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10 December 2020

Our ref: 17753

Lennon Project Management
PO Box 492
Forestville NSW 2087

Attention: Scott Lennon

Dear Scott,

Re: Peer review of Biodiversity Development Assessment Report components (vegetation communities and Serious and Irreversible Impacts) for development application DA 228/2020 328 - 330 Annangrove Road, Rouse Hill.

Eco Logical Australia Pty Ltd (ELA) was engaged by Abax Contracting Pty Ltd c\- Lennon Project Management to provide a peer review of two components of the *Biodiversity Development Assessment Report 328-330 Annangrove Road Rouse Hill* prepared by Keystone Ecological Pty Ltd, 15 July 2020.

These components were as follows:

- Vegetation communities and extents
- Serious and Irreversible Impacts(SAII)

The information used in this review is based on the Keystone Biodiversity Development Assessment Report (Keystone, 2020) and a site inspection carried out by ELA in November 2019 which involved mapping of Plant Community Types (PCTs) and collection of plot data.

ELA agrees with Keystone that the site contains the threatened ecological communities *Cumberland Plain Woodland in the Sydney Basin Bioregion* and *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*. Shale Sandstone Transition Forest is a transitional community and therefore the exact boundaries between communities can be arguable, however in this case we support the boundary used by Keystone. In our view there is marginally more Cumberland Plain Woodland and Shale Sandstone Transition Forest on site than is shown in the Keystone maps, mainly due to ELA mapping an area of Shale Sandstone Transition Forest Derived Native Grassland that was not identified by Keystone and our approach of mapping areas of missed native and exotic grassland between trees as being part of the PCTs. We believe our approach reflects the Biodiversity Assessment Method 2017 requirements, and is a standard approach to mapping vegetation communities in peri-urban areas.

With regard to SAII, there were some differences between Keystone and ELA in the spatial analysis of the TECs within 1000 ha and 10,000 ha, and the areas of TECs within the development site, which

resulted in slightly different results. Despite these differences ELA supports Keystone's assessment of SAII on Cumberland Plain Woodland and Shale Sandstone Transition Forest.

Yours Sincerely,

Nicole McVicar
Senior Ecologist

VEGETATION COMMUNITIES – THREATENED ECOLOGICAL COMMUNTIES AND PLANT COMMUNITY TYPES

Keystone 2020 identified 0.37 ha of *Cumberland Plain Woodland in the Sydney Basin Bioregion* (PCT 849) and 1.45 ha of *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* (PCT1395) within the development site. The PCTs were stratified into the following vegetation zones displayed below in Table 1.

Table 1: Vegetation Zones Keystone 2020

Vegetation Zone	PCT	Condition	Area
Zone 1	PCT 849 *Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Good condition with intact native understorey	0.3 ha
Zone 2	PCT 1395 *Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of Cumberland Plain, Sydney Basin Bioregion*	Good condition with intact native understorey, some parts regenerating	0.17 ha
Zone 3	PCT 1395 *Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of Cumberland Plain, Sydney Basin Bioregion*	Moderate condition – trees over dense native grasses with occasional patches of weeds	0.76 ha
Zone 4	PCT 1395 *Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of Cumberland Plain, Sydney Basin Bioregion*	Low condition – weed infested SSTF	0.52 ha
Zone 5	PCT 807 Derived grasslands on shale plains of the Cumberland Plain (<100m ASL)	Good condition with intact native groundcover. Exotic grasses (some high threat exotic weeds) also present	0.07 ha
Total			**1.82 ha**

Keystone's mapping of PCTs and vegetation zones is displayed below in Figure 1.

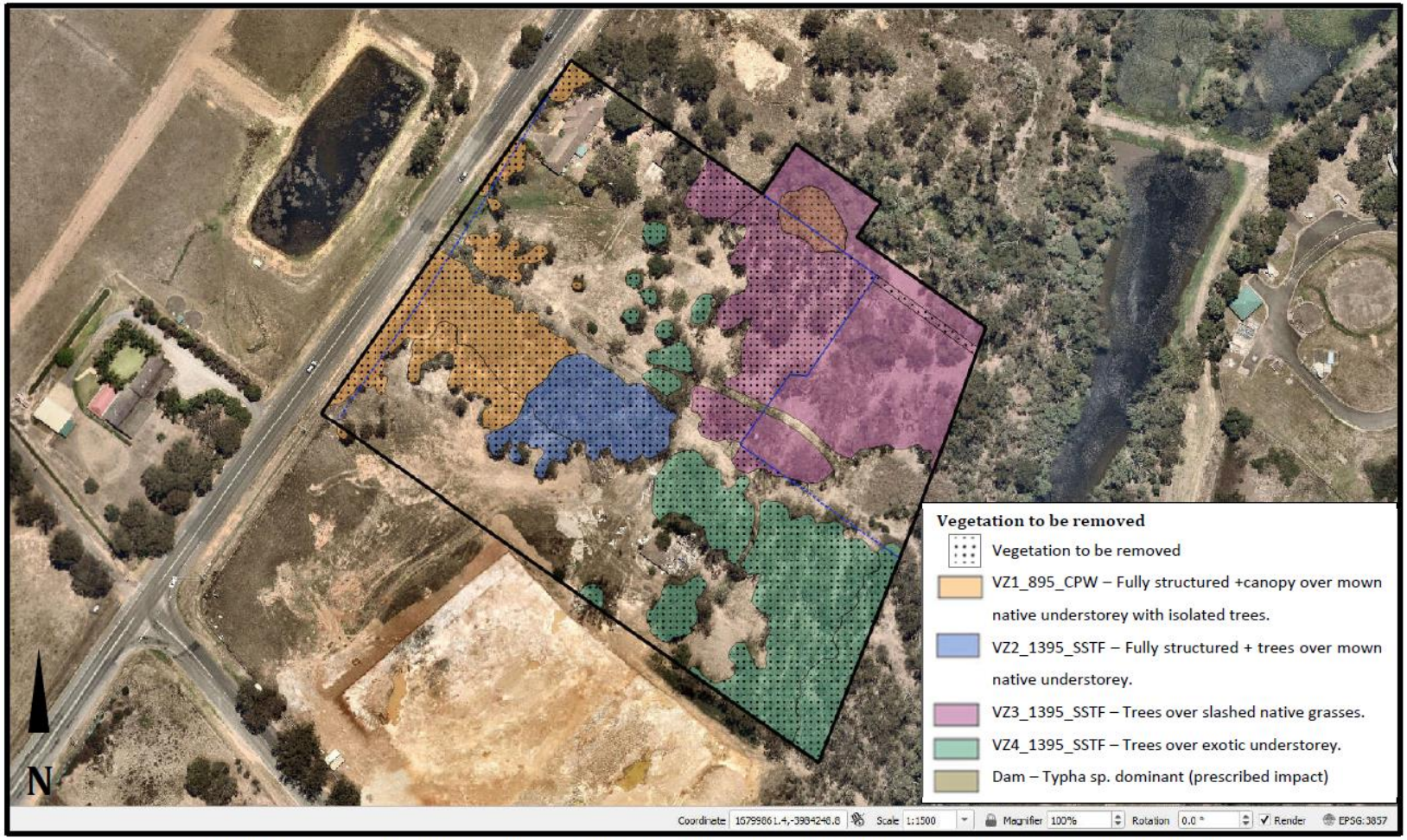

Figure 16: Impacts to native vegetation on the development site (black) and the development footprint (blue)..

Figure 1: Vegetation Zones Keystone 2020

ELA 2020 identified 0.52 ha of *Cumberland Plain Woodland in the Sydney Basin Bioregion* (PCT 849) and 2.18 ha of *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* (PCT1395) within the development site. These PCTs were stratified into the following vegetation zones displayed below in Table 2

Table 2: Vegetation Zones ELA 2019

Vegetation Zone	PCT	Condition	Area
Zone 1	PCT 1395 *Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of Cumberland Plain, Sydney Basin Bioregion*	Moderate condition	2.01 ha
Zone 2	PCT 849 *Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Exotic understorey	0.23 ha
Zone 3	PCT 849 *Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Moderate condition regrowth	0.29 ha
Zone 4	PCT 1395 *Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of Cumberland Plain, Sydney Basin Bioregion*	Slashed derived grassland	0.16 ha
Total			**2.7 ha**

ELA's mapping of PCTs and vegetation zones is displayed below in Figure 2.

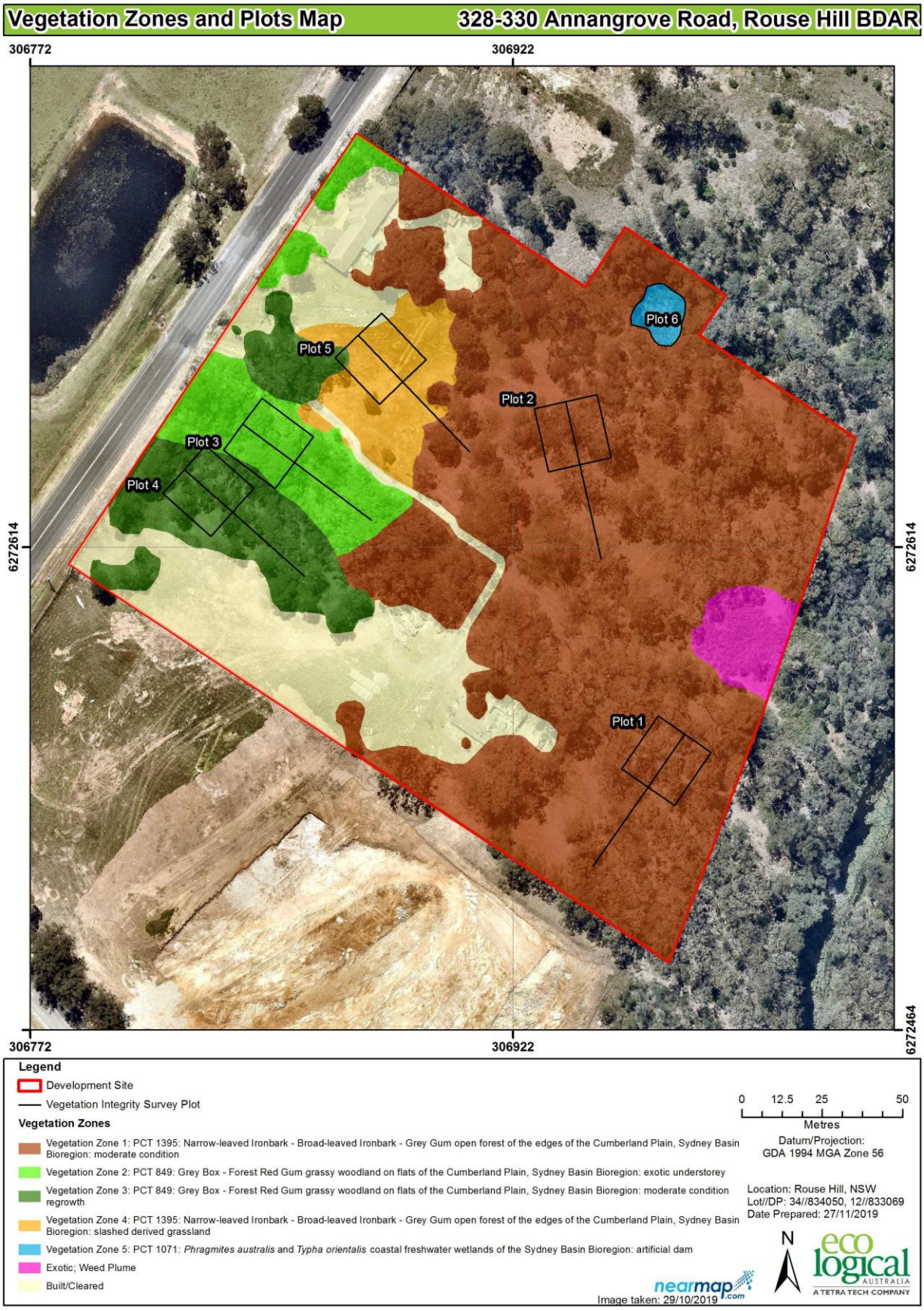

Figure 2: Vegetation Zones ELA 2019

The difference between the two assessments in the mapped extent of the TECs is displayed below in Table 3.

Table 3: TEC mapping extent comparison ELA 2019 and Keystone 2020.

Threatened ecological community	Extent mapped ELA 2019	Extent mapped Keystone 2020	Difference
Cumberland Plain Woodland in the Sydney Basin Bioregion	0.52 ha	0.37ha	0.15 ha
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	2.18 ha	1.45 ha	0.73 ha

For ELA's assessment in 2019, justification for the selection of Plant Community Types (PCTs) occurring on the development site was based on a qualitative and quantitative analysis of full-floristic plot data, analysis of the soils and parent geology on the site, and mapped soil landscapes. ELA's justification for the selection of PCT 1395 and PCT 849 (and thus corresponding TECs), from the 2019 assessment is provided below in Table 4.

Table 4: PCT justification ELA 2019

PCT ID	PCT Name	Selection criteria	Characteristics relied upon for identification of vegetation type and relative abundance
1395	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	IBRA region, subregion, soil landscape, elevation and results of floristic plot analysis including the presence of positive diagnostic species	Presence of extensive sandstone outcropping in the soil. Although the canopy was dominated by *Eucalyptus tereticornis* this is likely due to historical site disturbance. The presence of extensive amounts of sandstone indicates this vegetation is on the shale/sandstone boundary. An analysis using the Tozer 2010 quantitative analysis tool determined that based purely on floristics, the best fit was PCT 835 *Forest Red Gum-Rough-barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion,* or PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.* However, based on the dominance of sandstone outcropping and clear evidence of historical site disturbance, it was determined that PCT 1395 was the more appropriate best fit PCT. It is acknowledged that PCT 1395 transitions to PCT 835 further to the east towards Second Ponds Creek outside the development site due landform characteristics transitioning to an alluvial flat, and the increased presence of *Eucalpytus amplifolia* and *Angophora floribunda* in the canopy.
849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	IBRA region, subregion, soil landscape, elevation and presence of positive diagnostic canopy species	Shale soils and absence of sandstone outcropping. Presence of key diagnostic species such as *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Eucalyptus crebra.* An analysis using the Tozer 2010 quantitative analysis tool determined that based purely on floristics, the best fit PCT is PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*

ELA supports Keystone's assignment of the PCTs/TEC and delineation of the PCT/TEC boundary, despite the differences in the extent of mapping and stratification of the vegetation zones within each of the PCTs. Further detail and justification for our decision is provided below.

Soils

ELA 2019 and Keystone 2020 both determined that development site was mapped within both the Blacktown Residual and Gymea Erosional soil landscapes (Chapman and Murphy 1989).

The Blacktown residual soil landscape is associated with Wianamatta Group shales, characterised by gently undulating terrain, occurring extensively on the Cumberland Plain lowlands. The documented associated vegetation is open woodland primarily comprising *Eucalyptus tereticornis* (Forest Red Gum)*, Eucalyptus moluccana* (Grey Box)*, Eucalyptus crebra* (Narrow-leaved Ironbark) and *Corymbia maculata* (Spotted Gum). These species correlate with the *Cumberland Plain Woodland in the Sydney Basin Bioregion* threatened ecological community (TEC) (PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*), which was observed to occur in the west and north west of the development site.

Within the development site the Blacktown residual soil landscape transitions to the Gymea Erosional soil landscape, associated with Hawkesbury Sandstone. In this particular location in the development site, sandstone outcropping was visibly close to the surface and quite abundant. In comparison, the area of neighbouring Blacktown Residual, where the Cumberland Plain Woodland was observed, sandstone outcropping was not apparent, and the soil was characterise a clay – clay/loam texture. In the area within the development site mapped as Gymea Erosional soil landscape, Shale Sandstone Transition Forest in the Sydney Basin Bioregion TEC (PCT 1395 *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*), was observed.

TEC boundary mapping

In terms of mapping the areas and boundaries of the TECS, the Final Determination for Shale Sandstone Transition Forest in the Sydney Basin Bioregion states that Shale Sandstone Transition Forest is strongly ecotonal. With regard to the differences between assessors in the boundaries of the TECs, variation was due to ecotonal characteristics of SSTF plus site specific features discussed below.

The height and diameter at breast height of the trees dictated the site has been subject to historical clearance and disturbance. It was also evident that due to this disturbance, the potential diversity of canopy tree species was not present in the development site, which would assisted with the PCT boundary assignment.

In this instance *Eucalyptus tereticornis* occurred as a dominant species across the entire development site. As *Eucalyptus tereticornis* occurs as a dominant species in Cumberland Plain Woodland and subdominant in Shale Sandstone Transition Forest, using canopy species to assist with the boundary delineation of the Shale Sandstone Transition Forest was not 100% reliable. The canopy within the Cumberland Plain Woodland area was also modified, however it did contain some characteristic diagnostic species: *Eucalyptus tereticornis, Eucalyptus crebra* and *Eucalyptus moluccana.* This did assist to some degree with PCT delineation, however the dominance of *Eucalyptus tereticornis* in both PCTS

made interpretation of the boundary more subjective than if assessing an intact example which contained more diagnostic canopy species of both PCTs.

The site was also subject to considerable groundcover and midstorey clearance, disturbance and weed invasion, thus differences in the groundcover and midstorey species were less distinct that if assessing an intact vegetation community.

Therefore, the presence of sandstone outcropping in the area of Shale Sandstone Transition Forest, combined with the soil landscape mapping, and the location *Eucalyptus crebra* and *Eucalyptus moluccana* confined to the west and north west, provided the most accurate guidance for mapping the boundary of the two TECs.

Vegetation zones

The difference in vegetation stratification is not unexpected: Section 5.3 of the Biodiversity Assessment Method 2017 (BAM 2017) states a *vegetation zone means an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state*. *The assessor may consider areas of the PCT that have similar tree, shrub and groundcover, weed extent or combinations of these to assign similar condition.* Thus interpretation of this guidance and subsequent assignment of vegetation zones will differ between assessors.

A notable difference between the mapping was that ELA 2019 mapped mixed native and exotic grassland areas, which contained a slightly sparser canopy, as Shale Sandstone Transition Forest. ELA 2019 also included a small area of derived native grassland (0.16 ha). This was also the case in the areas ELA mapped as Cumberland Plain Woodland. Keystone 2020 did not include these areas, which accounts for difference in area of the PCTs/TECs between the two assessments.

BAM Subsection 5.3.1.1 states that a….*vegetation zone means an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state*. Mapping mixed native and exotic grassland areas and areas of canopy with mixed native and exotic groundcover to a vegetation zone is common approach to mapping disturbed vegetation communities in peri-urban environments. ELA believes that mapping these areas of mixed native and exotic grassland to a PCT aligns with the requirements under the BAM to map the native vegetation extent on the subject land (BAM Subsection 5.1.1.3 *The native vegetation extent on the subject land includes all areas of native vegetation including native groundcover and the canopy areas of trees*).

SERIOUS AND IRREVERSIBLE IMPACTS

The SAII assessment is undertaken in accordance with Subsection 10.2.2 of the BAM 2017, with the aim to assist the consent authority to' *evaluate the nature of an impact on a potential entity at risk of a serious and irreversible impact'* (BAM 2017 Subsection 10.2.1.6).

In accordance with Subsection 10.2.2.1 (d) of the BAM 2017, the scale of assessment required to be provided to the consent authority to assist their determination is an estimate of the extent of the TEC within an area of 1000 ha and 10,000 ha surrounding the development footprint. Assessors are also required to calculate an estimate of the amount remaining in the IBRA subregion and region after the proposed development has taken place, and also provide an estimate on the amount of the TEC that is within the reserve system. Under the BAM 2017, with regards to SAII, assessors are not required to

provide data on what is defined as the 'local occurrence' under the Threatened Species Test of Significance Guidelines 2018, prepared by the NSW Office of Environment and Heritage (now Department of Industry Planning and Environment). The term 'local occurrence' is used under Section 7.3 of the NSW *Biodiversity Conservation 2016* to determine whether a proposed development or activity is likely to have a significant impact on threatened species or ecological communities, or their habitats (i.e. the 'five part test). The term 'local occurrence' was also used previously under Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (i.e. the seven part test/assessment of significance) and the corresponding guidelines *Threatened Species Assessment Guidelines – The Assessment of Significance* (Department of Environment and Climate Change NSW 2007) to determine if a proposed development or activity was likely to result in a significant impact on threatened entities. The term is not used as part of the SAII assessment in the assessment criteria within BAM Subsection 10.2.2 for ecological communities.

ELA has undertaken an assessment of SAII for Cumberland Plain Woodland and Shale Sandstone Transition Forest. These two SAII assessments are provided below in Table 5 and Table 6. The extent of mapped Cumberland Plain Woodland and Shale Sandstone Transition Forest with 1000 ha and 10,000 ha is displayed below in Figure 3.

Table 5: Cumberland Plain Woodland SAII assessment

Impact Assessment Provisions	Assessment
1. The area and condition of the TEC to be impacted directly and indirectly by the proposed development	The proposed development will remove 0.52 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) which is in a disturbed and modified regrowth condition: Zone 2 PCT 849 exotic understorey has a vegetation integrity score of 46.7, Zone 3 PCT 849 moderate condition regrowth has a vegetation integrity score of 38.5. The CPW impacted within the development site is represented by regrowth canopy trees and a ground layer of mixed native and exotic species subject to regular mowing and disturbance. The shrub layer is generally absent.
2. The extent and overall condition of the TEC within an area of 1000ha, and then 10,000 ha, surrounding the proposed development footprint. The extent remaining in the IBRA region.	There is an estimated 60.6 ha of CPW within an area of 1000 ha, in varying condition (from larger tracts to small remnant urban canopy patches) (mapped by the Office of Environment and Heritage 2013 and The Hills Shire Council 2008). Within 10,000 ha of the development site, there is an estimated 1021.6 ha of CPW that has been mapped. Within the IBRA region, there is an estimated 11,200 ha remaining according to the BioNet Vegetation Classification . This ranges from larger tracts to small remnant urban canopy patches.
3. An estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The removal of 0.52 ha of CPW within the development site represents 0.86% of the mapped CPW extent within the 1000 ha area. This removal represents 0.05 % of the mapped CPW extent within the 10,000 ha area. The removal of 0.52 ha of CPW within the IBRA region represents 0.005% of the estimated CPW in the IBRA region. The removal of this small patch of disturbed CPW will not

Impact Assessment Provisions	Assessment
	result in the overall decline of the condition of CPW remaining after the development.
4. The development proposal's impact on:	
a. Abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The development will not impact abiotic factors critical to the long-term survival of the TEC. The proposal will not result in a reduction in ground water levels or substantial alteration of surface water patterns or natural disturbance regimes of which the TEC depends upon outside of the development site.
b. Characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The proposed development will not impact characteristic and functionally important species outside of the proposed impact area.
c. The quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	The development site is located within a modified urban area with areas impacted by weeds which will be removed during the proposed works. The proposed development has the potential to result in the introduction of new weed plumes into and adjacent to the development site. These potential impacts will be controlled during the construction phase and long-term maintenance of the development site and adjacent proposed conservation area through implementation of a Vegetation Management Plan.
5. Direct or indirect fragmentation and isolation of an area of the TEC	The development will result in an increase in the direct or indirect fragmentation or isolation of areas of CPW. All CPW in this development site will be removed therefore increasing fragmentation of remaining CPW in the locality.
6. The measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	In its current form, the proposed development does not contribute to the recovery of this TEC in the IBRA subregion.

Table 6: Shale Sandstone Transition Forest SAII Assessment

Impact Assessment Provisions	Assessment
1. The area and condition of the TEC to be impacted directly and indirectly by the proposed development	The proposed development will remove 1.7 ha of Shale Sandstone Transition Forest (SSTF) which is in a moderate condition: Zone 1 1395 moderate condition has a vegetation integrity score of 48.5, Zone 4 PCT 1395 slashed derived grassland has a vegetation integrity score of 36.5. The SSTF impacted within the development site is represented by regrowth canopy trees and a ground layer of mixed native and exotic species subject to regular disturbance. The shrub layer is generally absent.
2. The extent and overall condition of the TEC within an area of 1000 ha, and then 10,000 ha surrounding the proposed development footprint. The extent remaining in the IBRA region.	There is an estimated 120.6 ha of SSTF within an area of 1000 ha, in varying condition (from larger tracts to small remnant urban canopy patches) (mapped by the Office of Environment and Heritage 2013 and The Hills Shire Council 2008). Within an area of 10,000 ha of the development site, there is an estimated 1258.7 ha of SSTF that has been

Impact Assessment Provisions	Assessment
	mapped. This also ranges from larger tracts to small remnant urban canopy patches. Within the IBRA region, there is an estimated 9,600 ha remaining according to the BioNet Vegetation Classification. This ranges from larger tracts to small remnant urban canopy patches.
3. An estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The removal of 1.7 ha of SSTF within the development site represents 1.41% of the mapped SSTF extent within 1000 ha. This removal represents 0.14 % of the mapped SSTF extent within 10,000 ha. The removal of 1.7 ha of SSTF within the IBRA region represents 0.018% of the estimated SSTF in the IBRA region. The removal of this patch of SSTF will not result in the overall decline of the condition of SSTF remaining after development. It is proposed to undertake weed control works within the proposed conservation area and adjacent riparian area at Second Ponds Creek.
4. The development proposal's impact on:	
a. Abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The development will not impact abiotic factors critical to the long-term survival of the TEC. The proposal will not result in a reduction in ground water levels or substantial alteration of surface water patterns or natural disturbance regimes of which the TEC depends upon outside of the development site.
b. Characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The development will not impact characteristic and functionally important species outside of the proposed impact area.
c. The quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	The development site is located within a modified urban area of with areas impacted by weeds which will be removed during the proposed works. The proposed development has the potential to result in the introduction of new weed plumes into and adjacent to the development site. These potential impacts will be controlled during the construction phase and long-term maintenance of the development site and adjacent proposed conservation area through implementation of a Vegetation Management Plan.
5. Direct or indirect fragmentation and isolation of an area of the TEC	The development will result in an increase in the direct and indirect fragmentation and isolation of areas of SSTF. 1.7 ha of SSTF in this development site will be removed therefore increasing fragmentation of remaining SSTF in the proposed conservation area and in the locality.
6. The measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	In its current form, the proposed development does not contribute to the recovery of this TEC in the IBRA subregion.

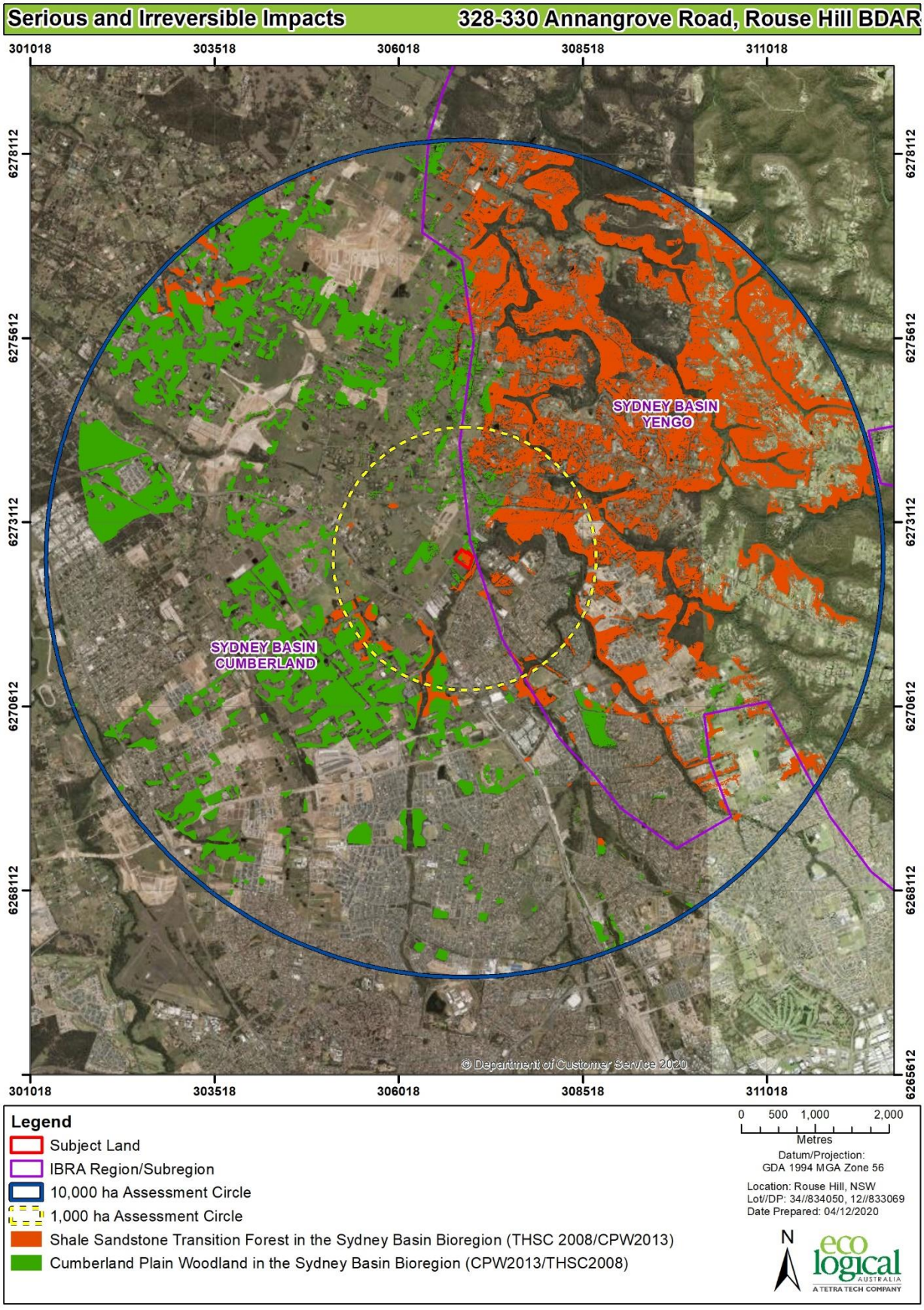

Figure 3: Extent of Cumberland Plain Woodland and Shale Sandstone Transition Forest within assessment areas

Keystone's SAII assessment provided slightly different figures to ELA's assessment for the extent remaining in the 1000 ha and 10,000 ha assessment areas. This is likely due to differences in spatial analysis methods and data interpretation.

This is summarised below Table 7.

Table 7: Comparison of percentage removal of TECs within 1000 ha and 10,000 ha assessment areas

TEC	Assessment area	ELA 2019	ELA 2019 percentage removed	Keystone 2020	Keystone percentage removed
Cumberland Plain Woodland	1000ha	60.6 ha	0.86%	59.8 ha	0.6%
Cumberland Plain Woodland	10,000ha	1021.6 ha	0.05%	918.8 ha	0.04%
Shale Sandstone Transition Forest	1000ha	120.6 ha	1.41%	74.7 ha	1.3%
Shale Sandstone Transition Forest	10,000	1258.7 ha	0.18%	1057.8 ha	0.09

Despite this, the outcome is comparable between the two reports:

- at the 1000 ha scale there is a range of 0.6%-0.86% removal of Cumberland Plain Woodland and 1.3%-1.41% removal of Shale Sandstone Transition Forest. The impact is not considered significant at this scale of assessment.
- at the 10,000 ha scale there is a range of 0.04%-0.05% removal of Cumberland Plain Woodland and 0.09%-0.18% removal of Shale Sandstone Transition Forest. The impact is not considered significant at this scale of assessment.

CONCLUSION

ELA supports the mapping of the boundaries of the two TECs undertaken by Keystone in 2020, despite some differences in mapping of vegetation zones and boundaries between the two assessments. ELA also supports Keystone's assessment of SAII on Cumberland Plain Woodland and Shale Sandstone Transition Forest, despite some differences in spatial analysis and mapping of TECs within the development site.

REFERENCES

Chapman, G.A and Murphy, C.L. 1989. *Soil Landscapes of the Sydney 1:100 000 sheet.* Soil Conservation Service of NSW, Sydney

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Keystone Ecological Pty Ltd July 2020 *Biodiversity Development Assessment Report 328 -330 Annangrove Road, Rouse Hill*

NSW Scientific Committee 2014 Shale Sandstone Transition Forest in the Sydney Basin Bioregion – critically endangered ecological community listing https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/guidance-decision-makers-determine-serious-irreversible-impact-190511.pdf date accessed 8 December 2020

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The Hills Shire Council 2008 vegetation mapping