1
Total Area	**15.16**	**13.72**	**0.7**	**15.12**	**30.28**	**2.2:1**

x

Note 1:- Existing good condition CPW is considered to be high quality habitat for CPLS. Where the existing vegetation can be improved through regeneration and habitat enrichment works in the short term, i.e. generally moderate to good condition, it is counted as being high quality post restoration habitat.

Note 2:- Moderate quality habitat is considered to be restored habitat or existing vegetation immediately surrounding higher quality vegetation areas.

Note 3:- Low Quality habitat are those areas that are fringing but still support scattered CPLS or may support CPLS after restoration works or habitat enrichment is completed.

Conclusions

Implementation of the proposed biodiversity offsets will achieve a 'pass' for all affected vegetation communities in the form of protection and restoration biodiversity offsets on site. Offsets have been provided based on the NSW Biodiversity Certification Assessment Methodology and a pass using the *EPBC Act* Environmental offsets calculator.

In conjunction with the conserved vegetation at Macquariedale Road, Appin, the proposed Elladale Road biodiversity offset site offers significant offsite biodiversity offset value for both CPW and SSTF and exceeds the minimum requirements for the Macquariedale planning proposal.

Travers bushfire & ecology generally recommends that the proposed biodiversity offsets should be secured under a conservation agreement in accordance with the approved voluntary planning agreement. This will ensure that the site is secured for conservation purposes. In addition the proposed biodiversity offsets should be zoned as E2 Environmental Conservation to ensure use of the land is consistent with the conservation agreement.

List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CMA	Catchment Management Authority
CPW	Cumberland Plain Woodland
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DEC from 4/07)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)
DoE	Department of Environment (formally SEWPAC)
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
FMP	fuel management plan
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NV Act	*Native Vegetation Act*
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	NSW Office of Environment and Heritage
OPA	outer protection area
OSL	Office of Strategic Lands
PCL	priority conservation lands
PBP	*Planning for Bush Fire Protection 2006: A Guide for Councils, Planners, Fire Authorities and Developers*
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants

SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities (superseded by the Department of Environment)
SIS	species impact statement
SSTF	Shale Sandstone Transition Forest
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act 1995*
VMP	vegetation management plan

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Introduction 1

1.1 Background

Travers bushfire & ecology has been engaged to prepare a Biodiversity Offset Strategy to mitigate against the impacts of the proposed rezoning at Macquariedale Road, Appin, within the Wollondilly LGA.

The planning proposal seeks to:

- rezone land at Appin from RU2 Rural Landscape, R3 Medium Density Residential and RE1 Public Recreation to R3 Low Density Residential, SP2 Special Uses and E2 Environmental Conservation,
- vary the minimum lot size from part 40ha and part 975m^2 to part 100ha and part 450m^2,
- vary the maximum building height to apply a 9m maximum building height to the R2 Low Density Residential zoned land, and
- amend the land reservation map to show the land proposed to be zoned SP2 Infrastructure to facilitate acquisition by the RMS.

The proposed rezoning results in the loss of significant areas of SSTF, smaller areas of CPW and significant areas of CPLS habitat. The proposed residential zone has been minimised taking into account the future Appin bypass which is yet to be designed or given approval.

Walker Corporation has offered to offset the loss of the impacted habitats in lands under their ownership which have significant biodiversity conservation value within priority conservation lands (PCLs).

This biodiversity offset strategy examines the ability of the proposed Elladale Offset Site to adequately offset the impacted communities and key affected threatened species.

Travers bushfire & ecology advises that it is current policy for offsets to be transparently evaluated through the use of the Biodiversity Certification Methodology or the Biobanking Credit Calculator to satisfy NSW Biodiversity offsetting principles, and the *EPBC Act* environmental offset calculator to satisfy *EPBC Act* Environmental Offsets (2012). At present, both offset calculators are needed to demonstrate compliance with current policies at both the state and Commonwealth assessment levels.

This report identifies that the proposed Macquariedale and Elladale Offset areas have the ability to provide biodiversity gains to compensate for the loss of habitat as a result of the proposed rezoning. As a result of the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014) and preliminary calculations using the *EPBC Act* environmental offsets calculator, biodiversity offset areas have been proposed that exceed the minimum offset requirements.

1.2 Ecological survey within biodiversity offset sites

A full ecological survey report has been prepared for the proposed rezoning at Macquariedale Road (*Travers bushfire & ecology 2014*). Biodiversity offsets are proposed as:

- on site conservation areas at Macquariedale Road, Appin
- off site biodiversity offsets at Elladale Road, Appin

The current ecological survey on Macquariedale Road, Appin is comprehensive and has been prepared using biometric quadrat and data collection methods suitable for Biobanking or biodiversity certification assessment. The vegetation communities present at Elladale Road have been verified and remapped accordingly.

The Elladale Road biodiversity offset site (Figure 1), has been selected on the basis of ground-truthed vegetation mapping undertaken for *Walker Corporation* by *Travers bushfire & ecology* that meets the minimum offset requirements as defined by *EcoLogical Australia* in their Preliminary Biodiversity Certification Assessment (2014) and preliminary assessment of environmental offsets using the *EPBC Act* environmental offsets calculator undertaken by *Travers bushfire & ecology* (Attachment 2).

1.3 Targeted survey - Macquariedale Road, Appin

Travers bushfire & ecology undertook extensive presence / absence and targeted threatened species surveys at Macquariedale Road, Appin in late 2012 and 2013 which incorporated targeted threatened flora and fauna survey, Biometric vegetation assessment to confirm the vegetation types, their quality and habitat values, as well as engagement of an owl / bird specialist to assist in target surveys.

As all previous vegetation assessments were not conducted using accepted survey methods for biodiversity offsetting assessment, biometric quadrat survey was conducted by *Travers bushfire & ecology* throughout the entire Macquariedale Road Appin and Elladale Road sites to ascertain the condition of the vegetation and compare it with published Catchment Management Authority (CMA) vegetation benchmark figures and the final determinations of relevant EECs.

1.4 Ecological impacts of proposed rezoning

The rezoning proposal will potentially result in the following impacts on the recorded endangered ecological communities (*Travers bushfire & ecology* 2014):-

- SSTF - A total of 46.20ha within the site. 34.06ha will be conserved (73.07%), and 9.12ha will be removed or modified of SSTF vegetation (19.74%)

- CPW - A Total of 3.78ha within the site including all low to moderate condition CPW and regrowth will be removed from the site.

The vegetation on site (Figures 1 & 2) forms an important corridor for fauna as evidenced by the presence of several threatened fauna species. The proposal will likely cause an adverse impact in particular upon CPLS habitat (43%), including snails utilising the southern portions of the site or low-sandstone influenced vegetation. The presence of hollow-bearing

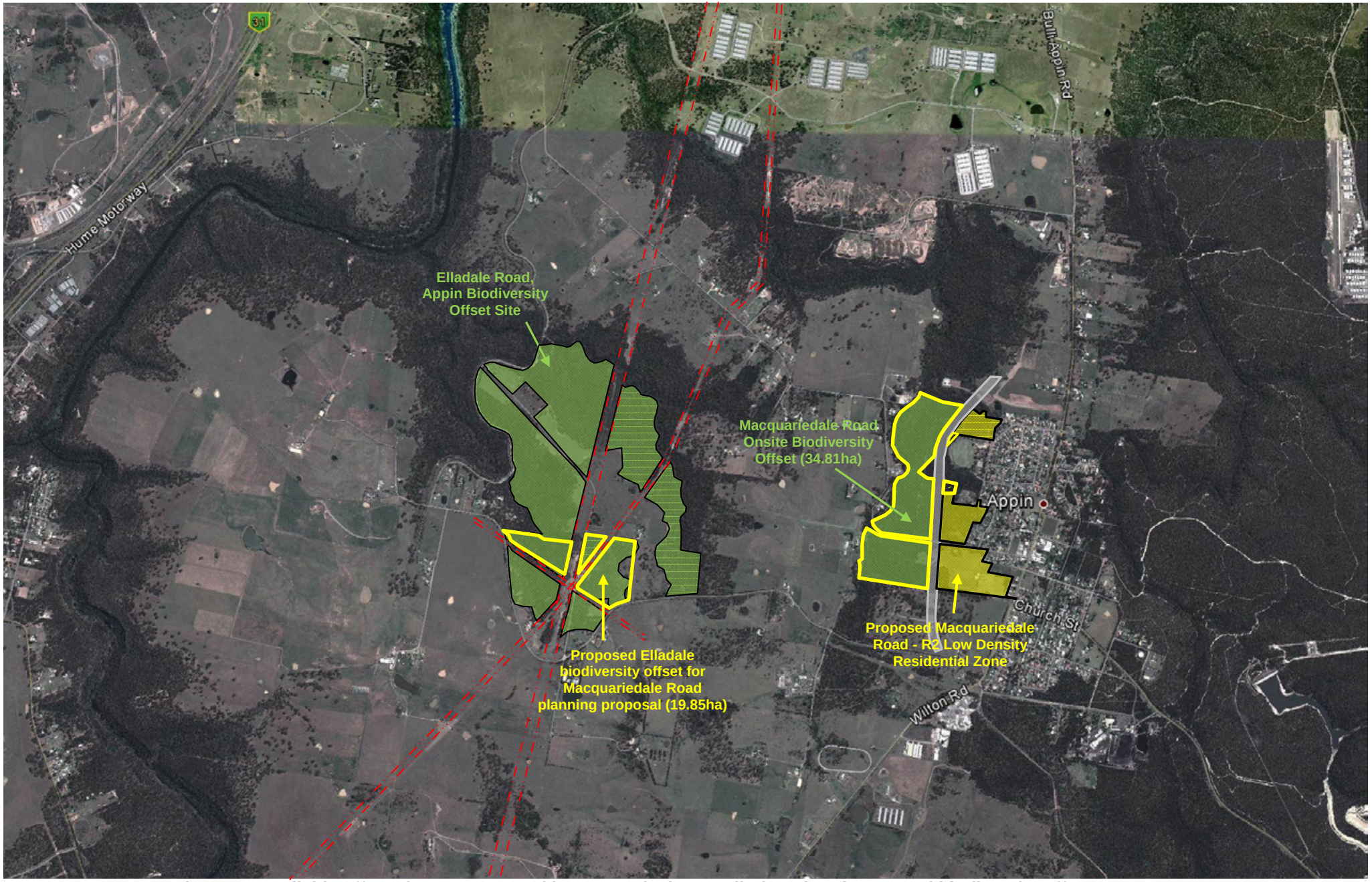

Figure 1 - Available offset sites as assessed by EcoLogical Australia (2014) and proposed biodiversity offset areas

resources will be reduced and stands of *Allocasuarinas* will be removed, thereby potentially impacting foraging bird species and microbats.

Threatened fauna species recorded within the study area include:

- Powerful Owl (*Ninox strenua*),
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*),
- Gang-gang Cockatoo (*Callocephalon fimbriatum*),
- Varied Sittella (*Daphoenositta chrysoptera*),
- Little Lorikeet (*Glossopsitta pusilla*),
- Grey-headed Flying-fox (*Pteropus poliocephalus*),
- Greater Broad-nosed Bat (*Scoteanax rueppellii*),
- East-coast Freetail Bat (*Micronomus norfolkensis*),
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*),
- Eastern Bentwing-bat (*Miniopterus orianae oceansis*) and
- Cumberland Plain Land Snail (*Meridolum corneovirens*).

As a result of the vegetation removal, 13.72 ha of CPLS habitat will be removed representing 43% of a total of 31.91ha of known habitat for this species within the study area.

The loss of CPLS habitat within the site as a result of the rezoning is a significant reduction in the snail habitat and the cumulative impact associated with the future Appin bypass increases that impact by 4.67ha (cumulative 52.5% loss). This is an adverse outcome for the existing CPLS population but not such that the combined on site population will be made extinct from the site. The habitat being removed consists of degraded CPW and in part good quality SSTF which currently supports fringing snail habitat adjacent to long since removed higher quality CPW for the Appin township. The existing snail population is mostly surviving within the poorer quality SSTF substrate sparsely distributed across the site which may or may not be sustainable in the long term.

All other recorded threatened species are not expected to be significantly affected as they are breeding in other sites or conserved areas of the site and will have sufficient habitat available to maintain viable populations. In association with the proposed mitigation measures and the retention of the higher quality habitat associated within the main riparian corridor, most species will continue to utilise the site, albeit with a reduced foraging area.

As part of the biodiversity offset strategy, limited revegetation is possible within the Macquariedale Road conservation area (maximum 0.7ha (Figure 6) consisting of SSTF / CPW transition vegetation. Subject to an investigation into the feasibility of using this site for restoration purposes, and the potential relocation of appropriate soils, CPW could be restored. CPW in this location will support CPLS in the future once the vegetation has matured and sufficient on ground protection has been established. Likewise, the existing CPW in the northern biodiversity offset area will be improved for CPLS through habitat enrichment. Both areas will assist in maintaining the local populations on site.

Given the occurrence of CPLS in SSTF, the proponent has offered to enrich habitat areas to protect CPLS, to move the existing snail populations within the site to adjoining conserved habitat areas and to provide appropriate offsite biodiversity offsets for the loss of vegetation and habitat.

Habitat enrichment for CPLS can be achieved by relocating trunk fragments from the proposed R2 Residential zone into existing snail habitat areas to be conserved and planting additional CPW species where canopy is absent. The snail habitat areas will then form a more protected habitat area for the existing CPLS.

It is proposed to prepare a CPLS relocation procedure within the site and bushland management plans which include habitat enrichment of the proposed off site biodiversity offset to support CPLS..

1.5 Conservation outcomes within Macquariedale Road, Appin

The rezoning proposal (Figures 2 and 3):

- Will retain a large area of foraging habitat for recorded threatened microbats and potential breeding habitat through retention of hollow-bearing resources and possible caves or similar type habitat within Ousedale Creek.
- A major environmental corridor will be maintained.
- Will not cause a significant loss of foraging or breeding habitats resources for the Little Lorikeet, Powerful Owl, Varied Sittella, Glossy Black-Cockatoo, Gang-gang Cockatoo or Grey-headed Flying-fox. Large areas of similar habitat types will be retained in situ in the northern portion of the study area and west of the future bypass.
- Will retain a 35ha remnant of SSTF vegetation (77% retention). The future bypass potentially results in the loss of an additional 4.67 ha.
- Will retain viable CPLS populations within the conservation areas and extended habitat west of the future bypass.

The proposed Elladale Road biodiversity offset site offers significant offsite biodiversity offsets for both communities and existing threatened species.

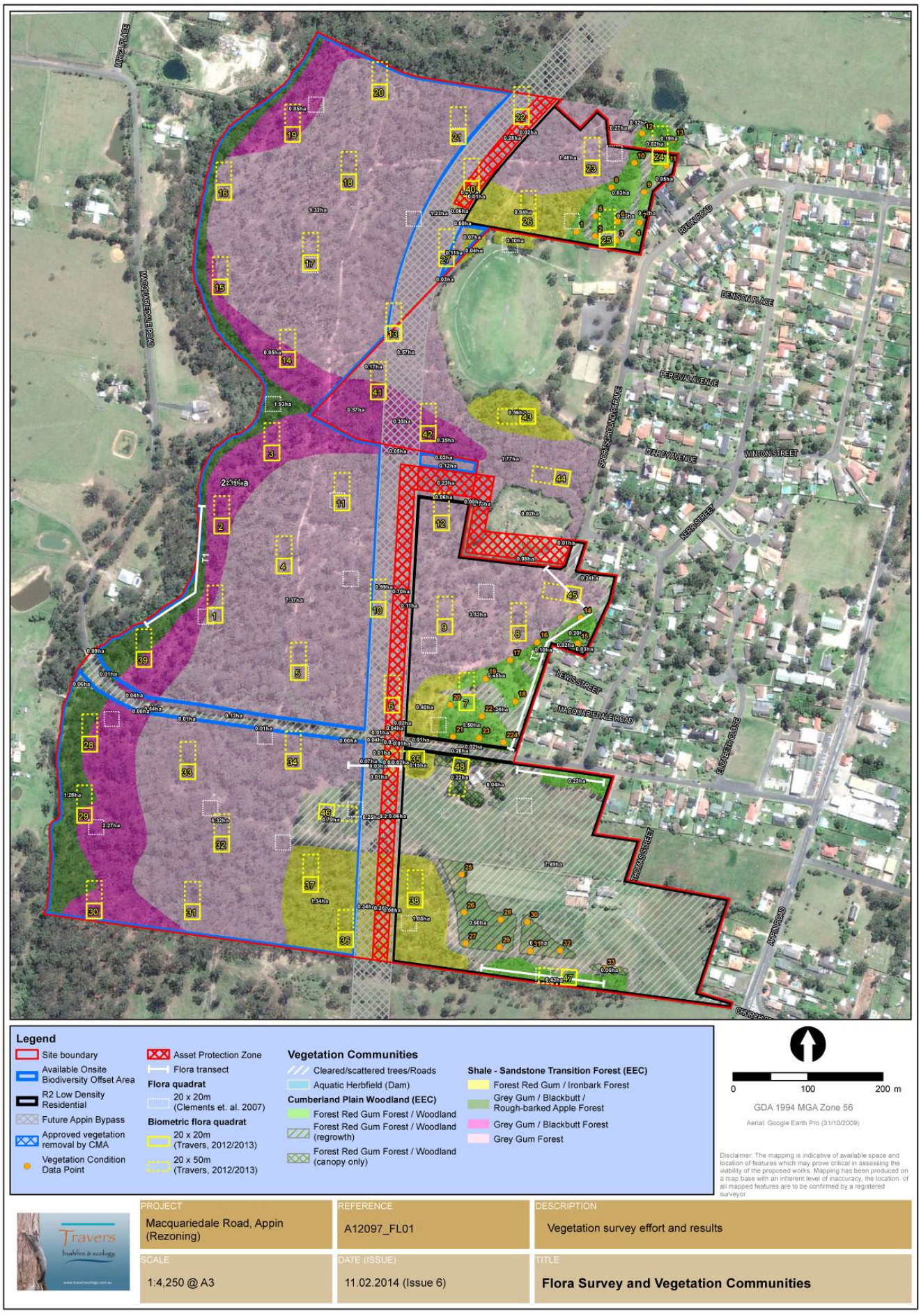

Figure 2 - Flora survey effort and results

(Source: - Flora and Fauna Survey Report – Macquariedale Road, Appin (Travers bushfire & ecology 2014)

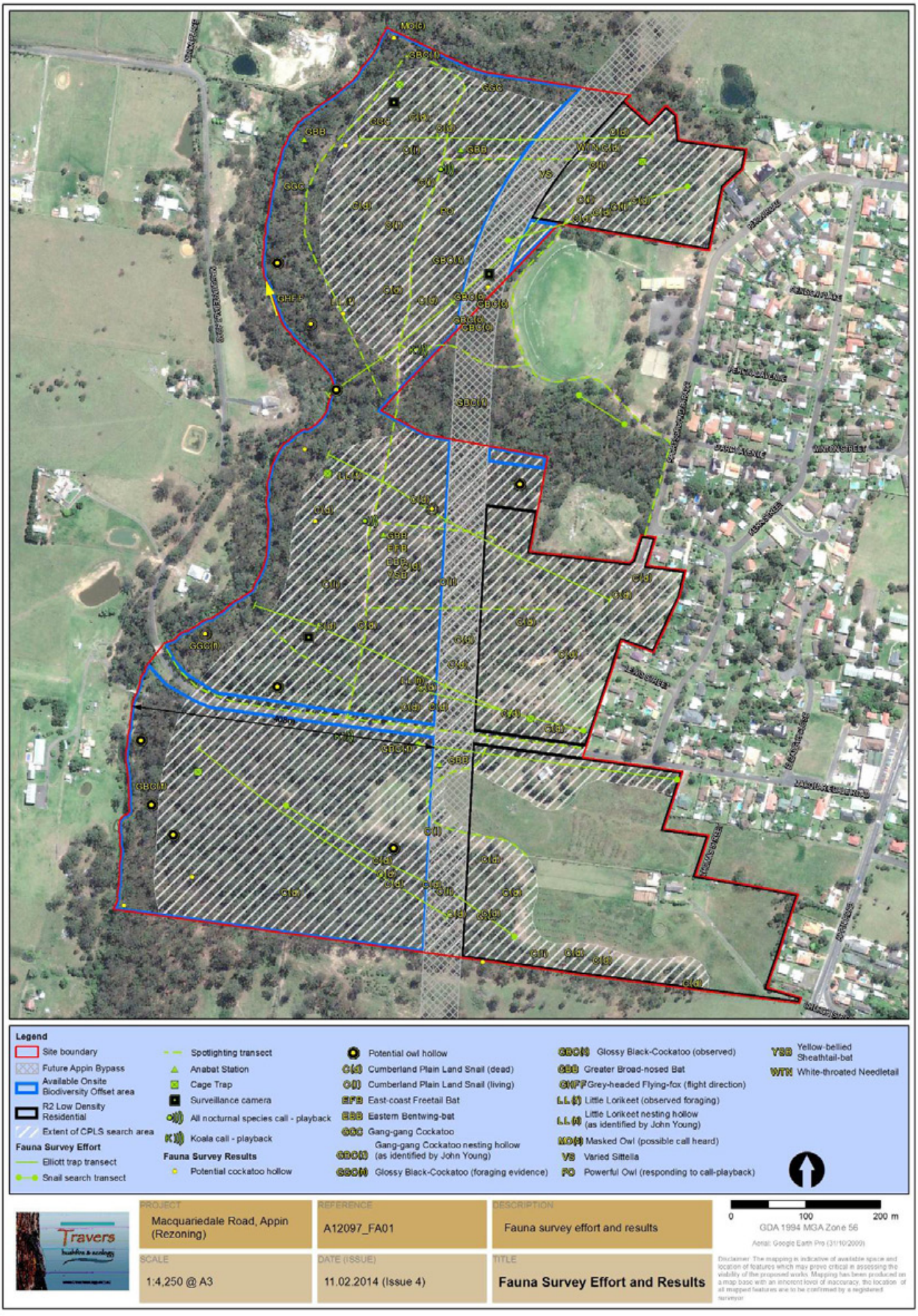

Figure 3 - Fauna survey effort and results
(Source: - Flora and Fauna Survey Report – Macquariedale Road, Appin (Travers bushfire & ecology 2014)

1.6 Cumberland Plain Recovery Plan

The Cumberland Plain in Western Sydney is Australia's fastest growing and most populous region. Many of its unique natural attributes need special effort to maintain their values and ensure their protection. Just 13% of Western Sydney's native vegetation remains in highly fragmented patches of varying size and condition. The Cumberland Plain Recovery Plan (DECCW 2011) has been designed to provide for the long-term survival and protection of the threatened biodiversity of the Cumberland Plain as the area develops.

Figure 4 provides an overlay of the Priority Conservation Lands (PCL) mapping for both the Macquariedale Road planning proposal and the Elladale biodiversity offset site. Both sites are mapped as Priority Conservation Lands.

The overall objective of the recovery plan is to provide for the long-term survival of the threatened biodiversity of the Cumberland Plain. The proposal meets the four (4) main objectives:

- *Recovery Objective 1: To build a protected area network, comprising public and private lands, focused on the priority conservation lands*.

  The planning proposal results in two (2) secure conservation areas, one (1) at Macquariedale Road and another at Elladale Road, Appin. Both sites have significant corridor connectivity values.

- *Recovery Objective 2: To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation.*

  The primary management objectives of the conserved lands under the planning proposal are biodiversity conservation. The Macquariedale Road conservation areas will be secured under E2 Environmental Conservation. The Elladale Road, biodiversity offset site will be conserved under a voluntary conservation agreement or similar mechanism.

- *Recovery Objective 3: To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program*

  The proposed conservation areas will be managed in accordance with best practice standards as approved in accordance with site specific bushland management plans

- *Recovery Objective 4: To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.*

  The planning proposal provides an integrated planning package to conserve a significant portion of the lands mapped as priority conservation lands (total of 70ha). It also considers future infrastructure requirements which can be integrated with rezoning proposals on adjoining lands.

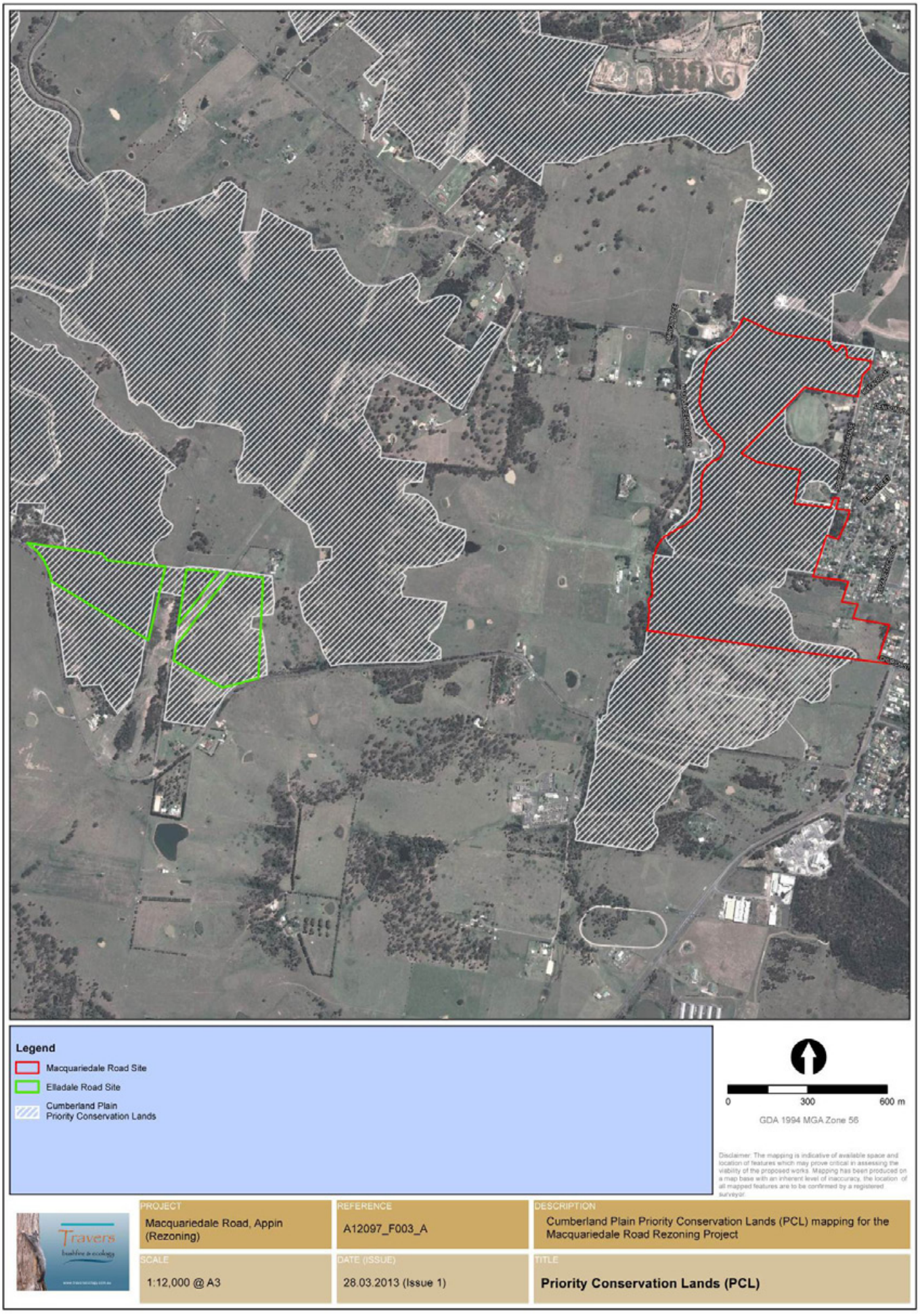

Figure 4 - Priority conservation land mapping in accordance with the Cumberland Plain Recovery Plan (2011)

The recovery plan describes the necessary actions to halt further losses of vegetation and to achieve a net gain. This approach should be balanced with the growing needs to deliver sustainable land for future housing developments and thus vegetation offsets are a way of having both economic development and environmental protection.

DECCW has completed an assessment of the remaining bushland based on these principles and other factors, including the distribution and zoning of remnant vegetation, which has resulted in the identification of the PCL. The PCL have been identified as the lands that represent the best remaining opportunities in the region to secure long-term biodiversity benefits for the lowest possible cost.

The PCL contain habitat for a far broader suite of threatened and regionally significant species and ecological communities than those addressed in the recovery plan (DECCW 2011 - *Cumberland Plain Recovery Plan*). Conservation activities within PCL are recognised as having greater biodiversity benefits than just for the threatened biodiversity addressed in the recovery plan.

The PCL have been identified as regional priorities for the implementation of recovery actions. The mapping does not, in itself, imply or guarantee conservation outcomes (DECCW 2011 - *Cumberland Plain Recovery Plan*).

Vegetation remnants within the proposed Macquariedale Road, Appin rezoning area clearly have significant conservation benefit as an environmental corridor and provide direct benefit to residential threatened fauna species. No threatened flora species have been observed to date.

The proposed residential zone area enables retention of a 200-400m wide environmental corridor, conserves significant areas of habitat for threatened fauna species and the conservation of a significant portion of this remnant will result in a securely conserved Cumberland Plain reserve. Best practice management of the reserve will form future management of the site in accordance with the *Cumberland Plain Recovery Plan* (2010).

The removal of all of the existing areas of CPW and the loss of potential threatened species habitat such as CPLS, even with conservation of the northern patch is considered to be inconsistent with the objectives of the Cumberland Plain Recovery Plan (2010).

The proposed offset area will be securely conserved and actively managed for conservation purposes. The sizes of the remnants to be retained are viable and sustainable into the future. As freehold land, the preferred methods of securing the lands for conservation include:

- voluntary acquisition (reservation)
- Biobanking agreements
- conservation covenants.

Other less desirable options include:

- voluntary acquisition (open space)
- environmental protection zoning
- property vegetation plan under the *Native Vegetation Act 2003 (NV Act)* (Wollondilly LGA only).

As the proposal is a planning proposal to rezone the lands as a combination of residential and environmental protection, the application of environmental protection zoning is considered appropriate at this stage. A voluntary planning agreement is expected to include establishment of conservation areas containing the proposed biodiversity offsets. The proposed offsets should be further secured through entering a voluntary conservation agreement (VCA) to meet the offsetting requirements of NSW and the Commonwealth.

The identification of the PCLs as priorities should not be misinterpreted as underrating the significance of other remnant vegetation. While the plan promotes the PCLs as the regional priorities for the Cumberland Plain, areas of local significance (such as corridors and smaller council reserves) are intended to complement and enhance regional conservation priorities (DECCW 2011 - *Cumberland Plain Recovery Plan*).

The *Cumberland Plain Recovery Plan* also supports the use of offsets where impacts on threatened species, populations and ecological communities cannot be avoided. Offsets at a predetermined ratio increase the extent and condition of vegetation on the Cumberland Plain using assisted natural regeneration and revegetation techniques.

Active management to best practice standards is needed to prevent the degradation of the remaining bushland in such a fragmented landscape. Without active management, weed invasion, frequent fire, stormwater flooding, grazing, mowing and recreational impacts such as illegal rubbish dumping will continue. Consequently, this offset strategy requires the preparation of a bushland management plan to define the active management requirements of the identified protection and restoration offsets.

1.7 Current offsetting approaches

Environmental offsets are considered to provide an overall positive environmental benefit to the community to counterbalance an adverse environmental impact. The principle of achieving a 'no net environmental loss' or a 'net environmental benefit' outcome is critical to the establishment of any offset which is based on ecological survey, verified environmental attributes OF the offset site and an offset ratio that results in a net increase in the area of securely conserved habitat in NSW.

Offsets are generally categorised in two types:

- a restoration offset – involving the recreation of habitat in degraded areas which may include significant component of revegetation works and providing for long term protection as a conservation area
- a protection offset – involving the protection of existing habitat areas in non-secured lands and providing for long term protection as a conservation area.

A biodiversity offset strategy may include one or both of the above types of offsets inclusive of both on site and off site biodiversity offsets and can be established through several mechanisms. However, all approaches intend to provide a securely conserved biodiversity gain which is supported by long term management as a conservation area.

Biodiversity offsets are also considered at two separate levels including:

- Ecosystem offsets
- Threatened species offsets

Ecosystem offsets are considered as a base level offset to ensure the protection of sufficient floristic habitat for both flora and fauna in general. Threatened species may be considered separately or addressed as an ecosystem offset. It also considers whether any of the vegetation being impacted is a 'red flag'. For example, impact on any EEC is considered to be a red flag and requires approval from a consent authority. Low condition areas (as determined in accordance with the biometric field assessment method) are typically assessed but have lower conservation value and typically do not significantly contribute to the offsets required. Medium quality or better vegetation is however considered to have insitu conservation value and requires offsetting if impacted. The presence of a threatened

flora or fauna species may result in a greater offset ratio being applied to a proposed development.

However, the assumption that an ecosystem offset provides an adequate biodiversity offset for specific threatened flora and fauna species can be challenged on the basis of an insitu threatened species population. For example, the presence of Powerful Owls within a site (a state listed threatened fauna species) may require insitu conservation or extraordinary conservation measures such as the protection of breeding habitats or adequate foraging habitat to sustain a local population. Alternatively, the presence of a threatened flora species population may require active protection in situ or restoration in an appropriate location suitable for that threatened species.

The amount of offset land requirements appear to be increasing in recent years from a 'like for like' situation such as at a 1:1 ratio to a 3:1 or 5:1 ratio which may be put forward to the relevant government body for approval. This has mainly arisen out of the need to achieve a 'no net loss' of habitat as a result of a proposed development or planning scheme. As offsets can include the protection as well as restoration of habitat the offset ratio is set to achieve an overall net gain.

The Biodiversity Banking and Offsets Scheme – known as Biobanking – commenced in 2008. The BioBanking Scheme was established under Part 7A of the *TSC Act* to assess a site for environmental values which are put into a BioBanking Credit Calculator which is a computer program that applies a particular methodology to determine the classes and quantity of credits required at a development site or created at a Biobanking site. Credits are an estimated conservation value which is required to offset the loss of biodiversity values on development sites or created on Biobanking sites from management actions that improve biodiversity values.

Biodiversity Offsets can be provided in accordance with DECCW *Guidelines for Biodiversity Certification of Environmental Planning Instruments*. A voluntary planning agreement may include the provision of biodiversity offsets that demonstrate a maintain or improve outcome in accordance with the Biodiversity Certification Assessment Methodology (DECCW 2011b) and to secure conservation areas through planning instruments.

The offsets as proposed are also subject to approval under the *Environment Protection and Biodiversity Conservation Act* (1999) (*EPBC Act)* as administered by the Commonwealth Department of Environment.

Due to the complexity of mechanisms available to establish biodiversity offsets, an examination of the options is recommended to maximise both ecological and commercial outcomes.

1.8 Biodiversity offsetting principles

The major principle of biodiversity offsetting is to avoid, mitigate and to offset impacts caused by an action. The following principles for the use of biodiversity offsets have been defined by OEH (2013):

1. Impacts must be avoided first by using prevention and mitigation measures
2. All regulatory requirements must be met
3. Offsets must never reward ongoing poor performance
4. Offsets will complement other Government programs
5. Offsets must be underpinned by sound ecological principles
6. Offsets should aim to result in a net improvement in biodiversity over time

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs
8. Offsets should be agreed to prior to the impact occurring
9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated
10. Offsets must be targeted
11. Offsets must be located appropriately
12. Offsets must be supplementary
13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conserving agreements or a contract

These principles are specifically addressed for the proposed offset sites under this strategy (Section 3.6).

Ecological Description Macquariedale Road 2

2.1 Site description

Table 2.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 2.1 - Planning, cadastral and general site features

Location	Macquariedale Road, Appin
Local government area	Wollondilly
Grid reference	295500E 6213500N
Elevation	195-245m AMSL
Topography	Situated on a flat to low graded landscape with Ousedale Creek along the western boundary where slopes are moderate along the riparian zone. There are also some moderate slopes at the narrowest point of the site where there is a small drainage line which comes off Ousedale Creek.
Geology and soils	Geology; Hawkesbury Sandstone (west and central) and Wianamatta Group Shale (east). Soils; Hawkesbury Soil Landscape along Ousedale Creek – shallow soils with rock outcropping present. The remainder of the site is Blacktown Soil Landscape – moderately deep yellow podzols and soloths.
Catchment & drainage	Sydney Metro CMA; Nepean River. The site borders Ousedale Creek to the immediate west
Vegetation	SSTF and CPW
Existing land use	Residential (rural) and grazing
Clearing	Approximately 13-14ha of the site has been cleared or under-scrubbed in recent years within paddocks south of Macquariedale Road, the vegetation around the existing dwelling, vegetation immediately west of Lewis Street and vegetation to the north east of the existing sporting oval.

2.2 Vegetation of Macquariedale Road, Appin

Vegetation communities were identified within the subject site through ground-truthing after reviewing current aerial photography (Figure 1).

Nine (9) vegetation communities were observed within the site boundary through extensive ground-truthing. Within the offset lands, the following vegetation communities are present:

- Vegetation Community 1 – Aquatic Herbfield
- Vegetation Community 2 – Cleared or Scattered Trees
- Vegetation Community 3 – Forest Red Gum Forest / Woodland
- Vegetation Community 4 – Forest Red Gum / Ironbark Forest
- Vegetation Community 5 – Grey Gum / Blackbutt / Rough-barked Apple Forest
- Vegetation Community 6 – Grey Gum / Blackbutt Forest
- Vegetation Community 7 – Grey Gum Forest

Aquatic Herbfield

One small dam is located on the southern side of Macquariedale Road, approximately 120m west of the existing residence and 15m from the road. The size of the dam is around 0.03ha.

Vegetation within the dam is sparse to moderate with only a few species present including *Eleocharis sphacelata* and *Otellia ovalifolia.* There are some fringing *Juncus* species on the rim of the dam. The invasive exotic species *Myriophyllum aquaticum* was noted in the eastern edge of the dam.

Photo 1 - Aquatic Herbfield on the south side of Macquariedale Road

Cleared or Scattered Trees

The majority of cleared vegetation was observed on the southern side of Macquariedale Road. A few remnant eucalypt trees may remain to the south of the Aquatic Herbfield otherwise the only trees are Acacia species.

The ground layer is predominately exotic south of Macquariedale Road due to previous grazing activities and maintenance as a grassed paddock. The number of native species increases amongst the few remnant trees to the south of the Aquatic Herbfield. North of

Macquariedale Road, the understorey is fairly evenly mixed between natives and exotics with *Microlaena stipoides* being the dominant native grass species.

Some of this vegetation type exists adjacent to the eastern boundary amongst the remnant Cumberland Plain vegetation.

Forest Red Gum Forest / Woodland

This vegetation community occurs in the eastern extremities of the remnant vegetation to the north-east of the sporting oval, immediately west of Lewis Street, and as two linear patches along Macquariedale Road and the southern site boundary. In total, this vegetation community occupies approximately 3.5ha.

Forest Red Gum Forest / Woodland is equivalent to the biometric vegetation type ME020 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin. This is equivalent to the EEC CPW.

Canopy – Predominantly comprised of *Eucalyptus tereticornis.* North of Macquariedale Road, the projected foliage cover was generally less than 10%. South of Macquariedale Road in the two (2) linear patches, the canopy cover was around the benchmark figure of between 20-30%. The average height of the canopy is approximately 22-30m.

Mid-storey – Occasional *Acacia decurrens, Bursaria spinosa, Kunzea ambigua, Acacia parramattensis* and *Allocasuarina littoralis* with a projected foliage cover of 5-25%.

Ground layer – Common native species include *Einadia hastata, Leucopogon juniperinus, Dichondra repens, Centella asiatica, Pratia purpurascens, Oxalis perennans, Entolasia marginate, Microlaena stipoides* and *Echinopogon caespitosus.*

Disturbances – Moderate to high incursions of ground layer weeds in most areas however very low around Quadrat 7.

Photo 2 - Forest Red Gum dominated vegetation, Quadrat 24

Forest Red Gum / Ironbark Forest

This vegetation community occurs on low sandstone influenced soils and adjoins CPW vegetation. The vegetation relates to the CMA's biometric equivalent of ME021 – Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest on the edges of the Cumberland Plain, Sydney Basin. This is equivalent to the EEC SSTF.

Forest Red Gum / Ironbark Forest occupies approximately 4.8ha of the site, occurring to the immediate west and north west of the residence, just south of Macquariedale Road, and as a larger patch of over 3ha near the southern boundary.

Canopy – Comprised of *Eucalyptus tereticornis* and *Eucalyptus fibrosa.* To a lesser extent, there are *Eucalyptus resinifera, Eucalyptus eugenioides* and rarely *Eucalyptus punctata.* The height of the canopy is mostly above 20m and up to 33m.

Mid-storey – Within the southern patch (3.1ha), the mid-storey vegetation is moderate through to very dense with the projected foliage cover reaching up to 80%. On the eastern edge of this patch it is reduced back to around 15%. The patches to the west and north-west of the residence vary between 15-35%. Common species include *Bursaria spinosa, Kunzea ambigua, Acacia decurrens, Exocarpos cupressiformis, Allocasuarina littoralis* and the vine *Parsonsia straminea.*

Ground layer – variable in make-up between the presence of grasses, herbs, ferns and small shrubs. Common species include *Microlaena stipoides, Entolasia* spp., *Echinopogon caespitosus, Dichelachne micrantha, Austrostipa pubescens, Aristida vagans, Leucopogon juniperinus, Solanum prinophyllum, Desmodium varians, Calotis dentex, Dichondra repens, Glycine clandestina, Lomandra filiformis, Lomandra multiflora* and *Pratia purpurascens.*

Disturbances – There are some existing pathways in the southern patch. The other patches to the west and north west of the existing residence have had some understorey clearing in the past and there is a low to moderate incidence of weeds present.

Photo 3 - Forest Red Gum / Ironbark vegetation, Quadrat 35

Grey Gum / Blackbutt / Rough-barked Apple Forest

This vegetation community occurs on high sandstone influenced soils and adjoins Ousedale Creek. It has moderate levels of rock-outcropping and some riparian influences. The vegetation relates to the CMA's biometric equivalent of ME021 – Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum Open Forest on the edges of the Cumberland Plain, Sydney Basin. This is equivalent to the EEC SSTF.

Canopy – Dominated by the presence of *Eucalyptus punctata, Eucalyptus pilularis* and *Angophora floribunda. Angophora floribunda* occurs almost exclusively within this vegetation community and was mostly found within 50m of Ousedale Creek. The height of the canopy varies between 25-35m with an average projected foliage cover of 30-35%.

Mid-storey – Common species include *Pomaderris ferruginea, Acacia floribunda, Acacia parramattensis, Dodonaea triquetra, Notelaea longifolia, Allocasuarina littoralis, Kunzea ambigua, Acacia binervata, Persoonia linearis* and *Exocarpos cupressiformis.* The height of the mid-storey is largely between 1-4m with emergent *Acacia* spp. up to 12m and a projected foliage cover of 50%.

Ground layer – The ground layer is diverse with small shrubs, herbs, ferns and grasses. Common species include *Stypandra glauca, Morinda jasminoides, Lomandra longifolia, Doodia aspera, Dianella caerulea, Billardiera scandens, Leucopogon juniperinus, Lepidosperma laterale, Glycine clandestina, Microlaena stipoides, Imperata cylindrica* var. *major, Entolasia stricta, Cheilanthes sieberi, Dichondra repens* and the vine *Clematis aristata.*

Disturbances – There are minimal disturbances to this community. There is one walking track adjacent to the creek line in the north-western portion of the site.

Photo 4 - Vegetation along Ousedale Creek, Transect 1

Grey Gum / Blackbutt Forest

This vegetation community occurs approximately 50-125m from Ousedale Creek in high sandstone influenced soils and limited rock outcropping (less than 5%). The vegetation relates to the CMA's biometric equivalent of ME021 – Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum Open Forest on the edges of the Cumberland Plain, Sydney Basin. This is equivalent to the EEC SSTF.

Canopy – Predominately comprised of *Eucalyptus punctata* and *Eucalyptus pilularis. Corymbia gummifera* was noted within the north-western corner of the site and not noted elsewhere (from Quadrat 14 and north). Less dominant, but common canopy species also include *Eucalyptus fibrosa* and *Eucalyptus sparsifolia.* Canopy height occasionally exceeded 30m but mostly 20-28m. The projected foliage cover of the canopy varied between 15-40%.

Mid-storey – Common species include *Acacia binervata, Acacia decurrens, Pomaderris ferruginea, Kunzea ambigua, Acacia implexa, Allocasuarina littoralis, Persoonia linearis, Acacia floribunda, Dodonaea triquetra, Bursaria spinosa, Exocarpus cupressiformis* and the vine *Parsonsia straminea.* There is a common layer to a height of approximately 4m then the *Acacia* spp. and *Allocasuarina littoralis* reach between 8-12m.

Ground layer – Moderately grassy with a mixture of herbs, small shrubs and ferns. Common species include *Stypandra glauca, Billardiera scandens, Leucopogon juniperinus, Lepidosperma laterale, Pimelea linifolia, Pomax umbellata, Hibbertia aspera, Poranthera microphylla, Glycine clandestina, Microlaena stipoides, Aristida vagans, Anisopogon avenaceus, Echinopogon caespitosus, Entolasia stricta, Dichondra repens* and the vine *Clematis aristata.*

Disturbances – Very limited; in good condition.

Photo 5 - Grey Gum / Blackbutt vegetation, Quadrat 14

Grey Gum Forest

This vegetation community comprises around 60% of all vegetation within the site, or approximately 32.7ha. The vegetation relates to the CMA's biometric equivalent of ME021 – Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum Open Forest on the edges of the Cumberland Plain, Sydney Basin. This is equivalent to the EEC SSTF.

Canopy – Heavily dominated by *Eucalyptus punctata.* Many other species exist as part of the canopy but vary in dominance. Examples include *Eucalyptus resinifera, Eucalyptus fibrosa, Eucalyptus pilularis, Eucalyptus longifolia* and *Eucalyptus tereticornis.* The average height of the canopy is around 25-30m with an average projected foliage cover of 25% (averaged over more than twenty (20) quadrats).

Mid-storey – Common species include *Acacia decurrens, Kunzea ambigua, Allocasuarina littoralis, Persoonia linearis, Acacia floribunda, Dodonaea triquetra, Bursaria spinosa, Exocarpus cupressiformis* and the vine *Parsonsia straminea.* In the northern portion of the site (north from Quadrat 13 and east of Quadrat 18) the mid-storey is dominated by *Melaleuca styphelioides.* There is a moderate clay influence in the area and limited topographical change. This area may be a short-term sink where excess water drains from the adjoining sports oval. The *Acacia* spp., *Melaleuca stypelioides* and *Allocasuarina littoralis* reach between 8-12m.

Ground layer - Moderately grassy with a mixture of herbs, small shrubs and ferns. Common species include *Stypandra glauca, Billardiera scandens, Leucopogon juniperinus, Lepidosperma laterale, Pimelea linifolia, Pomax umbellata, Hibbertia aspera, Poranthera microphylla, Glycine clandestina, Microlaena stipoides, Aristida vagans, Echinopogon caespitosus, Entolasia stricta, Dichelache micrantha, Austrostipa pubescens, Dichondra repens* and *Gahnia aspera.*

Photo 6 - Grey Gum dominated vegetation with Melaleuca mid-storey, Quadrat 21

Photo 7 - Grey Gum dominated vegetation, Quadrat 33

2.3 Recorded fauna

Fauna species observed by *Travers bushfire & ecology* and previous studies are listed in Table 2.2 below.

Table 2.2 - Fauna observations for the study area

Common name	Scientific name	Method observed
Birds		**Nov 2012 or Feb 2013**
Australian King Parrot	*Alisterus scapularis*	O C
Australian Magpie	*Gymnorhina tibicen*	O C
Australian Pelican	*Pelecanus conspicillatus*	O
Australian Raven	*Corvus coronoides*	O C
Australian Wood Duck	*Chenonetta jubata*	O
Bar-shouldered Dove	*Geopelia humeralis*	O C
Bell Miner	*Manorina melanophrys*	O C
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O C
Black-shouldered Kite	*Elanus axillaris*	O
Brown Cuckoo-Dove	*Macropygia amboinensis*	O C
Brown Goshawk	*Accipiter fasciatus*	O C
Brown Thornbill	*Acanthiza pulsilla*	O C
Channel-billed Cuckoo	*Scythrops novaehollandiae*	O C
Common Blackbird *	*Turdus merula*	O C
Common Bronzewing	*Phaps chalcoptera*	O
Common Koel	*Eudynamys scolopacea*	O C
Common Myna *	*Acridotheres tristis*	O C
Crested Pigeon	*Ocyphaps lophotes*	C
Crimson Rosella	*Platycerus elegans*	C [PR]
Dollarbird	*Eurystomus orientalis*	C

Common name	Scientific name	Method observed
Dusky Moorhen	*Gallinula tenebrosa*	O
Dusky Woodswallow	*Artamus cyanopterus*	O C
Eastern Rosella	*Platycercus eximius*	O C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O C
Eastern Whipbird	*Psophodes olivaceus*	O C
Eastern Yellow Robin	*Eopsaltria australis*	O C
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	C
Galah	*Cacatua roseicapilla*	O C
Gang-gang Cockatoo [TS]	*Callocephalon fimbriatum*	O C
Glossy Black-Cockatoo [TS]	*Calyptorhynchus lathami*	O C
Golden Whistler	*Pachycephala pectoralis*	C [PR]
Grey Butcherbird	*Cracticus torquatus*	O C
Grey Fantail	*Rhipidura fuliginosa*	O C
Grey Shrike-thrush	*Colluricincla harmonica*	O C
Jacky Winter	*Microeca fascinans*	C [PR]
Laughing Kookaburra	*Dacelo novaeguineae*	O
Leaden Flycatcher	*Myiagra rubecula*	O C
Little Black Cormorant	*Phalacrocorax sulcirostris*	O C
Little Lorikeet [TS]	*Glossopsitta pusilla*	C [PO]
Little Wattlebird	*Anthochaera chrysoptera*	C
Long-billed Corella	*Cacatua tenuirostris*	C [PR]
Magpie-lark	*Grallina cyanoleuca*	C
Masked Lapwing	*Vanellus miles*	O C
Musk Lorikeet	*Glossopsitta concinna*	O C
Nankeen Kestrel	*Falco cenchroides*	O
Noisy Friarbird	*Philemon corniculatus*	O C
Noisy Miner	*Manorina melanocephala*	O C
Olive-backed Oriole	*Oriolus sagittatus*	O C
Pacific Black Duck	*Anas superciliosa*	O
Pacific Baza	*Aviceda subcristata*	O C
Pallid Cuckoo	*Cululus pallidus*	C
Pied Currawong	*Strepera graculina*	O C
Powerful Owl [TS]	*Ninox strenua*	S P
Purple Swamphen	*Porphyrio porphyrio*	O
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Red Junglefowl *	*Gallus gallus*	I C
Rock Dove *	*Columba livia*	O
Rufous Whistler	*Pachycephala rufiventris*	O C
Sacred Kingfisher	*Todiramphus sanctus*	C
Satin Bowerbird	*Ptilonorhynchus violaceus*	O C
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	C
Silvereye	*Zosterops lateralis*	C
Spotted Pardalote	*Pardalotus punctatus*	C
Striated Thornbill	*Acanthiza lineata*	O C
Sulphur Crested Cockatoo	*Cacatua galerita*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Varied Sittella [TS]	*Daphoenositta chrysoptera*	O C
Variegated Fairy-wren	*Malurus lamberti*	O C
Welcome Swallow	*Hirundo neoxena*	O
White-bellied Cuckoo-shrike	*Coracina papuensis*	C
White-browed Scrubwren	*Sericornis frontalis*	O C
White-faced Heron	*Egretta novaehollandiae*	O
White-throated Gerygone	*Gerygone olivacea*	C

Common name	Scientific name	Method observed
White-throated Needletail	*Hirundapus caudacutus*	O
Willie Wagtail	*Rhipidura leucophrys*	O C
Yellow-tufted Honeyeater	*Licherostomus melanops*	O C
Yellow-faced Honeyeater	*Lichenostomus chrysops*	O C
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	O C
Mammals		
Black Rat *	*Rattus rattus*	T
Brown Antechinus	*Antechinus stuartii*	T
Chocolate Wattled Bat	*Chalinolobus morio*	A[PR]
Common Brushtail Possum	*Trichosurus vulpecula*	S
Common Ringtail Possum	*Pseudocheirus peregrinus*	S
Common Wombat	*Vombatus ursinus*	I
Domesticated Dog *	*Canis familiaris*	C
Domesticated Goat *	*Capra hircus*	O
East-coast Freetail Bat [TS]	*Micronomus norfolkensis*	A
Eastern Bentwing-bat [TS]	*Miniopterus orianae oceansis*	A[PR]
Eastern Freetail-bat	*Mormopterus ridei*	A[PO]
European Red Fox *	*Vulpes vulpes*	S
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Greater Broad-nosed Bat [TS]	*Scoteanax rueppelli*	A
Grey-headed Flying-fox [TS]	*Pteropus poliocephalus*	S
Horse *	*Equus caballus*	O
Large Forest Bat	*Vespadelus darlingtoni*	A
Long-eared Bat	*Nyctophilus sp*	A
Little Forest Bat	*Vespadelus vulturnus*	A
Rabbit *	*Oryctolagus cuniculus*	I
Short-beaked Echidna	*Tachyglossus aculeatus*	O
Sugar Glider	*Petaurus breviceps*	T S
Swamp Wallaby	*Wallabia bicolor*	S O
White-striped Mastiff-bat	*Austronomus australis*	A
Yellow-bellied Sheathtail-bat [TS]	*Saccolaimus flaviventris*	A[PR]
Reptiles		
Bar-sided Skink	*Eulamprus tenius*	H
Eastern Bearded Dragon	*Pogona barbata*	O
Eastern Water Dragon	*Physignathus lesueurii*	O
Eastern Water Skink	*Eulamprus quoyii*	O
Grass Skink	*Lampropholis guichenoti*	O
Jacky Lizard	*Amphibolurus muricatus*	O
Lace Monitor	*Varanus varius*	O I
Red-Bellied Black Snake	*Pseudechis porphyriacus*	O H
Amphibians		
Broad-palmed Frog	*Litoria latopalmata*	C
Common Eastern Froglet	*Crinia signifera*	C
Dwarf Tree Frog	*Litoria fallax*	C
Laughing Tree Frog	*Litoria tyleri*	C
Peron's Tree Frog	*Litoria peronii*	C
Smooth Toadlet	*Uperoleia laevigata*	C
Striped Marsh Frog	*Limnodynastes peronii*	C O
Whistling Tree Frog	*Litoria verreauxii*	C
Mollusc		
Cumberland Land Snail [TS]	*Meridolum corneovirens*	H
Common Garden Snail *	*Helix aspersa*	H
A carnivorous snail *	*Austrorhytida capillacea*	H

Common name	Scientific name	Method observed
Note: * indicates introduced species TS indicates threatened species All species listed are identified to a high level of certainty unless otherwise noted as: PR indicates species identified to a 'probable' level of certainty PO indicates species identified to a 'possible' level of certainty		

A	-	Anabat II/SD-1	C	-	Call Identification
O	-	Observation	P	-	Call-playback Response
T	-	Trap (*Elliott,* cage, etc)	H	-	Habitat Search
S	-	Spotlight	I	-	Scat, Track or Sign Identification

2.4 Recorded threatened species – Macquariedale Road, Appin

No plant species listed as threatened under either the *TSC Act* or *EPBC Act* have been recorded within the study area.

Threatened fauna species recorded within the study area include:

- Powerful Owl (*Ninox strenua*),
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*),
- Gang-gang Cockatoo (*Callocephalon fimbriatum*),
- Varied Sittella (*Daphoenositta chrysoptera*),
- Little Lorikeet (*Glossopsitta pusilla*),
- Grey-headed Flying-fox (*Pteropus poliocephalus*),
- Greater Broad-nosed Bat (*Scoteanax rueppellii*),
- East-coast Freetail Bat (*Micronomus norfolkensis*),
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*),
- Eastern Bentwing-bat (*Miniopterus orianae oceansis*) and
- Cumberland Plain Land Snail (*Meridolum corneovirens*).

2.4.1 Little Lorikeet (Glossopsitta Pusilla)

The species was recorded foraging at two (2) locations within the study area. A roosting hollow was also identified. Specialist advice and survey from Mr John Young indicated the Little Lorikeet nest tree could be retained in a small park area with a 15m buffer around the tree within the proposed urban landscape, which may effectively retain the nesting behaviour.

Mr Young indicates that if this was to fail (due to poor heath) there are other nesting opportunities for Little Lorikeet within the proposed conservation areas. Given this consideration, it is expected that this species which is well recorded in the surrounding locality, would not likely offer a constraint to rezoning for development within the study area.

2.4.2 Powerful Owl (Ninox Strenua)

The study area provides suitable breeding hollows for the Powerful Owl and suitable foraging habitat throughout the forest and woodland portions. Suitable roosting is also

present, particularly along the creek line and drainages where denser mid-storey foliage is present.

Preferred prey species of the Powerful Owl and recorded during survey include the Common Ringtail Possum, Common Brushtail Possum, Sugar Glider and Grey-headed Flying-fox.

Specialist survey and advice from Mr Young concluded that no large forest owls currently inhabit the site.

Following the site visit and assessment by John Young it may be concluded that the Powerful Owl is not likely to offer a constraint to the rezoning proposal.

2.4.3 Grey-Headed Flying-Fox (Pteropus Poliocephalus)

An individual Grey-headed Flying-fox was observed in flight over the study area during nocturnal surveys on 5 November 2012.

The study area provides seasonal year round foraging opportunity for this species however it provides no suitable roosting or breeding habitat. Loss of foraging resources within the study area would not likely cause a significant impact on this species; therefore this species will not likely offer a constraint to rezoning for development.

2.4.4 Varied Sittella (Daphoenositta Chrysoptera)

A small party of two (2), possibly three (3), birds were observed in the north-eastern portions of the study area on 7 November 2012. As this species more typically forages in parties of approximately six (6) birds, more individuals of this family group are expected to be present within the study area. No individuals were recorded present by *Travers bushfire & ecology* or birding expert John Young during four (4) days of more recent survey through the study area in February 2013.

Noske (1998) reports that Varied Sittellas hold weakly defended territories of 13-20ha in north eastern NSW which is equivalent in area to the conserved areas of the study area. The most recent rezoning proposal will retain the northern portions of the study area where this species was recorded which is sufficient in size (is in excess of 13ha) to maintain a local territory, particularly in association with connective habitat further north. The total conservation land for rezoning within the study area is in excess of 20ha.

There are also records of Varied Sittella in the large local remnants to the east of Appin, as well as the other creek line remnants further west from the study area, however, the extent of the local population for which the recorded individuals form part, is difficult to predict.

It should be noted that removal of habitat for the bypass, as well as habitat to the south-east, may place competitive pressures on the recorded family group in the lingering remnants. Bell Miner presence and extensive tree dieback exists to the south of Macquariedale Road as well as locations to the north of this, particularly the central drainage gully. Dominance by Noisy Miners occurs in the remaining fringes of the remnant patches present. Bell Miners and noisy Miners would themselves need to recolonise following clearance works. The Varied Sittella is reported to be adversely affected by the dominance of Noisy Miners in woodland patches (Olsen et al. 2005).

In conclusion, the Varied Sittella will not likely offer a constraint to rezoning for development given that the recorded area will remain, the species has not been

recorded within areas proposed for rezoning development and the connectivity to the recorded habitat area remains to further habitat areas.

2.4.5 Gang-Gang Cockatoo (Callocephalon Fimbriatum)

It is considered that the study area provides suitable nesting, roosting and foraging habitat for the Gang-gang Cockatoo, particularly along the riparian forest habitat adjacent to Ousedale Creek. This was reflected by the recorded locations during November 2012 survey which were all located proximate to this habitat. The survey was undertaken during the nesting period for this species and it was considered likely at this time that nesting was taking place proximate to recorded locations. Survey time constraints at this time did not allow time to ascertain exact nesting locations.

More recent target surveys undertaken by John Young in February 2013 located the likely nesting hollow for Gang-gang Cockatoo. This was not based on any recorded presence of the species at this time but rather by extensive field experience of Mr Young at determining nesting hollows based on nearby chew marks along branches. This hollow is located along Ousedale Creek to the north of Macquariedale Road, well away from the proposed Appin bypass and away from the likely future residential area.

This species will likely utilise the Open Forest and Woodland communities within the proposed rezoning areas for seasonal foraging requirements. The proposed rezoning for the development area east of the proposed bypass road is therefore not expected to provide core habitat values to the species. In conclusion, this species is not likely to offer a constraint to the current rezoning for development proposal.

2.4.6 Glossy Black-Cockatoo (Calyptorhynchus Lathami)

It is considered that the study area provides suitable foraging, roosting and nesting habitat for the Glossy Black-Cockatoo. Hollows providing potentially suitable habitat for nesting were identified during fauna surveys.

A male and female pair of Glossy Black-Cockatoos was observed every day of the November 2012 survey, foraging to the nearby west of Gordon Lewis Oval within the study area. Extensive foraging by evidence of chewed *Allocasuarina* cones was found surrounding this location as well as in another area to the nearby north. Other locations indicating foraging were also found at small isolated locations within the study area.

Given that the Glossy black-Cockatoo was not found by John Young to be utilising the study area for nesting and that all extensive and high use foraging areas will be retained within conservation areas, this species is not likely to offer a constraint to the rezoning proposal.

2.4.7 Cumberland Plain Land Snail (Meridolum Corneovirens)

It is considered that the study area provides suitable habitat for the CPLS in locations where the host community CPW exists as well as in adjacent SSTF areas with low sandstone influence that are currently, or would have been, within a few hundred metres of CPW.

Surveys recorded the species throughout the vegetated areas of the study area with the exception of the gully areas and the south-western portions. This included recording living specimens extending westward from CPW remnants up to 350m into SSTF.

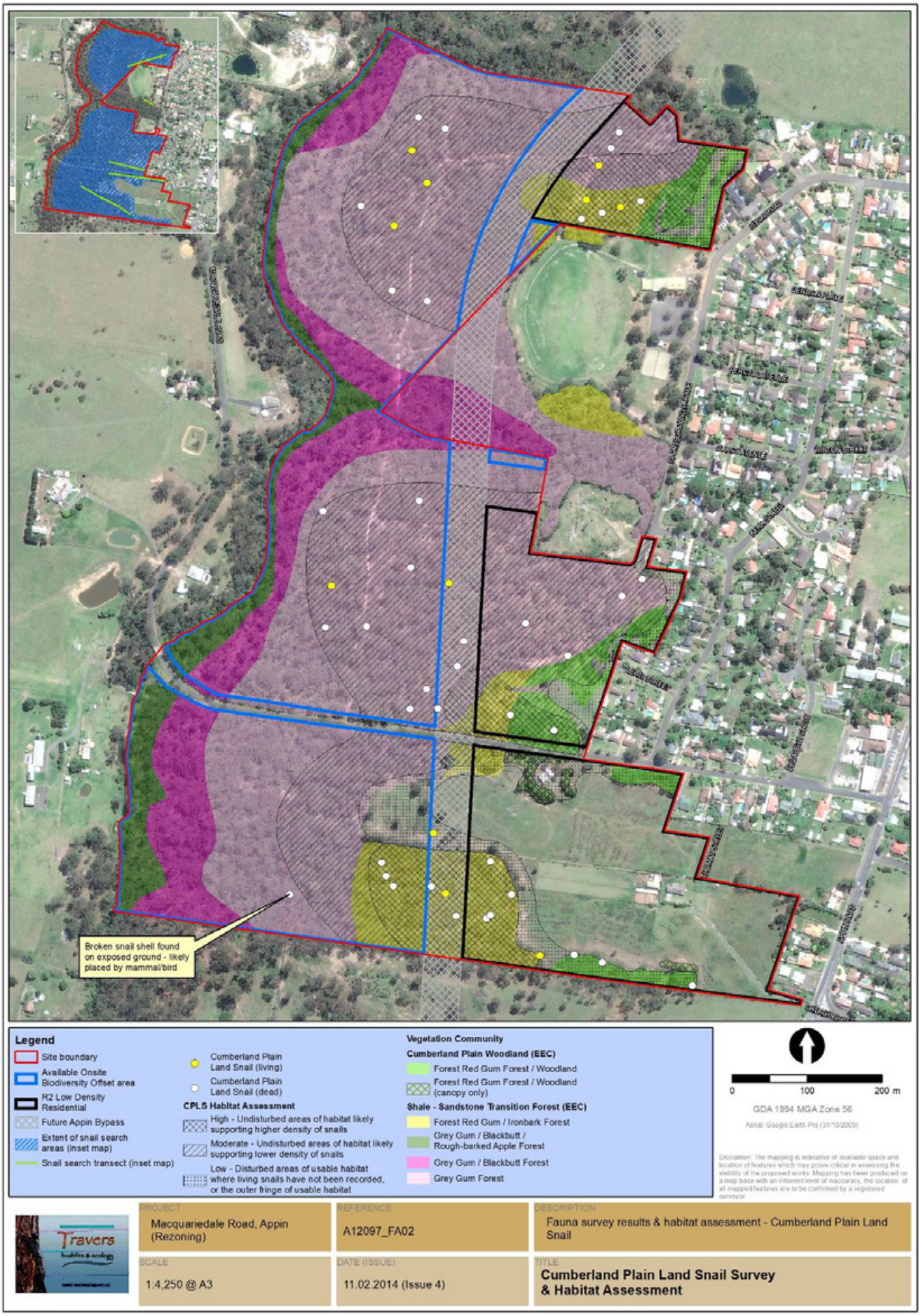

Figure 5 - Cumberland Plain Land Snail survey and habitat assessment
(Source: - Flora and Fauna Survey Report –
Macquariedale Road, Appin (Travers bushfire & ecology 2014)

It appears that Macquariedale Road and the degraded habitats immediately south as well as the central drainage gully running east-west to the south of the sports oval provide barriers to movement. As a result it is considered most likely that three (3) separate populations exist within the study area. This is consistent with population estimates being within the 100-300m range (pers. com. Dr Stephanie Clark). As this conclusion cannot be verified from survey effort to date the recorded areas will be termed 'patches' rather than 'populations'. This is given that the two (2) southern patches may have connective potential.

Snails extend further into SSTF within the two (2) northern patches. In both of these patches living specimens were located in the far western range extent, located on the western side of the proposed bypass road. The southern patch recorded only one (1) snail shell outside of low sandstone influence SSTF, this shell was found broken on the surface of a log and likely placed there by a small mammal or bird.

The recorded area to the west of the bypass road for the northern patch is considered sufficient in size to maintain a viable population, post development. This is SSTF at Airds.

CPLS habitat loss may be offset, however, measures to recover and relocate living specimens should be implemented in this case to maintain viable populations on site. Habitat restoration efforts in such areas should consider snail habitat requirements. A translocation and habitat restoration plan is recommended.

2.4.8 Hollow-dependent threatened microbat species

Greater Broad-nosed Bat (*Scoteanax rueppellii*), East-coast Freetail-bat (*Micronomus norfolkensis*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) have been recorded on or in close proximity to the site.

Each of these microbat species all have their own unique roosting and microhabitat requirements, however, they are considered here together due to their dependence on hollows for roosting and breeding. There is suitable foraging, roosting and breeding habitat for all three (3) species within the study area and proposed rezoning area for development east of the proposed bypass road.

These microbats were all recorded during overnight passive Anabat monitoring within the study area on 5 and / or 6 November 2012. They are all highly mobile species and local habitat would not be exclusive to the study area. The Greater Broad-nosed Bat was recorded several times at all recording locations, suggesting higher potential for a roost to be located nearby.

As it is very difficult to locate microbat roosting / breeding locations without exhaustive survey, their assessment is often based on the available foraging and hollow resources that remain in the locality. Hollow-dependent microbats are therefore not expected to provide a constraint to rezoning for development.

2.4.9 Eastern Bentwing-Bat (Miniopterus Orianae Oceanensis)

The Eastern Bentwing-bat was recorded during overnight passive *Anabat* recording surveys on both 5 and 6 November 2012, located along Ousedale Creek in the north and the central southern portions of the study areas. Given that this highly mobile microbat species was not recorded at the other two (2) *Anabat* stations it suggests use of the study area was not high at these times.

Whilst suitable caves for roosting and breeding may be present along the rocky escarpment edge of Ousedale Creek, there are no such opportunities within the proposed rezoning areas east of the proposed bypass road. Therefore, development within the eastern portions of the

study area will impact only on suitable foraging habitat for this species. Removal of foraging habitat will not likely cause this species to offer a constraint to rezoning for development within the study area.

Biodiversity Offset Strategy 3

The biodiversity offset strategy has been prepared on the basis of the following considerations:

- There is no threatened flora or fauna species being directly impacted by the proposed rezoning that are required to be offset as threatened species offsets.
- The impacted EECs, CPW and SSTF are to be offset at an adequate ratio using a combination of protection and restoration offsets
- The proposed offset sites have the authority of the land owner to be used as a biodiversity offset
- The offset sites can be secured for conservation purposes such as through a conservation agreement and a voluntary planning agreement.
- Impacts upon the CPLS habitat can be offset or mitigation measures implemented to maintain existing populations within the proposed conservation area at Macquariedale Road and the proposed offset site.

3.1 Objectives of the offset strategy

The objectives of the strategy are:

- to provide biodiversity offsets that will satisfy the Maintain or Improve test using the NSW Biodiversity Certification Methodology
- to provide sufficient offsets to satisfy the *EPBC Act* Environmental Offsets Policy
- to conserve a minimum of a 200m environmental corridor in the western portion of the Macquariedale Road site between the proposed bypass and Ousedale Creek to retain SSTF in situ and fauna habitat resources
- to enrich existing suitable habitat areas for the CPLS to improve carrying capacity,
- restore degraded habitats within the proposed conservation areas such as CPW
- to secure sites with suitable vegetation and threatened species habitat to compensate for the loss of on site vegetation
- to undertake long-term management of on site conserved bushland and offsite areas utilised as part of the offset strategy through a vegetation management plan (VMP) or equivalent.

3.2 Identification of offset lands

The proposed biodiversity offset areas (Figure 6), provide a significant conservation and development outcome in accordance that provides a maintain or improve outcome for all affected EEC's. The remaining lands at Elladale are being set aside for future offset requirements for other development projects and are expected to result in a larger conservation area in the future.

The biodiversity offset areas as proposed total 54.7ha including:

- on site conservation areas (34.81ha of existing SSTF including 0.7ha of SSTF / CPW revegetation) at Macquariedale Road, Appin
- off site biodiversity offset (8.99ha of CPW and 7.98ha of SSTF and 1.62ha Sandstone Gully Forest (SGF)) as contained within the proposed areas. An additional 1.26ha of CPW revegetation is also contained within the proposed biodiversity offset site.

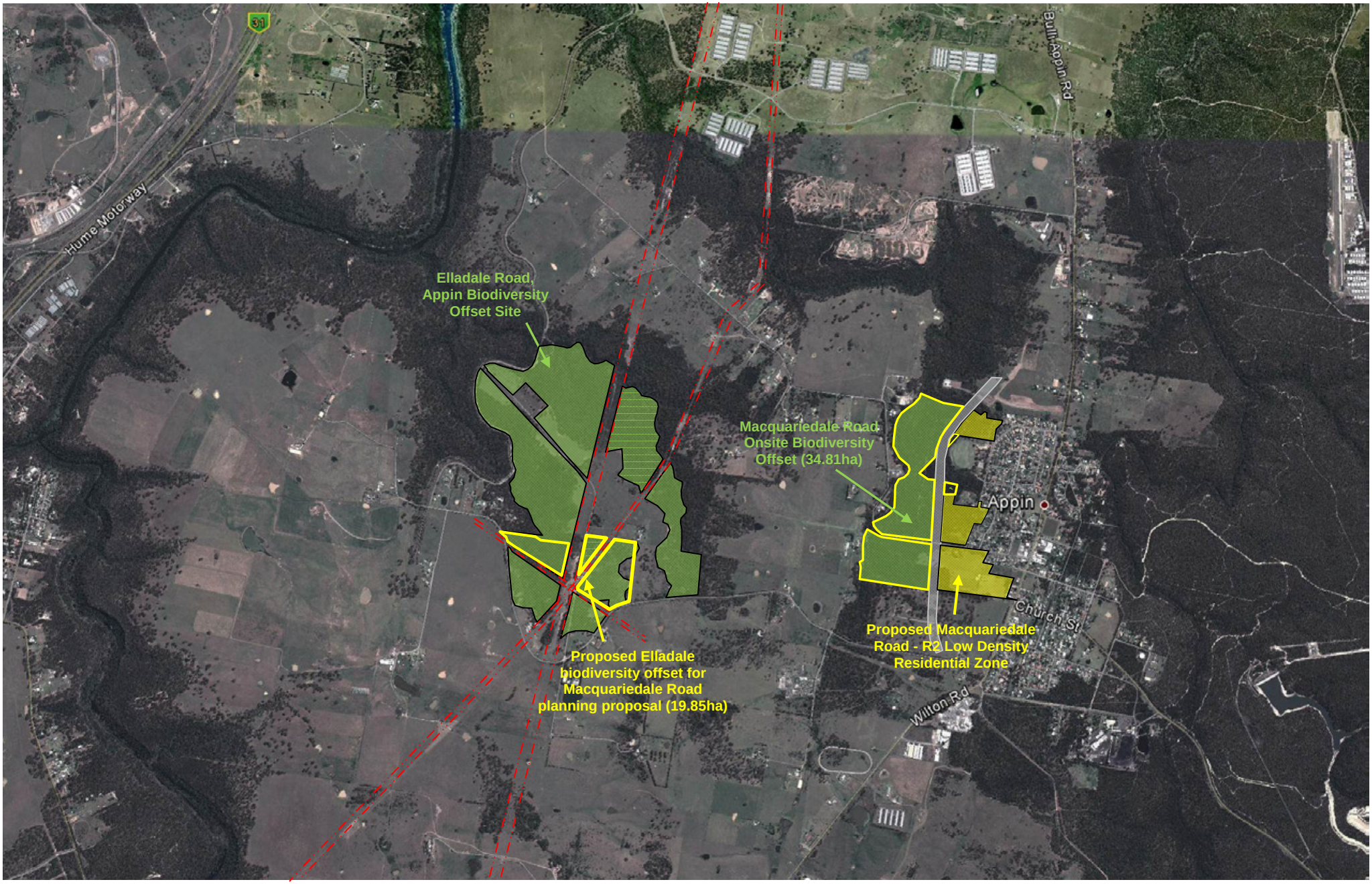

Figure 6 - Available offset sites as assessed by *EcoLogical Australia* (2014) and proposed biodiversity offset areas

The current ecological survey undertaken on the Macquariedale Road, Appin site is comprehensive and has been prepared using biometric assessment methodology as required by the NSW Biodiversity Certification Assessment Methodology.

The Elladale Road biodiversity offset site, was initially selected on the basis of existing vegetation mapping undertaken for *Walker Corporation* by *Anne Clements and Associates*. The vegetation communities present at Elladale Road, Appin, were verified by biometric quadrat analysis in late 2013.

Based upon vegetation survey by *Travers bushfire & ecology* in 2013 (Figure 7), the Elladale Offset Site contains the following vegetation units:

- CPW - good and managed remnants (22.31ha);
- SSTF - good to managed condition (80.65ha);
- SSTF - managed (0.94ha);
- Sandstone Gully Forest - (13.68ha)
- Cleared Lands with Scattered Trees - a portion of which could be revegetated to target offset communities.

Existing vegetation within the Elladale Road site will be utilised in part of the offsetting package for CPW and SSTF and partial restoration of cleared lands.

Figures 2, 7 & 8 provide an overview of the biodiversity offset areas at both Macquariedale Road and Elladale Road, Appin and the vegetation mapping at Elladale as undertaken by *Travers bushfire & ecology.*

The Elladale biodiversity offset site is considered appropriate because it contains a good sized remnant of vegetation that is contiguous, is located within 2km of the study area (same catchment), contains similar vegetation types, contains many similar habitat features, and forms part of mapped PCL in the same locality as the planning proposal.

The site also has capability to meet biodiversity offsets from other similar projects in the locality. An existing population of CPLS also exists within good quality CPW and transitional SSTF vegetation providing a total of 19.85ha of suitable habitat which can be expanded in the long term through strategic revegetation projects (Figure 7).

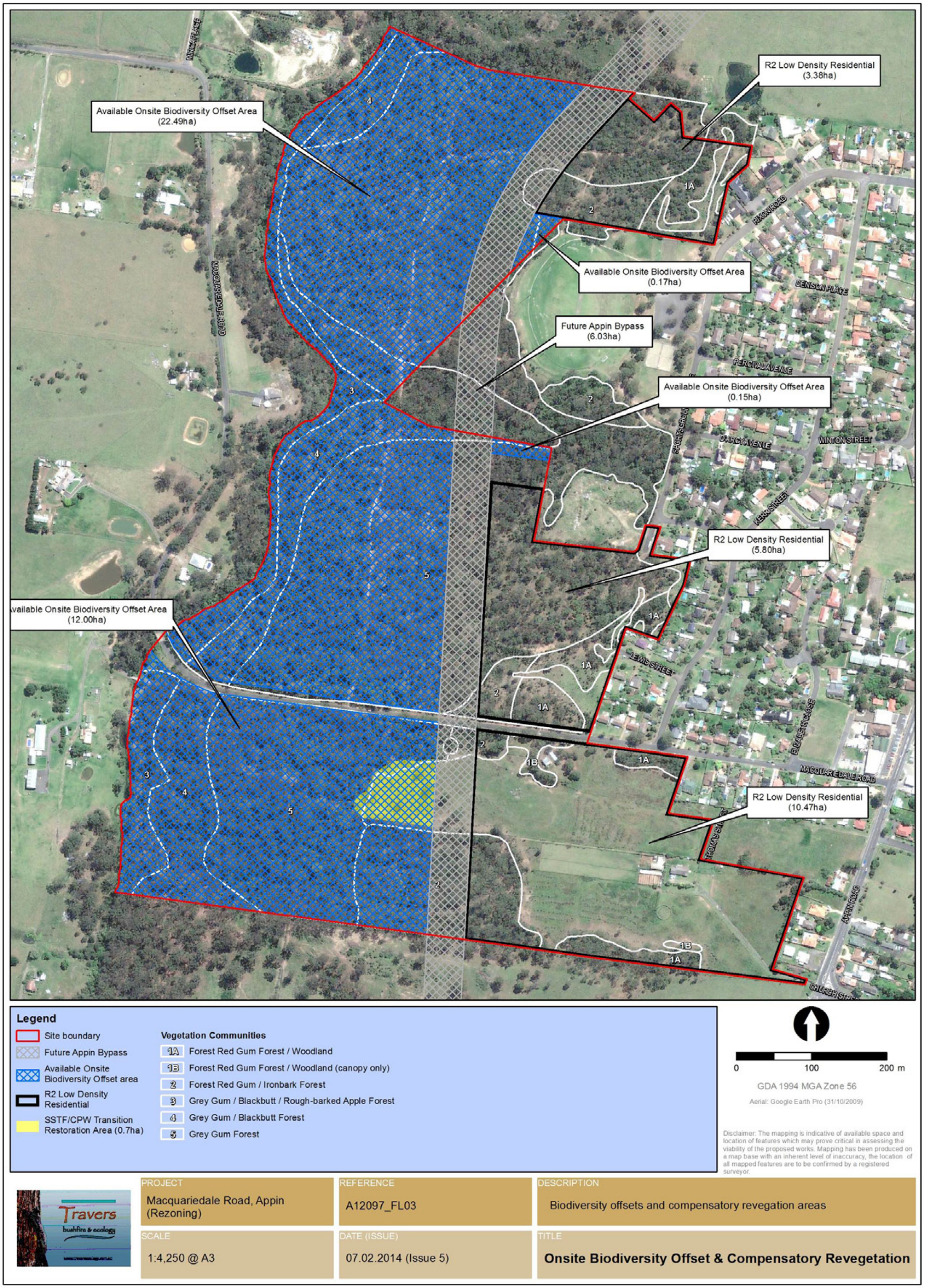

Figure 7 - Proposed biodiversity offset sites at Macquariedale Road, Appin

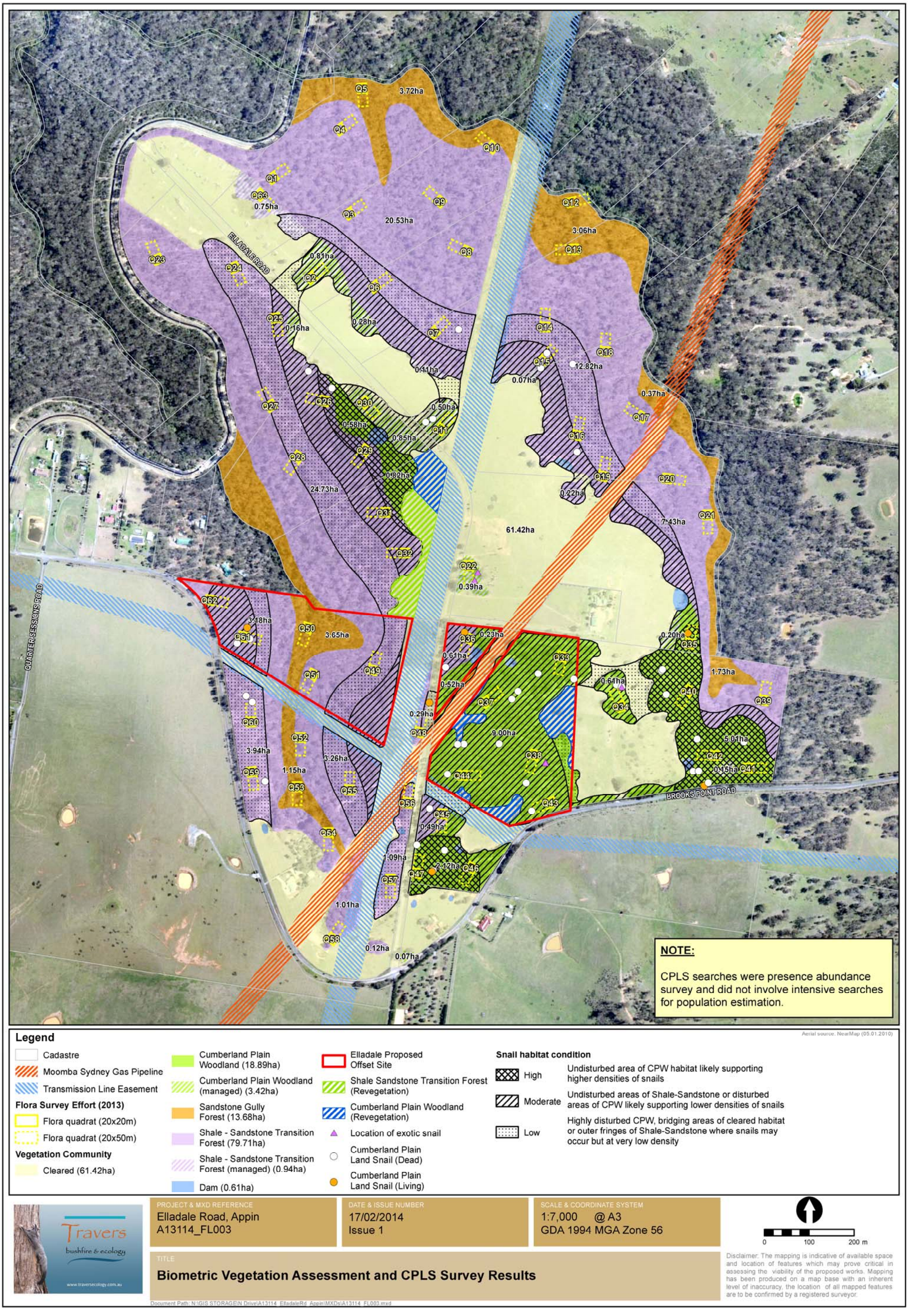

Figure 8 - Potential biodiversity offset sites at Elladale Road, Appin

3.3 Biodiversity offsetting outcomes

Travers bushfire & ecology advises that it is current policy for offsets to be transparently evaluated through the use of the Biobanking Credit Calculator or the Biodiversity Certification Assessment Methodology to satisfy NSW Biodiversity offsetting principles, and the *EPBC Act* environmental offset calculator to satisfy the *EPBC Act* Environmental Offsets Policy. Both offset calculators will need to demonstrate compliance with current policies at both the state and Commonwealth assessment levels.

A biodiversity offset to satisfy both NSW and the Commonwealth agencies is likely to include protection and an appropriate restoration offsets. Typically, offsets attract a higher offset ratio due to its conservation status, the condition of the proposed offsets and relative gain in biodiversity value through management actions.

3.3.1 Available biodiversity offsets at Macquariedale Road, Appin

As shown in Figure 4, the planning proposal results in a substantial conservation outcome, conserving 65% of all vegetation onsite. The most affected vegetation community by land area is SSTF (Table 3.1). The planning proposal results in the complete removal of all CPW from Macquariedale Road, Appin. The loss of CPW is significant but the loss is limited to 2.96ha of regrowth and degraded CPW habitat that has a moderate condition overall. Outlying isolated remnants of CPW in grazed paddocks or managed under an existing clearance approval under the *Native Vegetation Act* (2003), have been excluded from the areas required to be offset.

Table 3.1 - Onsite conservation of EEC– Macquariedale Road, Appin

Vegetation Community	Total Area (ha)	Area within onsite offset areas (ha)	Area within R2 Zone & external APZ (ha)	% loss
Scenario 1				
CPW	2.96	0.00	2.96	100%
SSTF	46.20	34.06	9.12	19.7%
Sub total	**49.16**	**34.06**	**12.08**	**24.6%**

3.3.2 Outcomes of Maintain or Improve Test – NSW Offsetting Requirements

The Preliminary Biodiversity Certification Assessment (*EcoLogical Australia 2014)* identifies that the planning scheme can be offset using a minimum average offset ratio of approximately 3.2:1 (CPW and SSTF combined). *EcoLogical Australia* advises that based on the number of required credits a total biodiversity offset of 45-50ha consisting of the CPW (10ha) and SSTF (35-40ha).

For the purposes of this assessment a total 50ha biodiversity offset area has been chosen to be ensure the planning proposal meets the biodiversity certification requirements. With the exception of approximately 5ha, the minimum offset requirements for SSTF are mostly met within the proposed E2 zone. The remaining 5ha would need to be provided in the form of an offsite biodiversity offset.

Travers bushfire & ecology notes that the Preliminary Biodiversity Certification Assessment includes an offset for the loss of all habitats within the Appin bypass. However the proponent is only utilising the first 20m of the bypass adjoining the R2 zone for asset protection purposes.

Under the NSW Biodiversity Certification Assessment Methodology the loss of CPLS habitat is treated as an ecosystem credit and is not required to have any further offsetting applied.

Additional offsets over and above the proposed CPW offset area at Elladale, are not offered for CPLS habitat under the planning proposal. However, the advice of Michael Shea (Australian Museum) has been sought by *Travers bushfire & ecology* regarding appropriate mitigation measures.

Mitigation measures as discussed in the Flora and Fauna Survey (*Travers bushfire & ecology* 2014) are likely to include within site relocation into adjoining habitat or the proposed Elladale offset site which supports higher quality snail habitat; partial restoration of habitat at Macquariedale Road and habitat enrichment measures. The implemented mitigation measures are subject to the approval of OEH.

3.3.3 Outcomes of EPBC ACT environmental offset calculator – EPBC Act requirements

To assist in defining the required offsets under the *EPBC Act,* preliminary assessment has been undertaken using the *EPBC Act* environmental offsets calculator (Attachment 2). This is a publicly available calculator but the variables require verification of the selected variables to firm up the results. In addition, the offset calculator is one tool used by the Department of Environment to assess whether the proposed biodiversity offset meets the *EPBC Act* 1999 Environmental Offsets Policy (2012).

Under the *EPBC Act*, CPLS is not a listed *Matter of National Environmental Significance* and is therefore not required to be offset. The loss of CPW is required to be offset under the *EPBC Act* Environmental Offsets Policy as it is part of a listed community 'Cumberland Plain Shale Woodland and Shale Gravel Transition Forest'. SSTF is a listed *EPBC Act* matter and requires to be offset.

Under the *EPBC Act* Biodiversity Offsets Policy (2012), and using the *EPBC Act* environmental offsets calculator, a 10ha CPW environmental offset will achieve a 136 % of impact offset (a minimum 90% of impact offset is required). The proposed offset therefore passes the maintain test for CPW. A 10ha CPW environmental offset is a 3.4:1 offset ratio.

A 40ha SSTF environmental offset will achieve a 245% of impact offset. Therefore the proposed SSTF offset does meets the 90% of impact offset requirement using the *EPBC Act* environmental offset calculator. A 40ha SSTF environmental offset results in a 4.4:1 offset ratio.

Therefore, the expected offsets as proposed by *EcoLogical Australia* (2014) meet the environmental offset requirements under the *EPBC Act* Environmental Offset Policy (2012).

3.3.4 Biodiversity offset targets

For the purposes of identifying offsets for the planning proposal a target 4.4:1 offset ratio has been applied for SSTF, 3.4:1 offset ratio for CPW to identify the target offsets for both SSTF and CPW (Table 3.2). This approach ensures that the proposed offsets achieve a maintain or improve outcome.

Table 3.3 provides a summary of the expected offset areas for both CPW and SSTF using a proposed offset of 4.4:1 offset ratio for SSTF, 3.4:1 offset ratio for CPW.

Taking into account the onsite conservation areas (approximately 34.81ha) the offsite biodiversity offsets to be achieved are estimated at approximately 15ha consisting of 10ha of CPW and 5ha of SSTF. The exact amount of protection and restoration offsets to be provided for the losses of vegetation and fauna habitat is subject to the parcels selected and the outcomes of the approval by NSW OEH and by Department of Environment under the *EPBC Act*.

The proposed biodiversity offset areas (Figure 3), provides a conservation and development outcome which is expected to meet NSW Biodiversity Certification and the *EPBC Act* Environmental Offsets Policy.

The proposed biodiversity offset areas (54.7ha) include:

- 34.81ha onsite conservation areas – Macquariedale Road, Appin
- 19.85ha offsite biodiversity offset – Elladale Road, Appin

A proposed SSTF / CPW transition revegetation area (0.7ha) within the conserved lands at Macquariedale Road is proposed to be enriched for CPLS through the provision of onsite habitat and an increased mix of CPW canopy species in cleared areas to provide higher quality foraging resources.

Travers bushfire & ecology has selected the appropriately sized SSTF and CPW vegetation areas at Elladale Road biodiversity offset site to meet the target for each community. It includes a minimum of 8.99ha of CPW and 7.98ha of SSTF and 1.62ha Sandstone Gully Forest (SGF) as contained within the proposed areas. An additional 1.26ha of CPW revegetation is also contained within the site.

Table 3.2 - Biodiversity offset targets for CPW (3.4:1 offset ratio) and SSTF (4.4:1 offset ratio)

Vegetation community	Total area (ha)	Area within onsite offset areas	Area within R2 Zone (ha)	% loss	Area bypass (ha)	Area affected by APZ in bypass (ha)	Area within bypass not impacted by APZ (ha)	Cumulative loss (ha) - R2 plus APZ	Cumulative loss (%) - R2 plus APZ	Recommended offset ratios (Note 1)	Target on site and off site offset areas (ha)	Target off site offset (ha)
CPW (Note 2)												
Forest Red Gum Forest / Woodland	2.66	0.00	2.66	100%	0	0.00	0.00	2.66	100.00%	3.4:1	9.044	9.04
Forest Red Gum Forest / Woodland Regrowth (3-5yrs) (Subject to clearance order under the NVA Act 2003)	0.82	0.00	0.82	100%	0	0.00	0.00	NIL (Note 6)	100.00%	Nil	Nil	Nil
Forest Red Gum Forest / Woodland (canopy only)	0.30	0.00	0.30	100%	0	0.00	0.00	0.3	100.00%	3.4:1	1.02	1.02
Sub total	**3.78**	**0.00**	**3.78**	**100%**	**0**	**0.00**	**0.00**	**2.96**	100.00%		**10.064**	**10.064**
SSTF (Note 3)												
Forest Red Gum / Ironbark Forest (EEC - SSTF)	4.95	1.42	2.47	50.2%	1.06	0.51	0.55	2.98	60.57%	4.4:1 (Note 4)	13.112	11.69
Grey Gum / Blackbutt / Rough-barked Apple Forest (EEC - SSTF)	3.21	3.21	0.00	0.00%	0.00	0.00	0.00	0	0.00%	4.4:1 (Note 4)	0	0.00
Grey Gum / Blackbutt Forest (EEC - SSTF)	6.28	6.19	0.04	0.64%	0.05	0.00	0.05	0.04	0.64%	4.4:1 (Note 4)	0.176	0.00
Grey Gum Forest (EEC - SSTF)	31.76	23.24	5.12	16.01%	3.40	0.98	2.42	6.1	19.07%	4.4:1 (Note 4)	26.84	3.60
Sub total	**46.20**	**34.06**	**7.63**	**16.52%**	**4.51**	**1.49**	**3.02**	**9.12**	19.74%		**40.128**	**6.07**
Total EEC	**49.98**	**34.06**	**11.41**	**22.83%**	**4.51**	**1.49**	**3.02**	**12.08**	**N/A**	**N/A**	**50.19**	**16.13**
										Overall EEC offset ratio	**4.15**	

Note 1:- The offset ratios are based on the preliminary Biodiversity Certification Assessment report by *EcoLogical Australia* (2014) and the *EPBC Act* environmental offsets calculator.

Note 2:- CPW is a critically endangered ecological community and is a red flag matter when considering biodiversity offsets. A red flag variation report is required to enable an approval to remove this vegetation under biobanking or biodiversity certification.

Note 3:- SSTF is an endangered ecological community and is a red flag matter when considering biodiversity offsets under the TSC Act. A red flag variation report is required to enable an approval to remove this vegetation under biobanking or biodiversity certification.

Note 4:- Offset targets do not include offsets for the future Appin bypass as RMS will be required to meet the biodiversity offset requirements for the bypass impacts. They do include offsets for the APZ impact within the bypass corridor which is caused by the proposed rezoning.

Note 5:- This figure does not exclude impacts caused by the future Appin bypass which is not caused by the planning proposal nor does it include any vegetation currently under a *NVA Act* clearance approval. It does include the asset protection zone for the planning proposal which impacts the first 20m of the bypass corridor

Note 6:- The Forest Redgum Forest/woodland regrowth area is subject to an active vegetation clearance approval under the NVA Act 2003, hence it is not require to be offset and is assumed to be cleared.

Table 3.3 - Summary of biodiversity offset targets for CPW and SSTF

Vegetation community (Notes 1 to 5)	Total area (ha) (note 5)	Area within on site offset areas (ha)	Area within R2 Zone & APZ (ha)	% loss	Offset ratio (Note 1)	Target on site and off site offset areas (ha) (Note 4)	Target off site offset (ha) (Note 4)
Target offset ratios (3.4:1 CPW 6:1 SSTF)							
CPW	2.96	0.00	2.96	100%	3.4:1	10.06	10.06ha
SSTF	46.20	34.06	9.12 (Note 5)	19.7%	4.4:1(Note 6)	40.12	5.31 ha
Sub total	**49.16**	**34.06**	**12.08**	**24.5%**	**4.15:1**	**50.18**	**15.37ha**

3.3.5 Available EEC offsets at Elladale Road, Appin.

Table 3.4 is a summary of the protection and restoration biodiversity offsets provided by the Elladale Road biodiversity offset site with respect to the direct loss of CPW and SSTF at Macquariedale Road, Appin. Table 3.4 demonstrates that the available offset lands exceed the expected offset requirements.

Table 3.4 - Available EEC offsets at proposed Elladale Road biodiversity offset site

Vegetation community	Area within on site offset areas (ha)	Area within R2 Zone & APZ (ha) (Note 1)	Target Offset ratio	Target on site and off site offset areas (ha)	Target off site offset (ha)	Available offset at Elladale (ha)	Proposed EEC Offsets (ha)	Proposed offset ratio
Offset ratios (3.4:1 CPW 4.4:1 SSTF)								
CPW	0.00	2.96	3.4:1	10.06	10.06	22.31	10.95	3.7:1
SSTF	34.06	9.12 (Note1)	4.4:1	40.12	5.31	80.65	42.04	4.6:1
Other Sandstone Vegetation (offset site only as mapped)						13.68	1.62	N/A
Sub total	**34.06**	**12.08**	**4.15:1**	**50.18**	**15.37**	**116.64**	**54.61**	
							Overall EEC offset ratio	**4.4:1**

Note 1 – The area of CPW by the R2 zone and APZ excludes portions of the Appin Bypass not impacted by the proposed asset protection zones. This differs from the Preliminary Biodiversity Certification Assessment prepared by *EcoLogical Australia* (2014) which includes all vegetation within the bypass as impacted habitat.

Based on these calculations the Elladale Road offset site has significant capacity to meet both offsetting scenarios for the loss of CPW and SSTF. It is clear that the Elladale Road offset site can provide for biodiversity offsets for future projects.

3.3.6 Impacts on Cumberland Plain Land Snail habitat

Table 3.5 provides an estimate of direct loss of habitat for CPLS. The biodiversity offset gains for threatened species have been addressed as ecosystem offsets within the Preliminary Biodiversity Certification Assessment by *EcoLogical Australia* (2014). However a preliminary comparison of what can be accommodated in the proposed offset sites, has been undertaken by a direct comparison of the known population habitat, estimated losses and available habitat areas on the proposed offset sites. The offsets in combination with proposed mitigation measures are part of the biodiversity offset package to mitigate the EEC and habitat losses caused by the planning proposal.

Table 3 estimates the loss of CPLS habitat based on the CPLS habitat assessment (Figure 5).This table concludes that the proposed rezoning impacts 16.75ha of known CPLS habitat (52.5% loss).

Table 3.5 - Direct impacts on Cumberland Plain Land Snail habitat

CPLS habitat quality	Area within entire site (ha)	Conserved in E2 zone (ha)	Impacted by R2 zone (ha)	Loss due to bypass corridor excluding APZ (ha)	Loss due to APZ in bypass (ha)	Total loss due to bypass corridor (ha)	Total loss due to R2, & APZ (ha)	% loss caused by R2& APZ (ha)	Total loss caused by R2 and bypass (ha)	% loss caused by R2 and bypass (ha)
High quality	5.81	0.91	3.74	0.57	0.59	1.16	4.33	74.53%	4.90	84.34%
Moderate quality	21.81	13.45	5.11	2.28	0.97	3.25	6.08	27.88%	8.36	38.33%
Low quality	4.29	0.80	3.23	0.18	0.08	0.26	3.31	77.16%	3.49	81.35%
Total area	**31.91**	**15.16**	**12.08**	**3.03**	**1.64**	**4.67**	**13.72**	**43.00%**	**16.75**	**52.49%**

3.3.7 Offsets for loss of Cumberland Plain Land Snail habitat

Table 3.6 provides an estimate of the offset ratio for CPLS habitat due to the proposed protection and restoration offsets at Macquariedale Road and Elladale Road, Appin. Based on these calculations, the Macquariedale Road and Elladale Road offset areas have capacity to offset the loss of CPLS habitat at an offset ratio of 2.2:1.

Table 3.6 - Cumberland Plain Land Snail habitat proposed restoration and protection offsets

CPLS habitat quality	Conserved in E2 Zone (ha)	Impacted by R2 Zone (ha)	Total loss due to R2, & APZ (ha)	Potential onsite (Macquariedale Road) restoration offsets (ha)	Available off site (Elladale) protection offset outcomes	Total habitat post restoration (ha)	Protection and restoration offset ratio
High Quality (note 1)	0.91	3.74	4.33	0	8.99	9.9	2.3:1
Moderate Quality (note 2)	13.45	5.11	6.08	0.7	4.13	17.58	2.9:1
Low Quality (note 3)	0.80	3.23	3.31	0	2.00	2.8	0.85:1
Total Area	**15.16**	**12.08**	**13.72**	**0.7**	**15.12**	**30.28**	**2.2:1**

Note 1:- Existing good condition CPW is considered to be high quality habitat for CPLS. Where the existing vegetation can be improved through regeneration and habitat enrichment works in the short term, i.e. generally moderate to good condition, it is counted as being high quality post restoration habitat.
Note 2:- Moderate quality habitat is considered to be restored habitat or existing vegetation immediately surrounding higher quality vegetation areas.
Note 3:- Low Quality habitat are those areas that are fringing but still support scattered CPLS or may support CPLS after restoration works or habitat enrichment is completed.

3.4 Summary of biodiversity offset outcomes

Table 3.7 summarises the biodiversity offset outcomes for both the Macquariedale Road and Elladale Road biodiversity offset sites.

Table 3.7 - Biodiversity offset outcomes within proposed offset areas

Vegetation community	Habitat loss (ha)	Insitu conservation & restoration at Macquariedale Road (ha)	Elladale Road restoration & protection offsets (ha)	Total biodiversity offsets (ha)	Offset ratios
CPW	2.96	0.7	10.25	10.95	**3.7:1**
SSTF	9.12	34.06	7.98	42.04	**4.6:1**
				Overall EEC offset ratio	**4.4:1**
CPLS habitat	13.72	15.16	15.12	30.28	**2.2:1**

The available protection and biodiversity offsets for CPW and SSTF will achieve a maintain or improve outcome with an overall offset ratio of 4.4:1.

The offset ratio for CPW at 3.7:1 is slightly higher than required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). However the available lands are slightly larger in size based on lot boundaries and is a reasonable outcome for the planning proposal which impacts fragmented CPW vegetation.

The offset ratio for SSTF at 4.6:1 is slightly higher than required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). The proposed offsets contain similar habitat attributes in close proximity to the study area and are identified as part of the PCL under the Cumberland Plain Recovery Plan (2010).

The offset ratio for CPLS habitat is also in a moderate to good range i.e. greater than a 2.2:1 offset ratio and is being offset using insitu and restored habitat at Macquariedale Road and Elladale Road. Mitigation measures are recommended within the flora and fauna survey report to support the existing populations' onsite and to recover and relocate existing live snails into suitable habitat areas (*Travers bushfire & ecology* 2014).

3.5 Offset security

A key principle of the offsetting guidelines issued by OEH, is that the proposed offsets be provided security in perpetuity for the proposed biodiversity offset areas to achieve a net gain in biodiversity values in the landscape.

As such, the offset areas can be protected in a number of ways including:

- rezoning as E2 (environmental protection),
- protection and management as a public reserve under the *Local Government Act (LG Act)*
- protected under a conservation agreement, covenant or equivalent
- transferred into national park estate or as a public reserve

- establishment as a Biobanking site.

The method of protection is to be resolved in consultation with the proponent and NSW Office of Environment & Heritage and the Commonwealth Department of Environment.

3.6 Principles for use of biodiversity offsets in NSW

The following principles have been defined by OEH for the use of biodiversity offsets in NSW. The proposed offset sites are considered in the context of these principles.

1. Impacts must be avoided first by using prevention and mitigation measures

The planning proposal has significantly reduced the residential impact zone by relocating the bypass route to the preferred R&MS route which conserves significantly more SSTF vegetation and associated habitat than previously proposed. Fragmented CPW within the R2 zone is being fully impacted and previous proposals to retain these areas are not possible on the basis of the preferred bypass and the need to provide viable development areas adjoining the existing Appin urban area. Walker Corporation has instead provided significant biodiversity offsets which in the long term will result in a better and more contiguous conservation outcome for CPW and associated habitat areas in a large reserve of greater than 20ha.

Targeted survey and expert advice has been undertaken by Mr John Young, focussing on avian ecology as most of the threatened fauna species recorded are birds. Mr Young was engaged to provide extensive advice in relation to each threatened avian species and advise what rezoning potential the study area has in relation to these species. On Mr Young's advice, the current rezoning area avoids significant impacts upon avian species, and he has further advised regarding the protection of a Little Lorikeet nest tree within the proposed rezoning lands.

CPLS is the most significantly affected threatened species due to removal of the existing fragmented areas of CPW from the site. The existing population will be maintained onsite by protection of a large portion of existing SSTF on site which contains CPLS at low population densities. The CPLS is expected to persist in marginal habitat areas but over a reduced area and population size.

Restoration of 0.7ha of CPW will be undertaken within the conservation area to assist in maintaining higher quality CPW vegetation at Macquariedale Road. In addition habitat enrichment will be undertaken to relocate suitable retained logs and offcuts from the R2 Zone as refuges within the conservation area. Michael Shea of the Australian Museum has supported the relocation of affected CPLS into existing CPW areas within the Elladale Road offset site preferably into non occupied snail habitat areas to avoid competition with existing snails. This can be aided by regenerating suitable areas and enriching on ground protection in the form of hardwood logs and offcuts.

2. All regulatory requirements must be met

A 7 part test of significance has not been completed for the proposed rezoning. The planning proposal has ecologically assessed impacts on threatened species, EECs and populations as listed under the *Threatened Species Conservation (TSC) Act (1995)*, *Fisheries Management (FM) Act (1994)* and the *Environment Protection and Biodiversity Conservation (EPBC) Act (1999)*. The outcomes of ecological survey and assessment are provided in the Flora and Fauna Survey (*Travers bushfire & ecology 2014*, which includes the expert advice of Mr John Young.

3. Offsets must never reward ongoing poor performance

Best practice conservation methods will be implemented within the proposed offset sites via the way of management plans. The performance of the proposed works and conservation initiatives will be monitored and certified in accordance with conditions of consent. Management plans for the proposed offset sites will be prepared in accordance with current restoration guidelines and best practice restoration methods.

4. Offsets will complement other government programs

The offsets are located within lands mapped as PCL. Offset sites will be managed in accordance with a bushland management plan in accordance with best practices and protected under a suitable zoning and a conservation agreement.

5. Offsets must be underpinned by sound ecological principles

The proposed external offset site at Elladale Road contains similar vegetation attributes as to our current study area, being that it contains two (2) EECs, CPW and SSTF, and is located approximately 1km from the study area. It also contains suitable habitat for the restoration of CPLS habitat.

There are sound offsets to provide in that they contains the same vegetation types (as surveyed by *Clements & Associates*), are greater than 20ha in size adjoining existing native vegetation areas, and is mapped as PCL..

6. Offsets should aim to result in a net improvement in biodiversity over time

The biodiversity offset package achieves offset ratios of 3.7:1 for CPW and 4.6:1 for SSTF. All biodiversity offset sites will be managed in accordance with an approved plan of management for long term improvement in biodiversity. Existing areas will be regenerated through the removal of grazing pressures, bush regeneration and strategic revegetation works.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs

The proposed offsets will fully offset the impact of rezoning and all offset sites shall be managed under a plan of management in accordance with the requirements of a conservation agreement.

8. Offsets should be agreed to prior to the impact occurring

The offsets are required to be approved by the Director General prior to commencement of any actions related to current development applications. It is current NSW policy for offsets to be transparently evaluated through the use of the Biobanking credit calculator to satisfy NSW biodiversity offsetting principles, and the *EPBC Act* environmental offset calculator to satisfy *EPBC Act* Environmental Offsets Policy. At present both offset calculators will needed to demonstrate compliance with current policies at both the state and commonwealth assessment levels. A red flag variation report will also need to be prepared to allow approval for the removal of CPW, SSTF and threatened species habitat.

The proposed offsets meet the Maintain or Improve test in accordance with the NSW Biodiversity Certification Assessment Methodology and pass the minimum 90% of impact offset in accordance with the *EPBC Act* environmental offsets calculator.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated

The area of Impact:

A total of 12.08ha of EEC vegetation will be impacted by the planning proposed due to the proposed R2 Residential zone and the required asset protection zones. Additional regrowth vegetation of 0.88ha will also be affected but it is currently subject to an existing vegetation clearance approval under the Native Vegetation Act 2003 as non-protected regrowth. The location of the proposed residential zone and the proposed offsets are clearly identified in this biodiversity offset strategy.

The types of ecological communities affected:

Biometric quadrat data has been collected for each vegetation community and compared against the CMA benchmarks. The affected vegetation communities have been confirmed as the endangered ecological communities (EECs) CPW and SSTF.

The condition of habitat:

The conditions of habitats at Macquariedale Road and Elladale Road Appin have been verified by biometric quadrat analysis which includes the collection of data on vegetative and structural elements of each vegetation community. This work is also supported by flora and fauna survey to verify the presence or absence of threatened flora and fauna species. Each vegetation patch has been compared against CMA benchmark data for each listed vegetation community which has allowed each area to be classed as 'low condition' or medium or higher condition i.e. 'not in low condition'.

The conservation status and / or scarcity / rarity of ecological communities:

CPW is listed as critically endangered under both the *TSC Act* and the *EPBC Act*. SSTF has been listed as EECs under both the *TSC Act* and the *EPBC Act.* Both vegetation communities have been over-cleared.

10. Offsets must be targeted

Offset sites provide a targeted like-for-like biodiversity offset outcome as they contain the same vegetation types as the rezoning area and thus likely similar habitat values such as threatened species potential.

11. Offsets must be located appropriately

The offsets have been located in areas of high conservation value, mapped as PCL and will contribute to conservation corridors and reserves in the long term.

12. Offsets must be supplementary

The proposed offset areas are owned by *Walker Corporation* and are not under any other conservation agreements and have not been previously offered as biodiversity offsets under any other scheme.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conserving agreements or a contract

The offset areas are intended to be protected in perpetuity via an E2 Environmental Conservation Zone, conservation agreement or planning agreement as a condition of consent.

Offset Restoration Works

4

4.1 On site protection and restoration offsets within the study area and adjacent

The proposed biodiversity offsets at Elladale Site and Macquariedale Road, Appin, will require secure protection and the preparation of bushland management plans to guide the restoration efforts to achieve the target community and the maximise the biodiversity gains.

To assist in management of the proposed restoration and protection offsets, the following measures will be required to be undertaken and documented in the form of a bushland management plan:

- fencing or delineation of areas of bushland to be conserved
- undertake weed control to assist in natural regeneration of native species
- undertake pest control to assist in natural regeneration of native species
- habitat enrichment works for threatened species habitat.
- apply a maintenance program for a minimum of ten (10) years to target existing and regrowth of exotic and noxious weed species
- revegetation works as required to enhance the structure and diversity of existing vegetation
- ecological burns appropriate to CPW vegetation - Cumberland Plain Recovery Plan advises that the interval should be between 5-12 years
- protection of slopes (erosion control) if required
- grazing exclusion
- pest control – rabbits, feral cats and foxes
- Removal of rubbish and litter
- Protect against vandalism and provide access along defined pathways
- Installation of conservation management signage.

There is capacity for revegetation works to be undertaken to re-establish CPW or SSTF within existing cleared areas within the Elladale Site and Macquariedale Road, Appin conservation area. Revegetation works shall include the replanting of suitably endemic tube stock or similar, grown from local provenance seed (where possible) to restore the native vegetation to good quality CPW or SSTF.

Revegetation of CPW within the Macquariedale Road conservation area (Figure 7) may require translocation of shale based CPW soils into the proposed 0.7ha CPW restoration area. Given the locality of the proposed revegetation area, the vegetation is likely to be either SSTF or SSTF / CPW transitional vegetation. However, the target vegetation community will be determined during preparation of the bushland management plan to be prepared for the Macquariedale Road conservation area.

Conclusions 5

Implementation of the proposed biodiversity offsets will achieve a maintain or improve outcome for all affected vegetation communities in the form of protection and restoration biodiversity offsets on site. Offsets have been provided based on the NSW Biodiversity Certification Assessment Methodology and a pass using the *EPBC Act* Environmental offsets calculator.

The proposed Elladale Road biodiversity offset site offers significant offsite biodiversity offset value for both CPW and SSTF and exceeds the minimum requirements for the Macquariedale Road, Appin planning proposal.

The available protection and biodiversity offsets for CPW and SSTF will achieve a maintain or improve outcome with an overall offset ratio of 4.6:1.

The offset ratio for CPW at 3.7:1 is slightly higher than required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). However the available lands are slightly larger in size based on lot boundaries and is a reasonable outcome for the planning proposal which impacts fragmented CPW vegetation.

The offset ratio for SSTF at 4.6:1 is slightly higher than required in accordance with the Preliminary Biodiversity Certification Assessment (*EcoLogical Australia* 2014). The proposed offsets contain similar habitat attributes in close proximity to the study area and are identified as part of the PCL under the Cumberland Plain Recovery Plan (2010).

The offset ratio for CPLS habitat is also in a moderate to good range i.e. greater than a 2.2:1 offset ratio and is being offset using insitu and restored habitat at Macquariedale Road and Elladale Road. Mitigation measures are recommended within the flora and fauna survey report to support the existing populations' onsite and to recover and relocate existing live snails into suitable habitat areas (*Travers bushfire & ecology* 2014).

5.1 Recommended documentation for approval of proposed biodiversity offsets

The following additional documentation will be required for biodiversity offsetting purposes:-

- Prepare and submit a referral to the Commonwealth Department of Environment for assessment under the *EPBC Act*. This will need to include a biodiversity offset assessment using the *EPBC Act* Environmental Offsets Calculator.
- Prepare bushland management plans for the proposed onsite conservation areas and offsite biodiversity offsets which are to address the above onsite mitigation measures and habitat enrichment to support the CPLS.

For the biodiversity offsets sites to receive biodiversity certification, a final biodiversity certification report and red flag variation report will be required to enable approval of the proposed offset strategy under the *TSC Act.* The proposed offset sites are required to be managed as conservation areas in perpetuity under a conservation agreement or similar mechanism. A conservation agreement is the current preferred mechanism of protection required by the Commonwealth Department of Environment.

Alternately a voluntary planning agreement can be entered into for the establishment of the offset areas and to be securely conserved under a conservation agreement or similar mechanism. The protection and management of the proposed offsets are subject to approval by Council, OEH and the Commonwealth Department of Environment.

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Attachment 1

Preliminary Biodiversity Certification Assessment
(*EcoLogical Australia* 2014)

Mr Gerry Beasley
Walker Corporation
C/O Travers bushfire & ecology

ECO LOGICAL AUSTRALIA PTY LTD
ABN 87 096 512 088
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Project No: 13SYDPLA-0037

16 January 2014

Dear Mr. Beasley

Preliminary Biocertification Assessment – Macquariedale Road Appin

Please find following our brief report on the findings of the preliminary Biodiversity Certification Assessment of the planning proposal for Macquariedale Road, Appin.

Background/Context

Walker Corporation has commissioned Eco Logical Australia (ELA) via Travers Bushfire and Ecology to undertake a preliminary Biodiversity Certification Assessment in accordance with the Biodiversity Certification Assessment Methodology (BCAM) to determine whether conservation lands at the Maquariedale Road site and Elladale offset site will meet the Biocertification Improve or Maintain (IoM) test for the planning proposal to rezone rural land to low density housing at Appin in the Wollondilly Shire.

This assessment has been prepared in close consultation with Travers Bushfire and Ecology who have undertaken extensive biodiversity investigations of the land holdings and have mapped the vegetation, threatened species habitats and collected biometric plot data in accordance with the BCAM. Travers Bushfire and Ecology and ELA are both accredited biodiversity certification assessors.

Figure 1 shows the proposed Biodiversity Certification Assessment Area (BCAA) which includes:

- land to be certified (developed/cleared) including an Asset Protection Zone – (APZ) and the preferred Appin bypass
- lands subject to conservation measures or offset areas
- retained land (land that is not proposed for biodiversity certification or to be used as a conservation measure). In the Macquariedale BCAA, the “retained land” comprises of cleared areas with small clumps of remnant trees.

Methods and Limitations

This is a preliminary assessment only and does not constitute the formal Biocertification Assessment Report or Biodiversity Certification Strategy which are required to submit a formal application to the NSW Minister for the Environment for biodiversity certification. This application must be made by a Planning Authority (i.e. Wollondilly Shire Council or the Minister for Planning). It is an Office of Environment and Heritage (OEH) requirement that a Planning Authority consult with OEH during the process of a Biocertification proposal and if you intend pursuing this option, this consultation should be commenced as early as possible.

To carry out the assessment ELA has used the GIS shape files and vegetation survey data collected by Travers Bushfire & Ecology. The data used includes:

- vegetation mapping (including conversion of the vegetation map units to the best fit biometric vegetation type)
- stratification of vegetation mapping based on vegetation condition and biometric type
- vegetation plot and transect data

Three biometric vegetation types have been mapped in the BCAA. The total BCAA is 176.3 ha; most of the site comprises of native woodland and forest vegetation in biometric 'moderate to good' condition with the exception of 14.4 ha of cleared/highly disturbed areas in biometric 'low' condition. A total of 15.64 ha of vegetation will be cleared for development and up to 160.69 ha of vegetation is available for conservation measures, if required, (an overall offset ratio of 10.27:1).

The three vegetation types have been further stratified into ten vegetation zones (similar condition states) with each zone given an ancillary code based on vegetation structure e.g. canopy and understorey present, only canopy present or minimal native vegetation present and revegetation proposed (for conservation lands).

Tables 1a and 1b shows the area of vegetation type to be impacted/conserved within the Macquariedale BCAA and corresponding vegetation zones.

To undertake credit calculations in accordance with the BCAM, the 'condition' of the vegetation to be impacted/protected needs to be assessed via biometric plots. Replicate plots are assessed in each vegetation zone (vegetation type in a homogenous condition state) measuring 10 site attributes in a 20x20 and 20x50m area including native plant species richness, canopy/mid/ground story cover, number of trees with hollows, length of fallen logs, proportion of regeneration and exotic plant cover.

The BCAM compares this data with benchmark data for each vegetation type to calculate site condition scores. If the vegetation is within benchmark condition, it receives a high site condition score and 'requires' more credits when impacted than a site in low condition. The BCAM specifies a minimum number of plots based on vegetation zone area. The number of plots used by Travers Bushfire & Ecology to collect site attribute data significantly exceeds the minimum number specified in the BCAM (**Table 1b**).

Figure 2 shows the distribution of biometric vegetation zones and location of vegetation plots across the BCAA.

The number of credits 'generated' depends on the condition of the vegetation to be protected and its capacity to be 'enhanced' or improved and the type of conservation measures proposed. Section 126L of the TSC Act provides a range of conservation measures that may be used in a Biocertification assessment and these are grouped into three categories:

- Areas that are managed and funded in perpetuity (i.e. Biobank sites or land transferred to national parks) – 100% credit entitlement
- Areas that are managed in perpetuity (e.g. NPW Act Conservation Agreements, adoption of Plan of Management under Division 2 of Part 6 of the Local Government Act, entering into a Planning Agreement under Section 93F of the EP&A Act) – 90% credit entitlement
- Areas that are secured through planning instrument (i.e. environmental zoning) – 25% credit entitlement

The aim is to 'generate' more credits by conservation measures for each vegetation type and threatened species than are 'required' for impacts – if this is achieved, an 'improve or maintain' outcome has been met and the proposal is then eligible to be conferred biocertification status. Please note that in accordance with the biocertification methodology, all impact areas (urban and APZ) are counted as 100% loss even though the APZ is only partial loss).

The threatened species that are 'assumed' to be present within the BCCA are shown in **Table 2** together with their Tg score (The Tg score is an offset multiplier based on the ability of the species to respond to management. A high Tg score gives a low offset ratio whilst a low Tg score requires a high offset ratio). The

BCAM uses the 'landscape' or average Tg score to calculate offset requirements. It is possible to remove predicted species (and change the landscape Tg score) if appropriate justification can be provided to clearly demonstrate that the species is unlikely to be present in the BCAA. Travers Bushfire and Ecology (2013) recorded several threatened fauna species on site that require ecosystem credits that have low Tg scores (i.e. Powerful and Masked Owl), which cannot be removed from the calculations to create a lower credit requirement.

Targeted threatened species surveys are required for all species that require 'species credits' (typically all threatened plants and approximately 50% of threatened fauna). There are a series of habitat filter questions (see **Table 3**) that are used to determine which species requiring species credits are likely to be within the BCAA (**Table 4**). These species require and have been the subject of targeted survey but were not recorded (Travers Bushfire and Ecology 2013). As with ecosystem credits, it is possible to remove species credits species if appropriate justification can be provided to clearly demonstrate that the species is unlikely to be present. Prior to making a formal application for biocertification, each of the species in **Table 4** will need to be specifically addressed.

Travers Bushfire & Ecology have carried out detailed targeted surveys within the BCAA and did not record any threatened flora species or species credit threatened fauna species (Travers Bushfire and Ecology 2013). As no species requiring species credits were recorded, the assessment has only addressed ecosystem credits.

'Red flag' areas (EECs, vegetation types that are greater than 70% cleared in the CMA and threatened species that cannot withstand further loss in the CMA area) must be avoided. If red flag areas cannot be avoided, an application may be made to the Minister to 'vary' the red flag on the basis that the area is not viable, is small, is in poor condition and/or their contribution to regional biodiversity is low. **Figure 3** shows the distribution of two vegetation types that are red flags within the land to be certified in the BCAA. These vegetation types are:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin which corresponds to the critically endangered ecological community, Cumberland Plain Woodland in the Sydney Basin Bioregion
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin which corresponds to the endangered ecological community Shale/Sandstone Transition Forest in the Sydney Basin Bioregion

These red flag vegetation types are impacted by the urban footprint, preferred Appin bypass and APZ on the eastern section of the BCAA for which requests for red flag variations will be required.

Results

Table 5 provides a summary of the number of ecosystem credits 'required' for impacts to each of the vegetation types in the BCAA and the number of credits 'generated' for the offset areas.

In summary, the lands to be certified requires **428 ecosystem credits** for impacts and the land available for conservation will 'generate' **1,713 credits** (100% conservation measures – transferred to NPWS or Biobanked) or **1,541 credits** (90% conservation measures – managed in perpetuity). If the area of the Appin Bypass outside of the APZ is excluded from the calculations, this reduces the impact area by 1.79 ha and 50 ecosystem credits. This calculation includes credit requirements for the proposed Appin Bypass. If the route of the Appin Bypass is removed from the calculations (1.79 ha of impact to Shale Sandstone Transition Forest, this would reduce the credit requirement by approximately 50 credits, i.e. 428 to 378 credits.

An IoM outcome can be achieved, providing a Red Flag variation is approved, for impacts to 15.31 ha of Grey Box - Forest Red Gum grassy woodland and Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest vegetation types. All three impacted vegetation types can generate a surplus of credits (216, 951, and 118 for Grey Box - Forest Red Gum grassy woodland, Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey

Gum open forest and Red Bloodwood - Grey Gum woodland respectively) if registered as a biobank site and could be sold on the open market to third parties or used for other Walker Corporation projects. Alternatively the conservation footprint could be reduced.

Conclusion

The preliminary biocertification assessment of the proposed subdivision has indicated that an IoM outcome in accordance with the BCAM can be achieved subject to the approval of a red flag variation request for impacts to Grey Box - Forest Red Gum grassy woodland and Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest vegetation types.

Should Walker Corporation decide to register the conservation area as a Biobank site (and thus obtain 100% benefit for the number of credits generated) the surplus 1, 285 ecosystem credits could be used to offset other Walker Corporation projects or traded on the biodiversity credit market and supplement the management costs of the offset area and provide a land value return.

Robert Humphries
Manager, Biobanking and Biodiversity Certification Offset Programs
Eco Logical Australia

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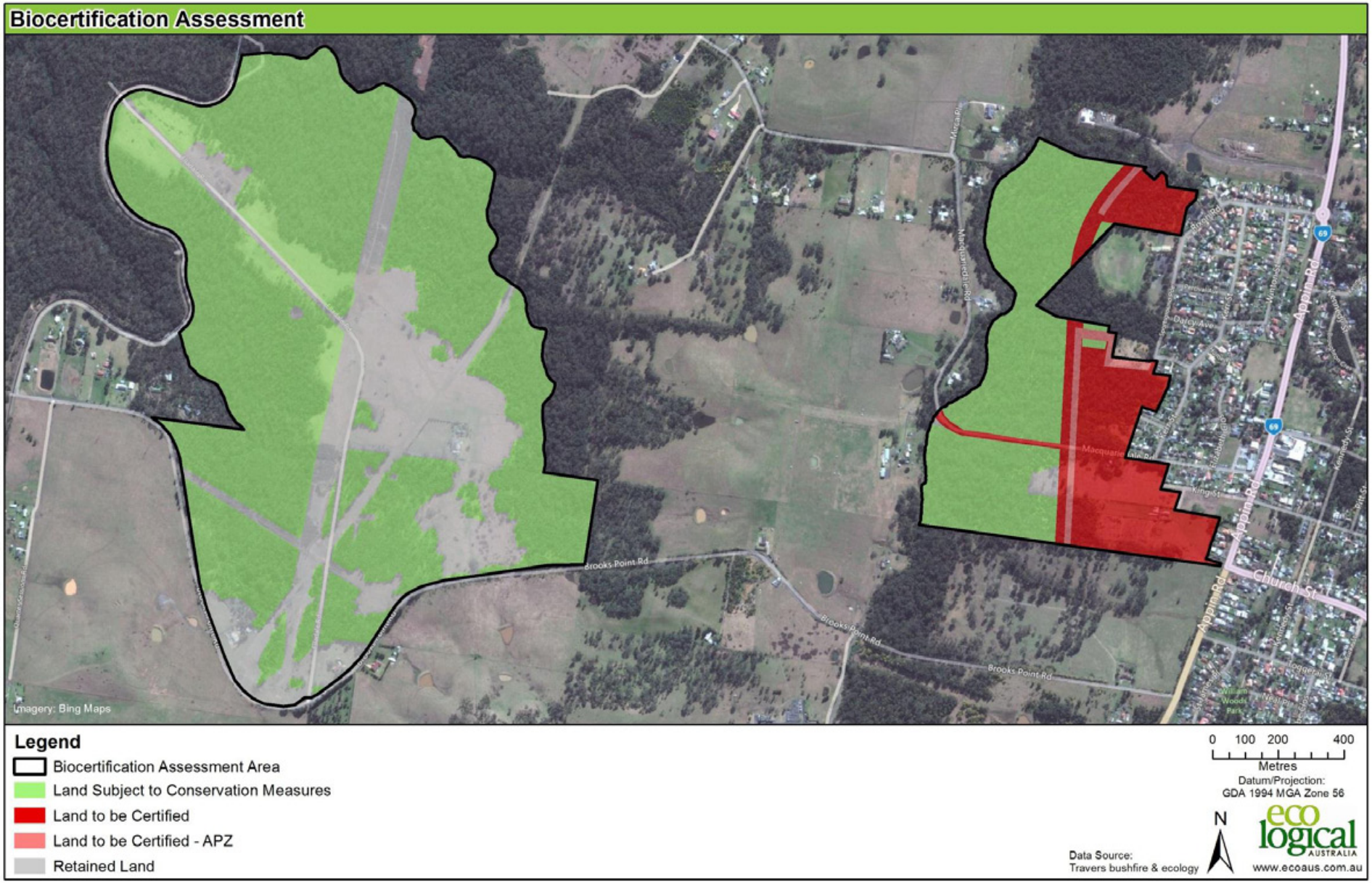

Figure 1: Biocertification Assessment Area showing land to be certified, land subject to conservation measures and retained land

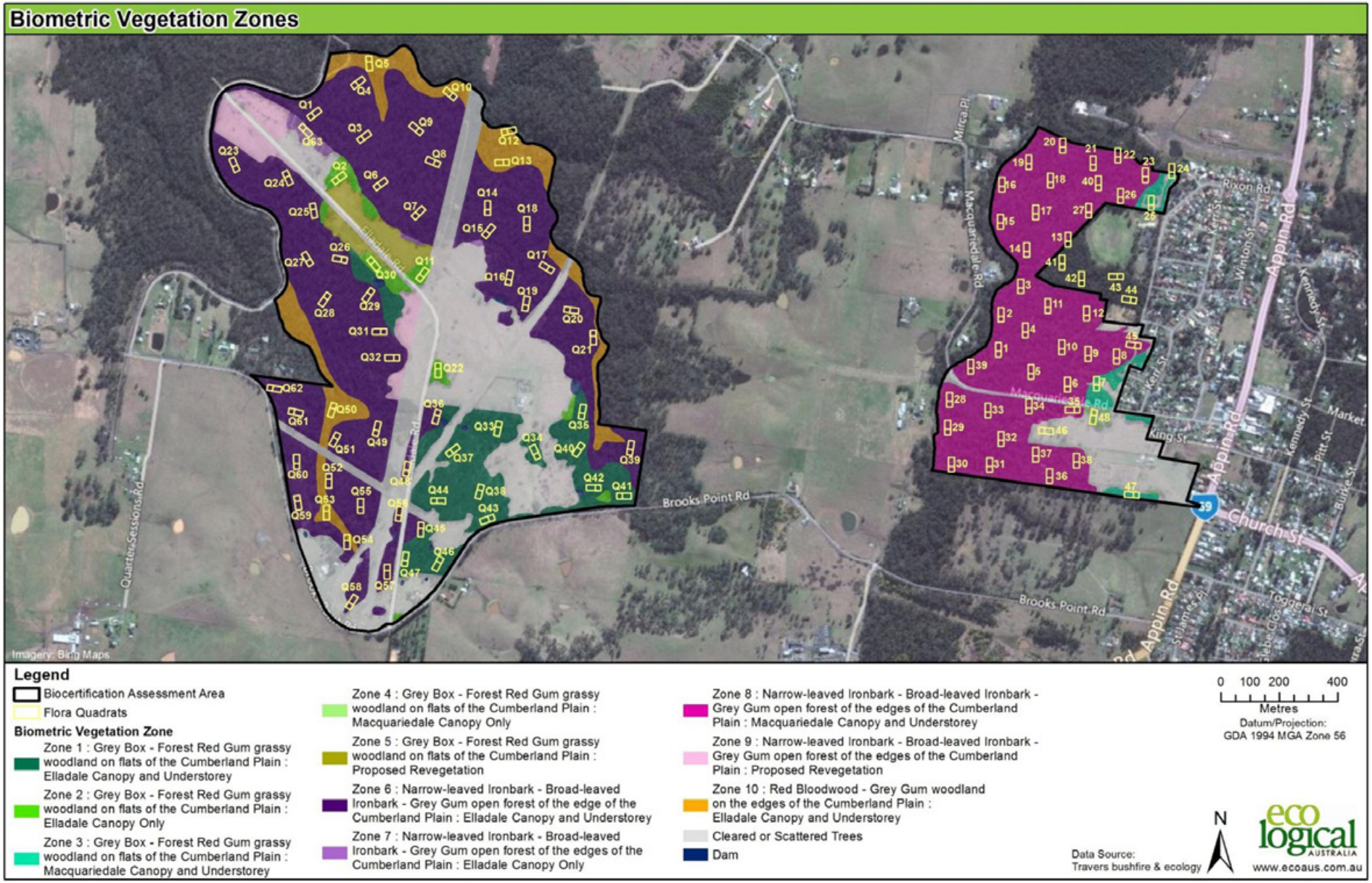

Figure 2: Mapped vegetation zones and plot locations in the Biodiversity Certification Assessment Area

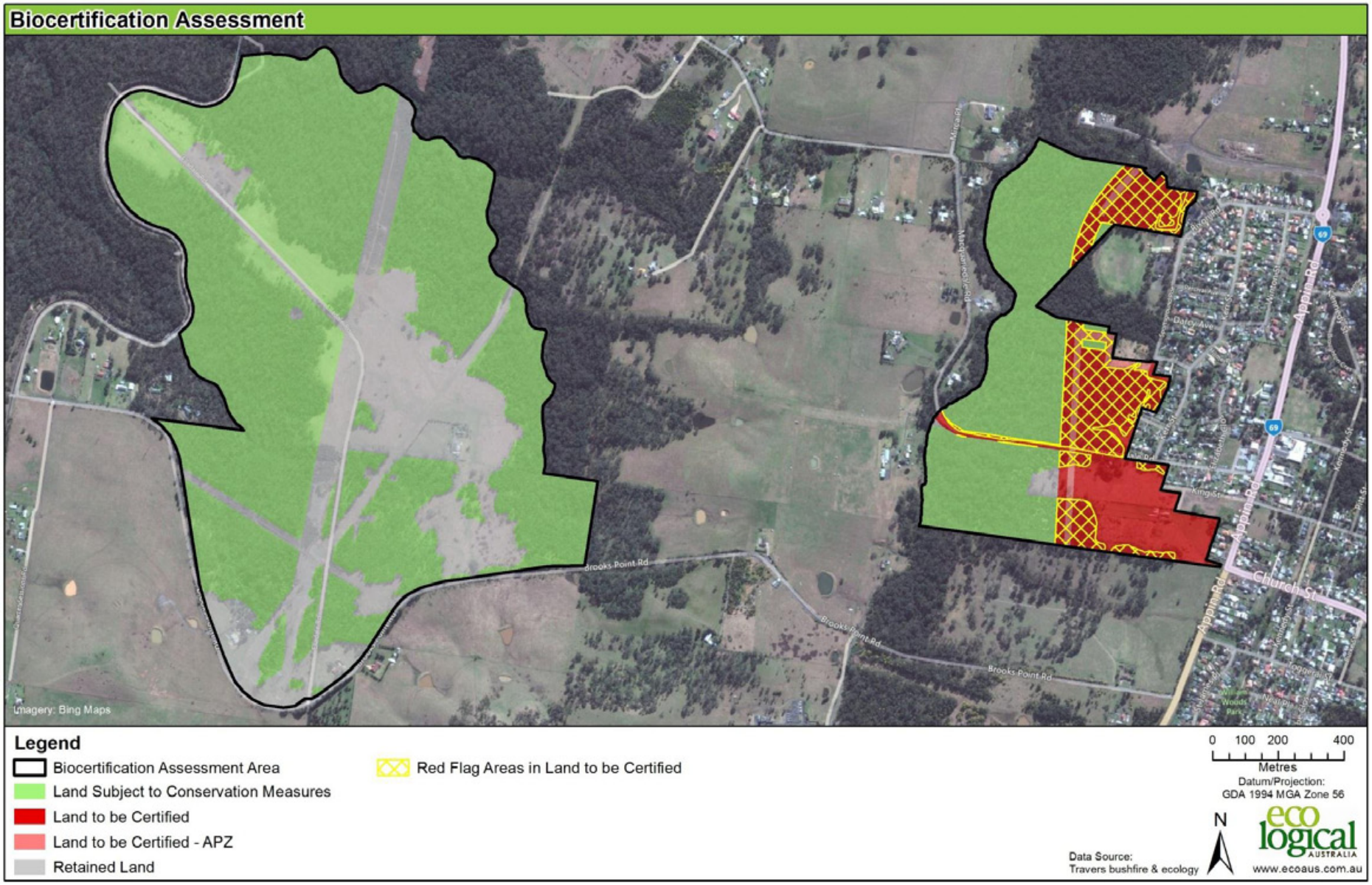

Figure 3: Red Flag areas within Biodiversity Certification Assessment Area

Table 1a: Area of vegetation to be impacted/protected within the Macquariedale Road, Appin BCAA

Biometric Vegetation Type	Development (ha)	Potential Conservation (ha)	Total
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	3.06	26.63	29.69
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	12.58	120.38	132.96
Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin	0	13.68	13.68
Vegetation Total	**15.64**	**160.69**	**176.33**

Table 1b: No. of plots required for each vegetation zone

Veg Zone	Biometric Vegetation Type	Condition	Ancillary	Development (ha)	Conservation (ha)	Total	Plots Required	Plots Used
1	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	M/G	Elladale Canopy and Understorey	0.00	18.89	18.89	2	11
2	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Low	Elladale Canopy Only	0.00	3.42	3.42	1	3
3	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	M/G	Macquariedale Canopy and Understorey	2.73	0	2.73	1	3
4	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	M/G	Macquariedale Canopy Only	0.33	0	0.33	1	1
5	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Low	Proposed Revegetation	0	4.32	4.32	1	1
6	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	M/G	Elladale Canopy and Understorey	0	79.71	79.71	4	40
7	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the	Low	Elladale Canopy Only	0	0.94	0.94	1	1

Veg Zone	Biometric Vegetation Type	Condition	Ancillary	Development (ha)	Conservation (ha)	Total	Plots Required	Plots Used
	edges of the Cumberland Plain, Sydney Basin							
8	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	M/G	Macquariedale Canopy and Understorey	12.58	34.25	46.83	3	33
9	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	Low	Proposed Revegetation	0	5.48	5.48	1	1
10	Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin	M/G	Elladale Canopy and Understorey	0	13.68	13.68	2	6
				15.64	**160.69**	**176.33**	**17**	**100**

Table 2: Predicted species (assumed to be present) in Ecosystem Credits (Targeted survey not required)

Vegetation Type	Common Name	Scientific Name	Tg Score
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Barking Owl	*Ninox connivens*	0.33
	Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	0.75
	Bush Stone-curlew	*Burhinus grallarius*	0.4
	Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	0.5
	Cumberland Land Snail	*Meridolum corneovirens*	0.75
	Diamond Firetail	*Stagonopleura guttata*	0.75
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	0.75
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	0.45
	Eastern Freetail-bat	*Mormopterus norfolkensis*	0.45
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	0.45
	Grey-headed Flying-fox	*Pteropus poliocephalus*	0.93
	Koala	*Phascolarctos cinereus*	0.83
	Large-footed Myotis	*Myotis macropus*	0.4
	Little Lorikeet	*Glossopsitta pusilla*	0.58
	Regent Honeyeater	*Xanthomyza phrygia*	0.75
	Scarlet Robin	*Petroica boodang*	0.6
	Spotted-tailed Quoll	*Dasyurus maculatus*	0.35
	Turquoise Parrot	*Neophema pulchella*	0.55
	Swift Parrot	*Lathamus discolor*	0.75
Landscape Tg			**0.60**
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	Barking Owl	*Ninox connivens*	0.33
	Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	0.75
	Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	0.5
	Cumberland Land Snail	*Meridolum corneovirens*	0.75
	Diamond Firetail	*Stagonopleura guttata*	0.75
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	0.75
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	0.45
	Eastern Freetail-bat	*Mormopterus norfolkensis*	0.45
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	0.45
	Grey-headed Flying-fox	*Pteropus poliocephalus*	0.93
	Koala	*Phascolarctos cinereus*	0.83
	Little Lorikeet	*Glossopsitta pusilla*	0.58
	Masked Owl	*Tyto novaehollandiae*	0.33
	Powerful Owl	*Ninox strenua*	0.33
	Regent Honeyeater	*Xanthomyza phrygia*	0.75
	Scarlet Robin	*Petroica boodang*	0.6
	Spotted-tailed Quoll	*Dasyurus maculatus*	0.35
	Turquoise Parrot	*Neophema pulchella*	0.55
	Swift Parrot	*Lathamus discolor*	0.75
Landscape Tg			**0.59**
Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney	Barking Owl	*Ninox connivens*	0.33
	Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	0.75

Basin	Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	0.5
	Diamond Firetail	*Stagonopleura guttata*	0.75
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	0.75
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	0.45
	Eastern Freetail-bat	*Mormopterus norfolkensis*	0.45
	Glossy Black-cockatoo	*Calyptorhynchus lathami*	0.55
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	0.45
	Grey-headed Flying-fox	*Pteropus poliocephalus*	0.93
	Koala	*Phascolarctos cinereus*	0.83
	Large-footed Myotis	*Myotis macropus*	0.4
	Little Lorikeet	*Glossopsitta pusilla*	0.58
	Masked Owl	*Tyto novaehollandiae*	0.33
	Powerful Owl	*Ninox strenua*	0.33
	Regent Honeyeater	*Xanthomyza phrygia*	0.75
	Scarlet Robin	*Petroica boodang*	0.6
	Spotted-tailed Quoll	*Dasyurus maculatus*	0.35
	Turquoise Parrot	*Neophema pulchella*	0.55
	Swift Parrot	*Lathamus discolor*	0.75
Landscape Tg			**0.57**

Table 3: Habitat filter questions for species credits (requiring survey)

Habitat Question: Does the biodiversity certification area contain any of the following:	Answer
Ridgetops	No
Land within 5 km of coast in South East Coastal Plains CMA subregion	No
Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities	Yes
Land within 40 m of heath, woodland or forest	Yes
Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone	Yes
Land within 250 m of termite mounds or rock outcrops	Yes
Land containing caves or similar structures	Yes
Land situated in damp, disturbed sites	Yes

Table 4: Species requiring targeted survey and survey months allowed

Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia bynoeana	Y	Y	Y						Y	Y	Y	Y
Acacia gordonii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Acacia pubescens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Callocephalon fimbriatum	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Callocephalon fimbriatum population in the Hornsby and Ku-ring-gai LGAs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Circus assimilis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cynanchum elegans	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dillwynia tenuifolia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dillwynia tenuifolia - endangered population Kemps Creek	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Epacris purpurascens var. purpurascens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eucalyptus ps. Cattai	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gallium australe	Y	Y	Y								Y	Y
Grevillea juniperina subsp. juniperina	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grevillea parviflora subsp. parviflora	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grevillea parviflora subsp. supplicans	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gyrostemon thesioides	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Heleioporus australiacus	Y	Y	Y	Y	Y				Y	Y	Y	Y
Hieraaetus morphnoides	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Leucopogon exolasius	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Leucopogon fletcheri subsp. fletcheri	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lophoictinia isura	Y	Y	Y						Y	Y	Y	Y
Marsdenia viridiflora subsp. viridiflora - endangered population	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Melaleuca deanei	Y	Y										Y
Miniopterus schreibersii oceanensis (Breeding habitat)	Y	Y	Y	Y	Y				Y	Y	Y	Y
Myotis macropus (formally Myotis adversus) (Breeding habitat)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Persoonia bargensis	Y	Y	Y	Y	Y							Y
Persoonia glaucescens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Persoonia hirsuta	Y	Y	Y	Y	Y							Y
Persoonia nutans	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pimelea curviflora var. curviflora	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pimelea spicata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pomaderris brunnea	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pteropus poliocephalus (Breeding habitat)	Y	Y	Y	Y	Y				Y	Y	Y	Y
Pterostylis sp. saxicola								Y	Y	Y		
Tetratheca glandulosa							Y	Y	Y	Y	Y	
Varanus rosenbergi	Y	Y									Y	Y
Wahlenbergia multicaulis - endangered population	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 5: Number of credits required/generated for each vegetation type, class and formation

Vegetation Type	Vegetation Class / Formation	Red Flag	Area of vegetation type certified	No. Credits required	No. credits required per ha of impact	Potential Offset Area	No. Credits generated per ha of protection	Number of credits created (funded/managed) 100% Measures	Number of credits created (managed) 90% Measures	Number of credits created (PI) 25% Measures
HN528 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin (CPW)	Biometric Vegetation Types	Yes (except for reveg and zone 4)	3.06	78	25.49	26.63	11	294	264	74
HN556 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (SSTF)		Yes (except for reveg)	12.58	350	27.82	120.38	11	1,301	1,171	326
HN564 Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin		No	0	0	0	13.68	9	118	106	30
Total			**15.64**	**428**	**27.37**	**160.69**		**1,713**	**1,541**	**430**
Coastal Valley Grassy Woodlands (CPW)	Vegetation Classes		3.06	78	25.49	26.63	11	294	264	74
Cumberland Dry Sclerophyll Forests (SSTF)			12.58	350	27.82	120.38	11	1,301	1,171	326
Sydney Hinterland Dry Sclerophyll Forests			0	0	0.00	13.68	9	118	106	30
Total			**15.64**	**428**	**27.37**	**160.69**		**1,713**	**1,541**	**430**
Dry sclerophyll forests (shrub/grass sub-formation) (SSTF)	Vegetation Formations		12.58	350	27.82	120.38	11	1,301	1,171	326
Dry sclerophyll forests (shrubby sub-formation)			0	0	0.00	13.68	9	118	106	30
Grassy woodlands (CPW)			3.06	78	25.49	26.63	11	294	264	74
Total			**15.64**	**428**	**27.37**	**160.69**		**1,713**	**1,541**	**430**

Attachment 2

Preliminary EPBC Act environmental offsets calculations prepared by *Travers bushfire & ecology* 2014

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Cumberland Plain and Shale Gravel
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	3.06	Hectares	TBE 2013
			Quality	**5**	Scale 0-10	
			Total quantum of impact	1.53	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	1.53	Adjusted hectares	10	**Risk-related time horizon (max. 20 years)**	15	**Start area (hectares)**	10	**Risk of loss (%) without offset**	60%	**Risk of loss (%) with offset**	5%	5.50	90%	4.95	1.85	2.10	136.95%	Yes		
									Future area without offset (adjusted hectares)	4.0	**Future area with offset (adjusted hectares)**	9.5									
					Time until ecological benefit	30	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**10**	5.00	90%	4.50	0.63					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	1.53	2.10	136.95%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Shale/Sandstone Transition Forest
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	9.12	Hectares	TBE 2014
			Quality	**9**	Scale 0-10	
			Total quantum of impact	8.21	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	8.21	Adjusted hectares	40	**Risk-related time horizon (max. 20 years)**	10	**Start area (hectares)**	40	**Risk of loss (%) without offset**	60%	**Risk of loss (%) with offset**	5%	22.00	90%	19.80	17.57	20.13	245.25%	Yes	
									Future area without offset (adjusted hectares)	16.0	**Future area with offset (adjusted hectares)**	38.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**9**	**Future quality without offset (scale of 0-10)**	**8**	**Future quality with offset (scale of 0-10)**	**10**	2.00	90%	1.80	1.60				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	8.208	20.13	245.25%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**