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Ecological Constraints Assessment

221-227, 229-231, 233-249, 251-261, 263-273, 275-285, 287, 319-325 and 289-317 Luddenham Road, Orchard Hills (Lot 1 // DP 1099147, Lot 1 // DP 396972, Lots 1, 2, 3, 4 // DP 520117, Lot 24 DP // 331426, Lot 2 DP // 219794 and Lot 242 // DP 1088991)

Draft Masterplan - Alspec Industrial Business Park

Prepared for: HBB Property

9 March 2022 Version: 1.0

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PROJECT NAME	Ecological Constraints Assessment			
PROJECT ADDRESS	221-227, 229-231, 233-249, 251-261, 263-273, 275-285, 287, 319-325 and 289-317 Luddenham Road, Orchard Hills (Lot 1 // DP 1099147, Lot 1 // DP 396972, Lots 1, 2, 3, 4 // DP 520117, Lot 24 DP // 331426, Lot 2 DP // 219794 and Lot 242 // DP 1088991)			
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Glossary and abbreviations

Acronym	Description
AW	Alluvial Woodland
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BVM	Biodiversity Values Map
DA	Development Application
DEWHA	NSW Department of the Environment, Water, Heritage and the Arts (now DAWE)
DAWE	NSW Department of Agriculture, Water and the Environment (formerly DEWHA)
DotE	Commonwealth Department of the Environment (now DAWE)
DoEE	Commonwealth Department of the Environment and Energy (now DAWE)
DPIE	NSW Department of Planning, Industry and Environment
EES	NSW Environment, Energy and Science Group (formerly OEH)
EPBC	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HBT	Hollow bearing tree
LGA	Local Government Area
NRAR	Natural Resources Access Regulator
OEH	NSW Office of Environment and Heritage (now EES)
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
SGTF	Shale Gravel Transition Forest'

Acronym	Description
SPW	Shale Plains Woodland
TEC	Threatened Ecological Community
WM Act	NSW *Water Management Act 2000*
VI	Vegetation Integrity
VIS	Vegetation Information System

1 Introduction

1.1 Background

This Ecological Constraints Assessment (ECA) has been prepared for following addresses and lot numbers on Luddenham Road, Orchard Hills, NSW (the 'study area'; **Figure 1.1**):

- 221-227 (Lot 1 // DP 1099147)
- 229-231 (Lot 1 // DP 396972)
- 233-249 (Lot 1 // DP 520117)
- 251-261 (Lot 2 // DP 520117)
- 263-273 (Lot 3 // DP 520117)
- 275-285 (Lot 4 // DP 520117)
- 287 (Lot 24 DP // 331426)
- 319-235 (Lot 2 DP // 219794)
- 289-317 (Lot 242 // DP 1088991)

Ecological constraints are determined by identification of the ecological values within the study area and assessment of the potential constraints that these values present for future development of the study area with respect to the Updated Masterplan (February 2022) for the Alspec Industrial Business Park (**Figure 1.2**).

As part of the ecological constraints assessment this report presents mapping of vegetation communities in accordance with the BAM, addresses the draft Cumberland Plain Conservation Plan (CPCP) and includes a summary of recent surveys for the Green and Golden Bell Frog (*Litoria aurea*) and for microbats.

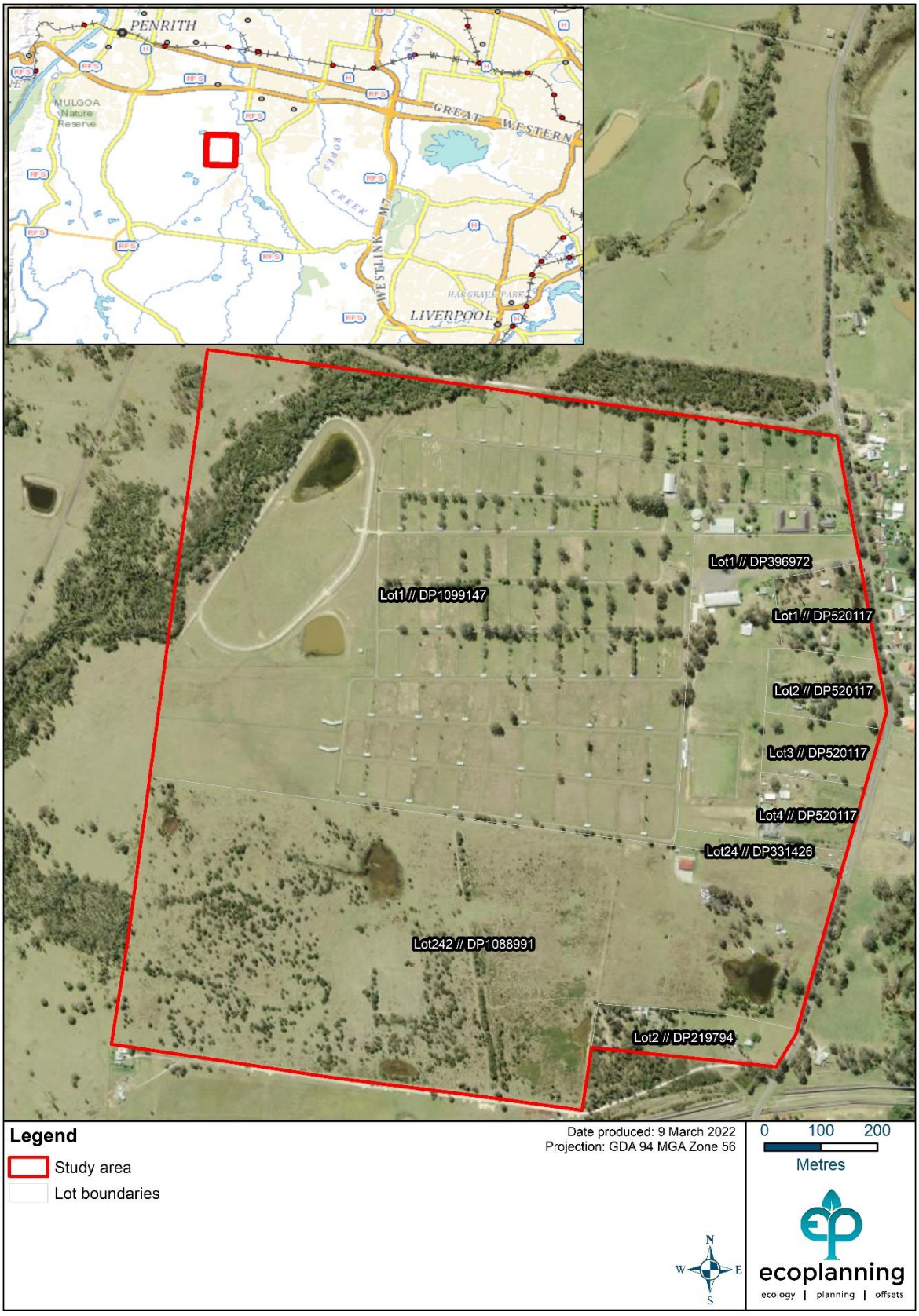

Figure 1.1: Location of the study area

Figure 1.2: Draft Masterplan (February 2022)

2 Study area description

The study area covers an area of approximately 146.7 ha, the vast majority of which has been historically cleared for agricultural purposes and no longer supports native vegetation. It consists of gently sloping land with a generally north-westerly aspect. Elevation across the study area ranges from approximately 52 masl in the south to a low point of approximately 38 masl adjacent to an un-named drainage line in the north-west.

The study area includes waterfront land as defined under the NSW *Water Management Act 2000* (WM Act). Waterfront Land which includes the bed of any river, together with any land lying 40 m of the highest bank of the river (**Figure 2.1**). Waterfront land is located within the north-west of the study area associated with an un-named 4th order stream which is a tributary of South Creek. An un-named 1st order stream is mapped in the central west of the study area, although this drainage line does not exhibit the features of a defined channel with bed and banks and may not be waterfront land for the purposes of the WM Act (**Figure 2.1**). Further consultation with the Natural Resource Access Regulator (NRAR) would be required to determine whether this area is waterfront land as defined under the WM Act.

Soils of the 'Blacktown' soil landscape have been mapped over are most of the study area. These soils are typically loams or clay loams derived from shales of the Wianamatta Group (Hazelton et al 1989). Soils of the 'South Creek' soil landscape have also been mapped in association with drainage lines in the study area. These soils are associated with Quaternary alluvium and typically include sandy clay loams or sandy loams (Hazelton et al 1989) (**Figure** 2.2).

The study area is located within the Penrith City Council Local Government Area (LGA) on land zoned RU2 – Rural Landscape. The study area is *not mapped* as 'Biodiversity' on the Terrestrial Biodiversity Map under the Penrith Local Environment Plan (PLEP) (2010).

The study area includes land identified on the Biodiversity Values Map as supporting "*Threatened species or communities with potential for serious and irreversible impacts*."

The study area forms part of the 'Greater Penrith to Eastern Creek Urban Release Investigation Area' and development across this area will be informed by the draft Cumberland Plain Conservation Plan. This strategic conservation plan aims to avoid and minimise impacts on biodiversity at a landscape scale early in the planning process, ensuring environmentally significant land is safeguarded ahead of development and rezoning.

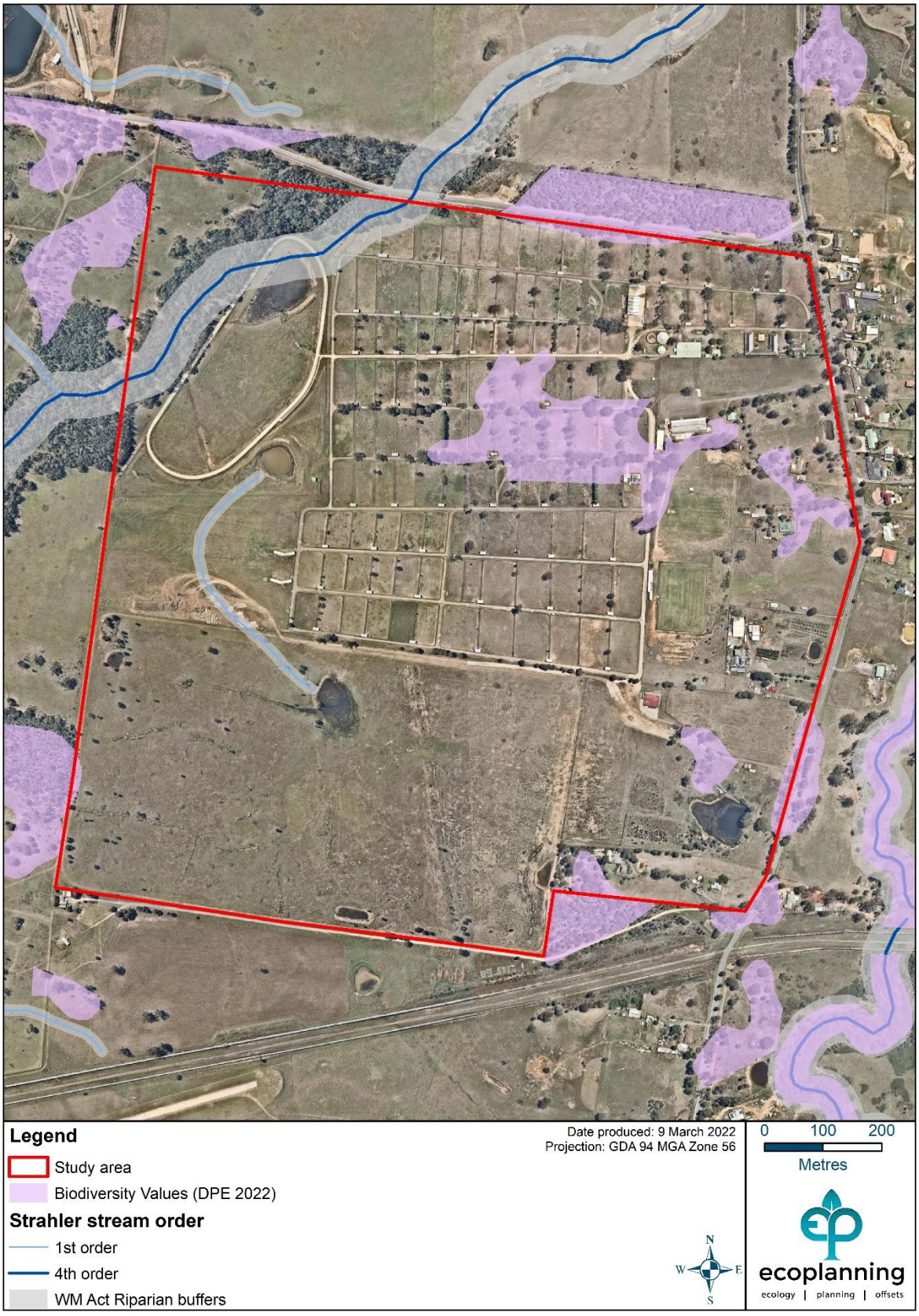

Figure 2.1: Biodiversity Values and waterfront land within the Study Area.

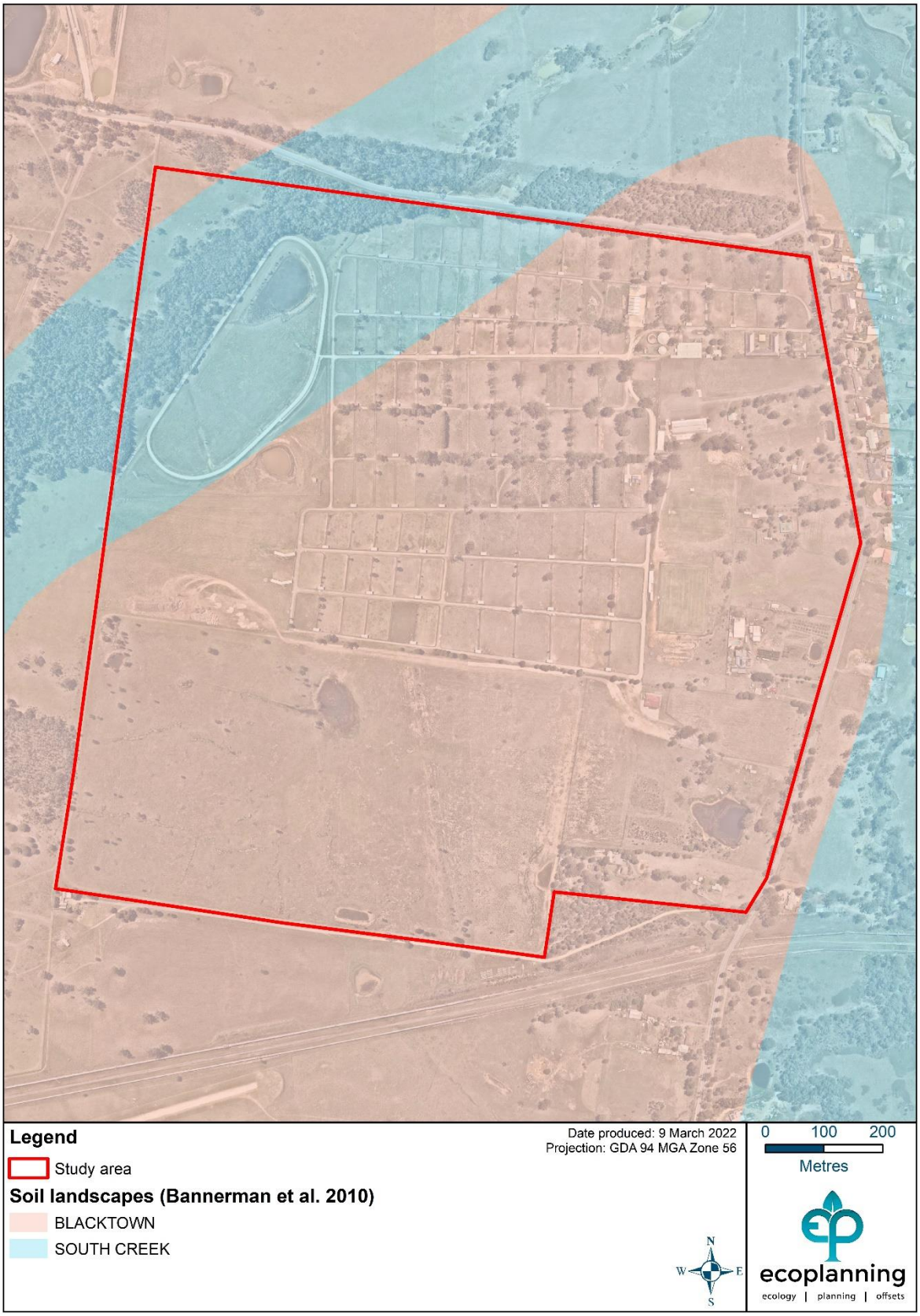

Figure 2.2: Soil landscapes within the Study Area.

2.1 Methods

2.2 Literature review and database review

A site-specific literature and database review were undertaken prior to the field survey and the preparation of this report. This included desktop analysis of aerial photography and review of regional scale information from the following sources:

- NSW Planning Viewer (NSW Dept. of Planning, Industry and Environment [DPIE] 2020b)
- BioNet Atlas of NSW Wildlife (DPIE 2020c)
- Protected Matters Search Tool (Commonwealth Department of the Environment and Energy 2020)
- SIX Maps (LPI 2020)
- Remnant Vegetation of the western Cumberland subregion, 2013 Update (OEH 2015)
- Soil Landscapes of the Penrith 1:100 000 sheet (Hazleton et al. 1989)

Threatened species, populations and migratory species recorded within 5 km of the study area were consolidated in a search of the Atlas of NSW Wildlife (BioNet) (DPIE 2020c). Their likelihood of occurrence was assessed by:

- review of location and date of recent (<5 years) and historical (5-20 years) records
- review of available habitat within the study area and surrounding areas
- review of the scientific literature pertaining to each species and population
- applying expert knowledge of each species

Following a review of available habitat within the study area, the potential for each threatened species, population and/or migratory species to occur was considered. The potential for species to use the site and to be affected directly or indirectly by the proposed action were considered as either:

- “Recent record” = species has been recorded in the study area a within the past 5 years
- “High” = species has previously been recorded in the study area (>5 years ago) or in proximity to (for mobile species), and/or habitat is present that is likely to be used by a local population
- “Moderate” = suitable habitat for a species is present onsite but no evidence of a species detected and relatively high number of records (5-20 years) within 5 km of the study area or species is highly mobile
- “Low” = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively low number of recent records (5-20 years) within 5 km of the study area
- “Not present” = suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

2.3 Field survey

A site inspection was conducted on 30 and 31 March 2020 by Brian Towle (Senior Ecologist), Bret Stewart (Senior Ecologist) and Ben Brown (Ecologist) over approximately 44 hours within the following lots:

- 221-227 (Lot 1 // DP 1099147)
- 289-317 (Lot 242 // DP 1088991)

The survey included traversing these lots to determine the extent of native vegetation and surveying the study area for potential fauna habitat, including recording any hollow bearing trees (HBT), stags, decorticating bark, mature/old growth tree, winter flowering eucalypts etc. Vegetation zones across the study area were sampled within floristic plots conducted in accordance with the BAM.

A further site inspection was conducted on 25 February 2022 by Simon Lee (Ecologist) over approximately two hours viewing the following lots from the adjacent property:

- 229-231 (Lot 1 // DP 396972)
- 233-249 (Lot 1 // DP 520117)
- 251-261 (Lot 2 // DP 520117)
- 263-273 (Lot 3 // DP 520117)
- 275-285 (Lot 4 // DP 520117)
- 287 (Lot 24 DP // 331426)
- 319-235 (Lot 2 DP // 219794)

The survey included inspecting these lots from adjoining properties to estimate the extent of native vegetation and vegetation zones, based on the existing data collection from the initial site inspection and assumptions based on canopy tree species corresponding to each vegetation zone (refer **Section 2.3.3**).

2.3.1 Targeted fauna surveys

Targeted surveys for the Green and Golden Bell Frog (*Litoria aurea*) were undertaken between 30 November and 13 January over four nights 2022 by Ed Cooper (Senior Ecologist), Gemma Gillette, Nicholas Agostino and Simon Lee (Ecologists). Microbat surveys were undertaken over 16 nights beginning on 13 January 2022.

Microbat surveys consisted of Anabat surveys using three Anabats deployed at three dams over 16 nights. Anabats recorded from dusk until dawn.

Green and Golden Bell Frog surveys consisted of listening for calls, call playback and active searching at six wetland sites with potential habitat (refer **Figure 2.3**). Survey effort consisted of two observers conducting aural-visual survey along the edge of each wetland site during four repeat surveys. Each survey was undertaken within one week of heavy rainfall (>50mm over the previous 7 days).

Table 2.1: Targeted fauna surveys

Dates	Survey Details	Results
30/11/2021	• Survey for Green and Golden Bell Frog (*Litoria aurea),* 2 x Ecologists	• No candidate species credit species recorded.
01/12/2021	• Survey for Green and Golden Bell Frog (*Litoria aurea),* 2 x Ecologists	• No candidate species credit species recorded.
02/12/2021	• Survey for Green and Golden Bell Frog (*Litoria aurea),* 2 x Ecologists	• No candidate species credit species recorded.
13/01/2022	• Survey for Green and Golden Bell Frog (*Litoria aurea),* 2 x Ecologists • 3 x Anabat devices deployed for microbat survey	• One Cumberland Plain Land Snail (*Meridolum corneovirens)* recorded
01/02/2022	• 3 x Anabat devices collected	• TBC

Targeted surveys for candidate threatened fauna species were undertaken in accordance with the relevant guidelines for the species surveyed. Microbat surveys were undertaken in accordance with *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (OEH 2018). Green and Golden Bell Frog surveys were undertaken in accordance with *NSW Survey Guide for Threatened Frogs A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE 2020) and *Survey guidelines for Australia's threatened frogs Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2010).

2.3.2 Weather conditions

Weather conditions during the targeted fauna surveys are presented in **Table 2.2**.

Table 2.2: Daily weather observations at Badgery's Creek (8.6 km away)

Date	Temp (°C)		Rainfall (mm)	Max wind	
	Min	Max		Direction	Speed (km/h)
30/11/2021	16.2	23.4	0	ENE	19
1/12/2021	18.8	27.9	0.2	NE	22
2/12/2021	14.8	29.3	0.0	NNE	31
13/01/2022	19	24.6	14.4	SE	30
14/01/2022	18.3	30.2	24.4	ENE	24
15/01/2022	19	31.3	0.6	ENE	30
16/01/2022	18.5	30.8	5.2	ESE	28

Date	Temp (°C)		Rainfall (mm)	Max wind	
	Min	Max		Direction	Speed (km/h)
17/01/2022	18	31.6	0	E	19
18/01/2022	20.8	24.4	0	SSE	20
19/01/2022	17.5	23.3	11.4	S	43
20/01/2022	16.7	24.5	2.6	SSE	39
21/01/2022	15.1	24.8	1	SE	31
22/01/2022	14.8	26.6	0.8	SSE	31
23/01/2022	16.2	27	0.2	ESE	24
24/01/2022	17.3	26.4	0.6	E	28
25/01/2022	18.5	28.6	0.2	ENE	22
26/01/2022	17.6	28.9	0	E	30
27/01/2022	16.4	28.3	0	ENE	24
28/01/2022	19.4	31.7	0	ENE	28

2.3.3 Survey limitations

Surveys conducted on 25 February 2022 were not able to access the subject lots at 229-231, 233-249, 251-261, 263-273, 275-285, 287, and 319-235 Luddenham Road. These additional lots were surveyed from adjacent properties. The vegetation zones identified on these lots and the extent of each vegetation zone are based on aerial photo interpretation of tree canopy extent, coupled with identification of canopy tree species at a distance (largely based on tree bark). The vegetation zone mapping in these lots is therefore based on the following assumptions:

- PCT 724 – canopy tree stands dominated by Broad-leaved Ironbark (*Eucalyptus fibrosa*) which was identified in the field by its rough, deeply furrowed bark.
- PCT 835 – canopy tree stands dominated by Forest Red Gum (*Eucalyptus tereticornis*) which was identified in the field by its smooth bark.

Note that the vegetation zones identified at a distance based on canopy trees which were identified by their bark may change once these vegetation zones are inspected more closely and canopy trees can be identified by more diagnostic characteristics.

Figure 2.3: Survey Effort

3 Results

3.1 Vegetation communities

Native vegetation within 5 km of the study area was assessed using desktop GIS analysis (**Figure 3.1**). The regional vegetation mapping by OEH (2015) showed that 'Shale Plains Woodland' (SPW) is dominant across the locality and that 'Alluvial Woodland' (AW) commonly occurrs in association with drainage lines (**Figure 3.1**). Small areas of 'Shale Gravel Transition Forest' (SGTF) are mapped to the south-east of the study area.

Within the study area OEH (2015) mapped approximately 6.8 ha of SPW and 5.5 ha of AW. The relationship between the vegetation communities of OEH (2015), Plant Community Types (PCTs) used by the BAM and ecological communities listed under the BC Act and EPBC Act are outlined within **Table 3.1**.

Field validation followed the mapping protocols of the BAM, which requires all vegetation native to NSW to be allocated to a PCT that was likely to have occurred onsite prior to European settlement. Whilst it is more likely that the study area retained a complex of many intergrading PCTs, the highly developed and modified state does not allow for any level of confidence predicting the pre-1750 vegetation. Mapping and delineation of vegetation boundaries has been informed by small areas of native vegetation, where present, and interpretation of the topography and landforms across the study area.

Field validation of vegetation communities confirmed that vegetation in the north-west of the study area corresponded with AW, however much of the vegetation mapped as SPW by OEH (2015) was found to more closely resemble SGTF (**Figure 3.2**). Features of the vegetation within the study area which were used to distinguish SGTF from SPW included: a canopy commonly including *Eucalyptus fibrosa* (Broad-leaved Ironbark); a moderately dense mid-storey of *Melaleuca* spp. (Paperbarks); and the presence of iron-indurated gravels. Areas of the study area without a mid-storey of *Melaleuca* spp. or iron-indurated gravels were retained as SPW.

Table 3.1: Relationship between vegetation communities, PCTs and TECs.

Vegetation community (OEH 2015)	Plant Community Types (PCTs)	Threatened Ecological Communities (TECs)	
		BC Act	EPBC Act
Alluvial Woodland	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	**E:** River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Not listed

Vegetation community (OEH 2015)	Plant Community Types (PCTs)	Threatened Ecological Communities (TECs)	
		BC Act	EPBC Act
Shale Plains Woodland	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	**CE**: Cumberland Plain Woodland in the Sydney Basin Bioregion	**CE[#]:** Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
Shale Gravel Transition Forest	PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	**E:** Shale gravel transition forest in the Sydney Basin Bioregion	

3.2 Vegetation condition

All native vegetation (as applied by the BAM) across the study area (approximately 55.7 ha) included evidence of past disturbance including selective thinning, slashing, under-scrubbing, non-indigenous plantings and weed invasion. Generally past disturbance was less evident within areas of AW adjacent to the un-named drainage line in the north-west of the study area, while past disturbance was more evident in native vegetation in the southern and eastern portions of the study area. Field assessment identified four condition classes across the study area (**Figure 3.2**) which are briefly summarised as follows:

- "Intact" – Areas in which all structural layers were present and dominated by native species.
- "Scattered trees" – Areas which have been historically cleared and now only include isolated remnant canopy trees, or planted canopy trees, over a predominately exotic or cleared understorey.
- "Derived Shrubland" – Areas of the study area where native canopy has been removed, although the shrub-layer and understorey remain.
- "Derived Grasslands" – Areas where the canopy and shrub layer vegetation have been removed, although native understorey species remain. This condition class included various levels of infestation of exotic understorey species.

For each vegetation zone (combination of the PCT and condition class) a Vegetation Integrity (VI) score was calculated from a single plot data in each vegetation zone. The exception was the 'scattered trees' vegetation zone which was only sampled once, despite being present across three PCTs. For these vegetation zones plot data from PCT 724 has also been entered for PCTs 835 and 849. Plot locations are shown in **Figure 3.2**. The VI scores ranged from 14.9/100 to 67/100 for vegetation zones within the study area (**Table 3.2**). The VI Scores for each zone represent a combination of scores for vegetation composition, structure and function. Across the study area all vegetation zones had a low composition score, except for intact areas of PCT 835, which is attributed to the history of vegetation clearing, under-scrubbing and across much of the subject land.

Table 3.2: The area and VI score for vegetation zones

Vegetation community / PCT	Condition class	Area (ha) within the study area	VIS score	SAII
PCT 835 (AW)	Intact	6.33	67	No
	Scattered trees	0.19	29.8*	
PCT 724 (SGTF)	Scattered trees	4.88	20	No
	DNS	14.23	33.3	
	DNG	28.81	14.9	
PCT 849 (SPW)	Scattered trees	1.23	19.9*	SAII
Artificial wetlands	-	2.03	-	No
Exotic grassland	-	87.83	-	
Other - infrastructure	-	1.13	-	-
Total	**-**	**146.66**	**-**	**-**

*VIS score calculated using plot data from plot in a separate PCT

3.3 Threatened flora species

A search of the Atlas of NSW Wildlife (DPIE 2020c) indicated that 36 threatened species (seven flora, 20 birds, eight mammals and one invertebrate) have previously been recorded within a 5 km radius of the study area (**Figure 3.3** and **Appendix A**). Within the study area, three threatened flora species and two fauna species have previously been recorded, namely:

- *Dillwynia tenuifolia*
- *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea)
- *Pultenaea parviflora*
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Latham's Snipe (*Gallinago hardwickii*)

Field survey confirmed the presence of the three threatened flora species previously recorded within the study area. The three threatened flora species, *D. tenuifolia*, *G. juniperina* subsp. *juniperina* and *P. parviflora*, were restricted to the southern portions of the study area (Lot 242 // DP 1088991), and are widespread within this area. Lot 2 DP 219794 has potential to contain these species as well, based on similar vegetation and proximity to the area where these species were recorded. However, it is noted that he vegetation in this lot appears to be more disturbed than in the mapped DNS and DNG where the threatened flora species were found.

3.4 Threatened fauna species

A range of fauna habitat values were identified within the study area including those associated with woodland including mature canopy trees, and those associated with open grassland. Based upon the habitat values within the study area, a suite of fauna species are likely to use the study area for foraging purposes. A number of fauna species may also utilise the more intact areas of habitat, generally those areas in association with the un-named drainage line in the north-west, for breeding purposes. The habitat features relevant to each fauna group are identified in **Table 3.3**.

Table 3.3: Key fauna habitat features present across the study area

Habitat features	Fauna species
Native woodland	Arboreal mammals, birds, reptiles, bats and amphibians
Open grassland	Birds and reptiles

A number of threatened fauna species are likely to use the resources available within the study area. Based upon the habitat resources available within the study area and records of threatened species from the locality (**Appendix A),** the following seven threatened fauna species were identified as having a 'moderate' likelihood of utilising the study area:

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Little Bentwing-bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus)*
- Cumberland Plain Land Snail (*Meridolum corneovirens*)

Targeted microbat surveys according to the BAM methodology were undertaken using Anabat recording devices. Data was recorded over a 16-day period from 13 January 2022. This data has not been analysed.

Targeted surveys for the Green and Golden Bell Frog did not detect any Green and Golden Bell frogs. Other amphibian species recorded during the surveys included :

- *Crinia signifera*
- *Limnodynastes peronii*
- *Limnodynastes tasmaniensis*
- *Litoria fallax*
- *Litoria peronii*
- *Uperoleia laevigata*

During frog surveys, one Cumberland Plain Land Snail (*Meridolum corneovirens*), was found incidentally along the far southeast edge of Lot 242 // DP1088991 in the area which has been mapped 'Non-certified avoided for biodiversity' in the SGTF (PCT 724) DNS vegetation zone (refer **Figure 2.3** and **Figure 4.2**).

3.5 Riparian corridors

Desktop survey and field assessment identified watercourses within the study area. While development in accordance with the Draft Masterplan would avoid waterfront land in association with the un-named fourth order stream in the north-west of the study area, waterfront land associated with an un-named first order stream in the central west of the study area would be impacted. Therefore, future works may be within 40 m from the top of bank of a watercourse and a controlled activity approval may be required in accordance with WM Act. Field surveys found that this drainage line does not exhibit the features of a defined channel with bed and banks and may not be waterfront land for the purposes of the WM Act. Further consultation with the Natural Resource Access Regulator (NRAR) would be required to

determine whether this area is waterfront land as defined under the WM Act. Several farm dams are present within the study area and any removal of these dams would require the preparation of a dam de-watering plan.

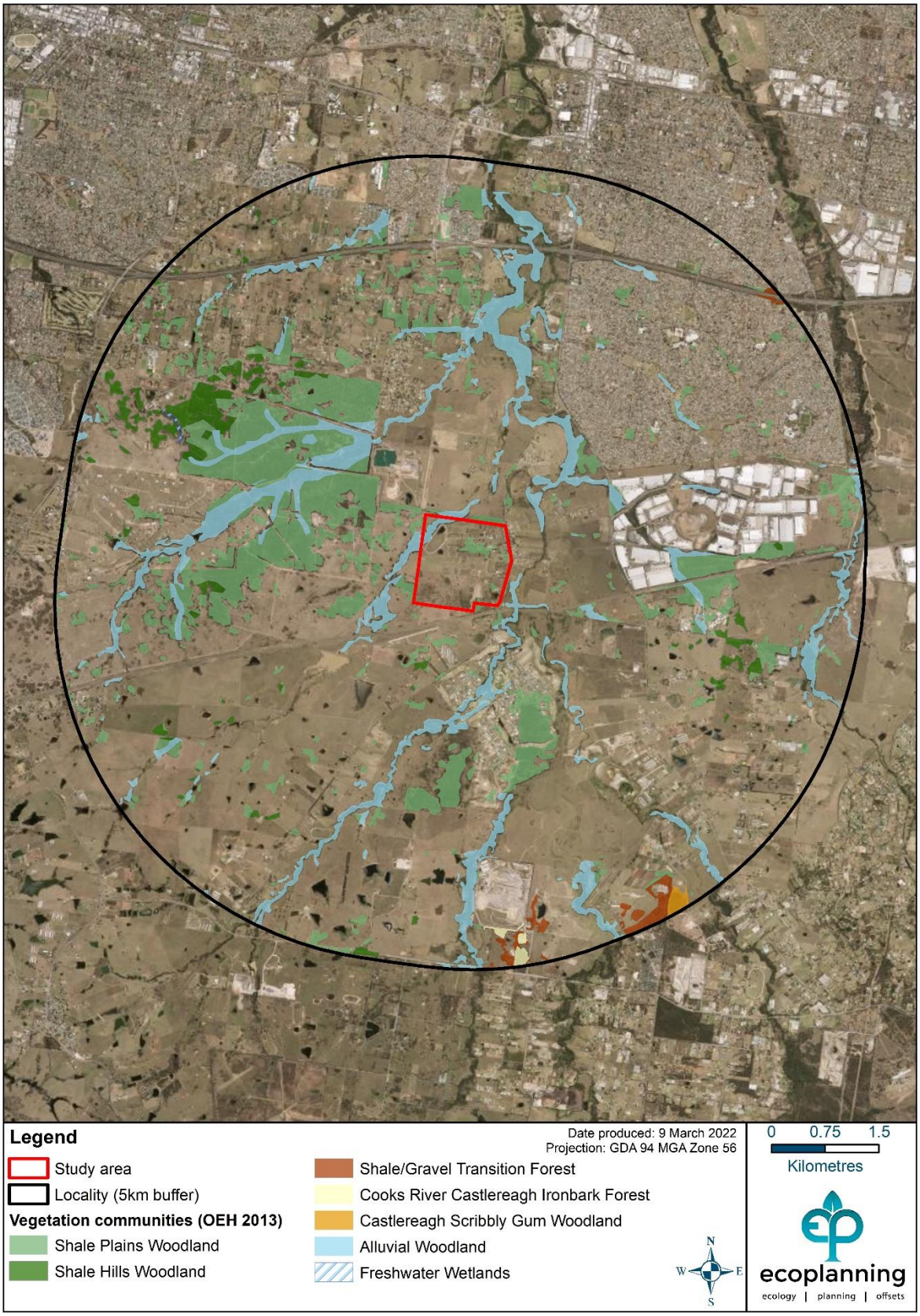

Figure 3.1: Native vegetation within the locality (OEH 2013).

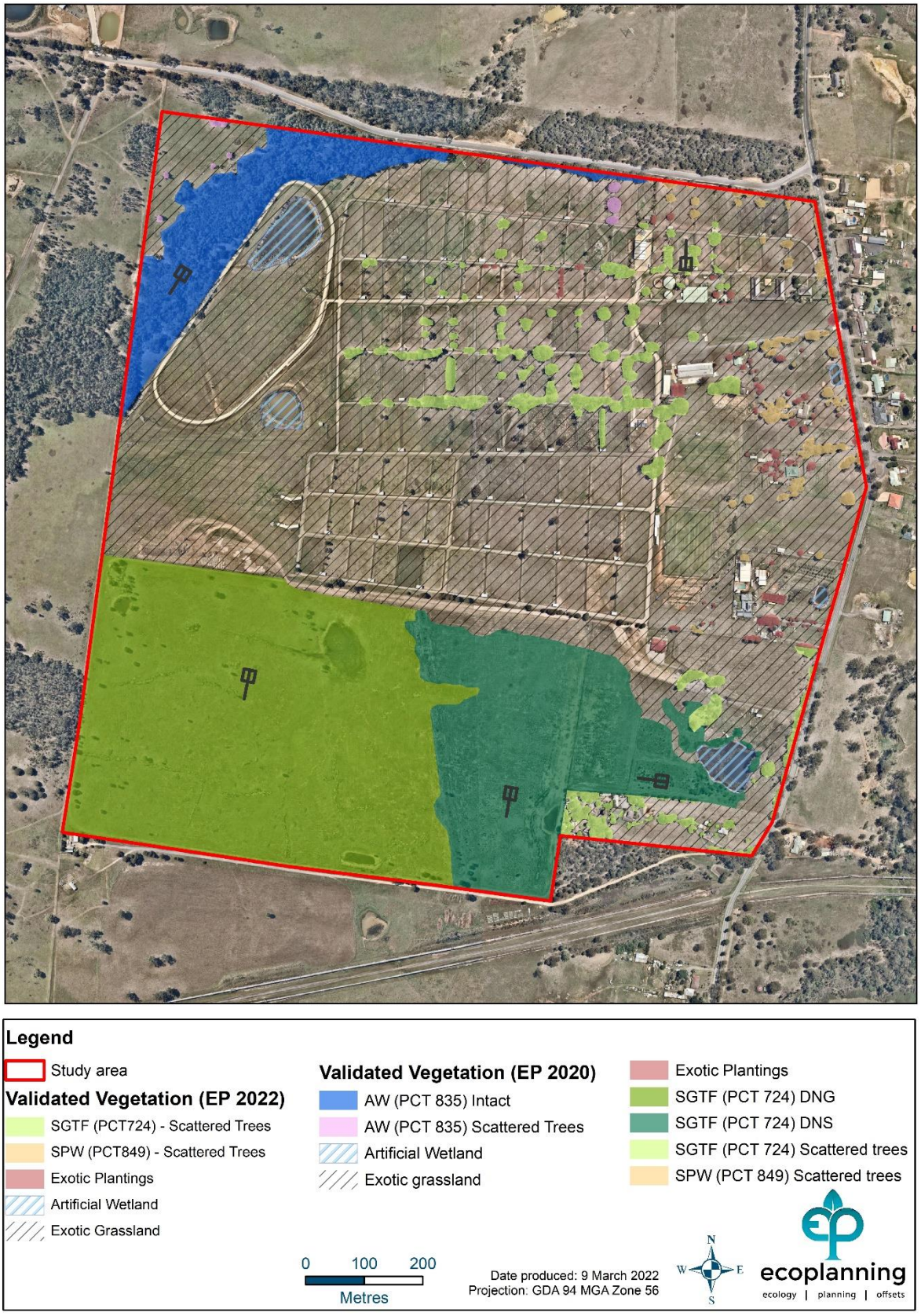

Figure 3.2: Field validation vegetation mapping

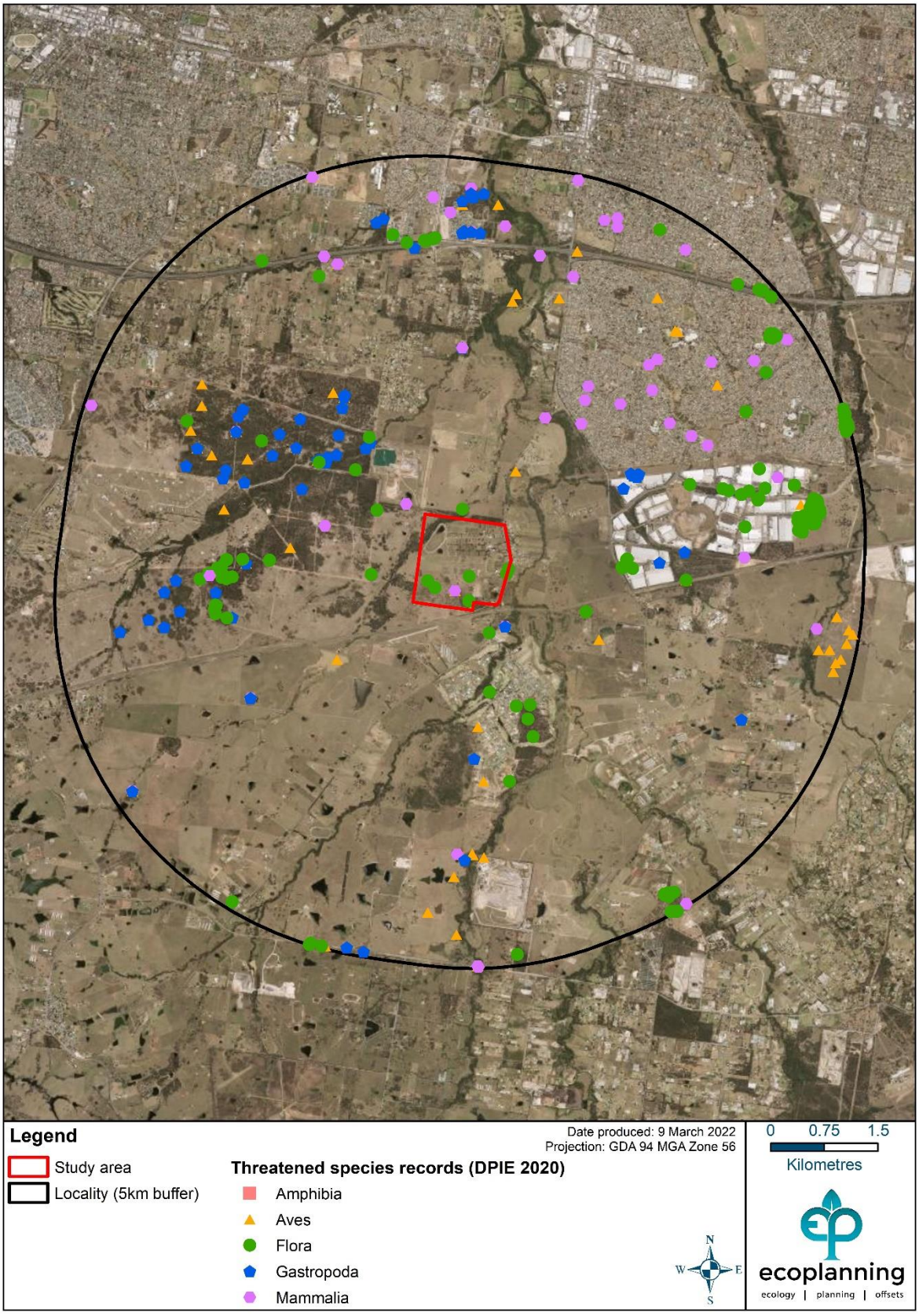

Figure 3.3: Threatened species records for the locality

4 Constraints and development

4.1 Conservation values

Ecological constraints are described in **Table 4.1** and are shown in **Figure 4.1**. As noted above, all PCTs and vegetation communities within the study area form part of a TEC listed under the BC Act, although the condition of the TECs across the study area are variable. Areas of highest conservation values and highest constraint are areas of TECs in an intact condition and which support threatened flora species. Moderate ecological values occur where isolated native trees, and planted non-local native trees, are present over a predominately exotic understorey. Areas of exotic grassland and artificial wetlands have been categorised as having a 'low' ecological constraint.

Table 4.1: Ecological constraints criteria

Ecological constraints	Criteria
High	• Areas of native vegetation that are listed as threatened ecological communities (TECs) under the BC Act • Riparian corridors for higher order drainage lines • Confirmed habitat for threatened species listed under the BC Act.
Moderate	• Areas of native vegetation that are listed TECs under the BC Act, but remain as only 'scattered trees'
Low	• Cleared 'exotic grassland/infrastructure'

4.2 Conservation significance

The entire study area has been subject to historical disturbance, including vegetation clearing for agricultural land uses, with the vast majority now supporting exotic vegetation with low ecological value. The area identified as potential conservation under the CPCP has a very low VI Score in accordance with the BAM (VI score of 14.8 to 33.3; see **Table 4.2**). It does not meet condition criteria to be considered a Matter of National Environmental Significance under the EPBC Act

Whilst the area identified as 'avoided for biodiversity' (**Figure 4.2**) does retain additional conservation constraints due to the presence of threatened flora or 'species credits' in accordance with the BAM, it would require significant restoration effort and funding. The BAM predicts that the area 'avoided for biodiversity' would only achieve a small gain in VI Score if managed as a BSA (PCT 724 – DNG = 14.8/100 to 38.8/100 and PCT 724 – DNS = 33.1/100 to 37.2/100. By contrast, the area avoided under the Draft Masterplan in the north west, which is PCT 835 – 'intact', currently has a VI Score of 67/100, and with no management will still remain at 66.2/100 (see **Table 4.2**).

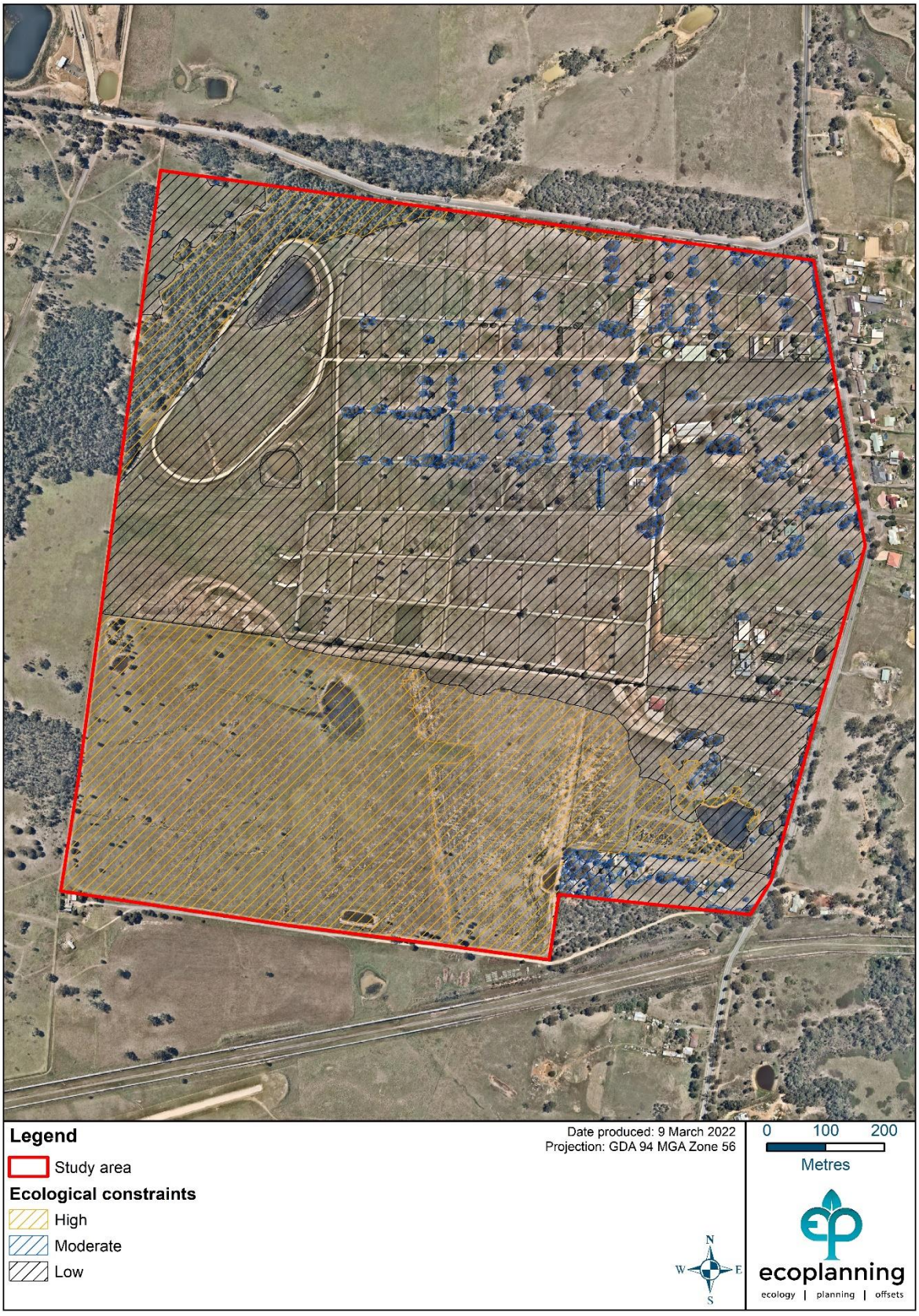

Figure 4.1: Ecological constraints within the study area

Table 4.2: Predicted VI Scores and ecosystem credit generation under a conservation management scenario.

PCT	Condition class	Area (ha)	Current VI score	Predicted VI Score (no manag.)	Predicted VI Score (default manag.)	No. of credits (default manag.)#	Credits/ha (default manag.)#	Predicted VI Score (active manag.)	No. of credits (active manag.)#	Credits/ha (active manag.)#
North										
PCT 835 (AW)	Intact	0.34	67	66.2	67.8	1	3	76.5	1	3
	Artificial Wetland*	0.13	14.8	14.5	18.4	1	1	38.8	1	5
	Exotic grassland*	0.6	14.8	14.5	18.4	1	1	38.8	4	6
South										
PCT 724 (SGTF)	DNS	7.03	33.1	32.8	37.2	8	1	52.3	34	5
	DNG	9.2	14.8	14.5	18.4	9	1	38.8	56	6

*Plot data was taken from the vegetation zone with the lowest VI scores as plots were not collected, #rounding errors apply

Table 4.3: Predicted candidate species credit generation under a conservation management scenario.

Species credit	PCT	Condition	Area (ha)	No. of credits (default manag.)#	Credits/ha (default manag.)#	No. of credits (active manag.)#	Credits/ha (active manag.)#
Dillwynia tenuifolia	PCT 724 (SGTF)	DNS	7.03	8	1	8	1
		DNG	9.2	9	1	9	1
Grevillea juniperina subsp. *juniperina* (Juniper-leaved Grevillea)	PCT 724 (SGTF)	DNS	7.03	8	1	8	1
		DNG	9.2	9	1	9	1
Myotis macropus (Southern Myotis)	PCT 835 (AW)1	Intact	0.34	1	3	1	3
Pultenaea parviflora	PCT 724 (SGTF)	DNS	7.03	8	1	8	1
		DNG	9.2	9	1	9	1

rounding errors apply

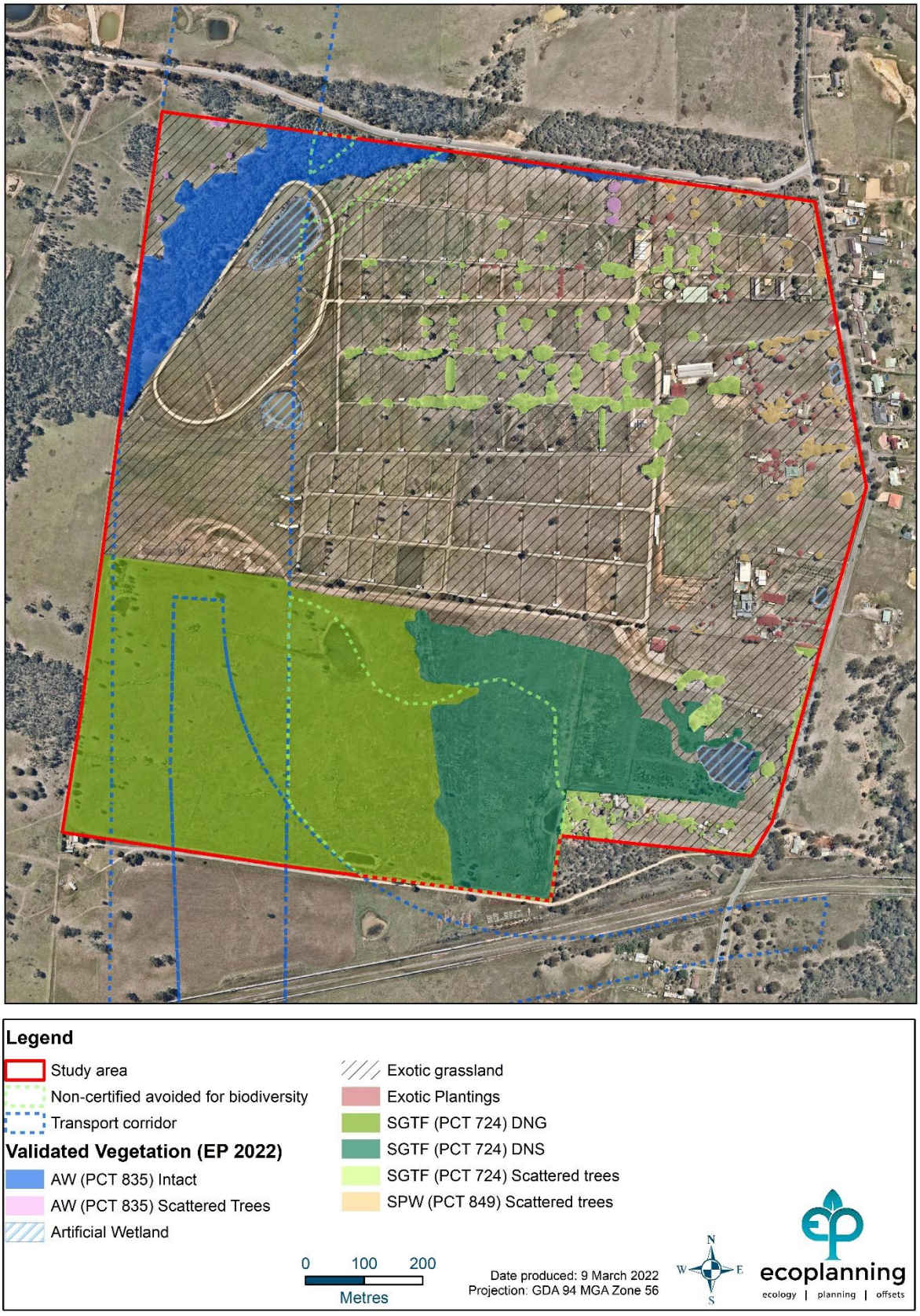

Figure 4.2: Non-certified land and CPCP area avoided for biodiversity and transport corridor within the study area

In accordance with the BAM, a higher level of improvement is achievable applying Active Restoration and Management Actions (ARMA), with a trade-off being higher input or management costs. With ARMA applied to the area identified as 'avoidance for biodiversity', this gain is only predicted to achieve a VI Score of 38.8 (PCT 724 – DNG) and 52.2 (PCT 724 – DNS), which would require significant additional funds to be achieved

This area is also relatively small in terms of a BSA, with most cost effective BSAs on the Cumberland Plain at least twice the size of the area identified by the CPCP in the study area.

Species credit generation in this area is also extremely low 1-3/ha, as it is tied to the VI Score for these zones (**Table 4.3**). It is notable that the species credits do not increase with ARMA. Trading for species credits, in particular threatened flora has been in the order of $100's per credit under the former Biobanking scheme (http://www.environment.nsw.gov.au/bimsprapp/biobankingpr.aspx), and predicted prices under the NSW Biodiversity Offsets Payment Calculator (BOPC) $145-260/credit for flora, and $975 for Southern Myotis. This would equate to a total return if all 'species credits' generated in the 'area avoided for biodiversity' to a total of <$10,000. This return would not recover the input cost for generating the credits, let alone managing the site in perpetuity.

If a BSA was to be placed over the 'area avoided for biodiversity' and fully restored through the application of ARMA for ecosystem credits, it is estimated that a Total Trust Fund Deposit (TFD) in the order of $1.5-2M would be required. This means the effective cost of restoration would affect a Part A or 'management only' cost per credit of $15-22K/credit. Without ARMA, it would be $75K/credit. This price point is prohibitive when land value or Part B / 'opportunity costs' are considered. As such, without a significant funding commitment the area proposed as 'avoid for biodiversity' will remain in a highly degraded state with low VI Score and cost prohibitive BSA options to the landholder.

4.3 Future development and the Biodiversity Offsets Scheme

Whilst the Draft Masterplan identifies areas of avoidance and minimisation of impacts to biodiversity, it would trigger the NSW Biodiversity Offsets Scheme (BOS) under the Biodiversity Conservation Act 2016, due to the triggers outlined in s7.3 of the BC Act, which are as follows:

- Clearing of 1 ha or greater of native vegetation (based upon the minimum lot size of 40 ha)
- Clearing of land identified on the Biodiversity Values (BV) Map (DPIE 2020a; Figure 3)
- Any works which would significantly affect threatened species in accordance with s7.3 of the BC Act.

As a result, impacts to biodiversity associated with the proposed development would need to be offset through retiring purchased or generated biodiversity credits to achieve no net loss of biodiversity values as established by the BAM. Impacts to areas of high biodiversity value should be avoided or minimised as part of any future developments. Demonstrating avoidance of areas of high ecological values is a requirement and key consideration for determining authorities during assessment of Development Applications.

5 Conclusions

The entire study area has been subject to historical disturbances including vegetation clearing for agricultural land uses. The vast majority of the study area has been historically cleared and now supports exotic vegetation with low ecological value. However, areas of high ecological value and high ecological constraint are present within the study in association with more intact areas of native vegetation, threatened species habitat and riparian corridors. Any future development should aim to avoid or minimise impacts to areas of high biodiversity value.

All native vegetation within the study area forms part of a TEC listed under the BC Act. Vegetation within the study area does not form part of equivalent TECs under the EPBC Act due to the condition thresholds for listings under this Act.

Large populations of three threatened flora species were confirmed as occurring across the southern portions of the study area, namely *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina* and *Pultenaea parviflora*. Cumberland Plain Land Snail was recorded incidentally within the area mapped as 'Non-certified avoided for biodiversity'. There is also potential habitat for threatened fauna species within the study area including microbat species. Three Anabat recording devices were deployed in the study area and the data from these will be analysed to determine presence of any threatened microbat species in accordance with the BAM. Targeted survey results will be used to confirm the presence or absence of these species as part of a formal BDAR at the Development Application stage.

It is likely that future development of the study area would trigger the BOS established under Part 6 of the BC Act. Triggering of the BOS would require the preparation of a BDAR and calculation of biodiversity offset requirements to achieve no net loss of biodiversity values as established under the BAM.

With regards to the creation of potential credits, whilst the area is identified under the BAM as a modified state of Shale Gravel Transition Forest (PCT 724), due to the low VI Score it is not a viable or desirable location for a BSA as credits would not provide a competitive market option for credit sales. Therefore, the site would be highly unlikely to ever achieve a full TFD or Part A component, therefore the assumed 'averted loss' in VI is more likely in the long term (see **Table 4.2**).

The alternative to this scenario is for the proponent to enter the NSW Biodiversity Offsets Scheme (BOS) and purchase offsets on a site where a more likely long term conservation measure is attainable – i.e. a larger site that is not fragmented by a significant transport corridor and industrial land use. By contrast the area of avoided vegetation in the Draft Masterplan, PCT 835, in the north-west already has a high VI Score and has a lower 'averted loss' without management intervention. This is coupled with the requirement to restore the riparian corridor associated with this area of avoided vegetation under the WM Act.

Due to the study area already being the subject of an active Planning Proposal, the low VI Score, and cost prohibitive restoration resulting in a low likelihood of any generated credits also being saleable, a conservation outcome at the site is high risk, and a preferable approach may be to enter the BOS, with the development proposed in the Draft Masterplan allowing for a more certain and low risk conservation outcome offsite.

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Appendix A Likelihood table

Scientific name (Common name)	Status	Number of records	Most recent record	Nearest record	Likelihood of occurrence
FLORA					
Acacia pubescens (Downy Wattle)	BC Act = V EPBC Act = V	2	4.2 km (12/07/2018)	4.2 km (12/07/2018)	Low
Dillwynia tenuifolia	BC Act = V	58	4.2 km (12/07/2018)	0 km (16/02/2016)	Recent record
Grevillea juniperina subsp. *juniperina* (Juniper-leaved Grevillea)	BC Act = V	118	5 km (21/03/2019)	0 km (16/02/2016)	Recent record
Marsdenia viridiflora subsp. *viridiflora*	BC Act = E2	29	4.2 km (12/07/2018)	2.1 km (11/09/2008)	Low
Persoonia nutans (Nodding Geebung)	BC Act = E1,P EPBC Act = E	1	4.2 km (12/07/2018)	4.2 km (12/07/2018)	Low
Pimelea spicata (Spiked Rice-flower)	BC Act = E1 EPBC Act = E	2	4.2 km (12/07/2018)	2.4 km (31/05/1999)	Low
Pultenaea parviflora	BC Act = E1 EPBC Act = V	10	3 km (21/03/2019)	0 km (16/02/2016)	Recent record
FAUNA Class: AVES					
Apus pacificus (Fork-tailed Swift)	EPBC Act = Mi	1	3.7 km (13/07/2005)	3.7 km (13/07/2005)	Low
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	BC Act = V,P	11	2.5 km (16/03/2018)	1.7 km (20/04/2006)	Low
Burhinus grallarius (Bush Stone-curlew)	BC Act = E1,P	2	3.3 km (16/05/1996)	3.1 km (15/05/1996)	Low
Calidris acuminata (Sharp-tailed Sandpiper)	EPBC Act = Mi	1	3.7 km (25/10/2018)	3.7 km (25/10/2018)	Low
Chthonicola sagittata (Speckled Warbler)	BC Act = V,P	10	1.7 km (20/04/2006)	1.7 km (20/04/2006)	Low
Climacteris picumnus victoriae (Brown Treecreeper (eastern subspecies))	BC Act = V,P	1	2.8 km (26/06/2019)	2.8 km (26/06/2019)	Low

Scientific name (Common name)	Status	Number of records	Most recent record	Nearest record	Likelihood of occurrence
Daphoenositta chrysoptera (Varied Sittella)	BC Act = V,P	7	4.7 km (25/06/2009)	1.8 km (19/04/2006)	Low
Gallinago hardwickii (Latham's Snipe)	EPBC Act = Mi	3	3.7 km (25/10/2018)	0 km (17/11/2009)	Moderate
Haliaeetus leucogaster (White-bellied Sea-Eagle)	BC Act = V,P EPBC Act = C	7	1.6 km (15/03/2019)	1.6 km (15/03/2019)	Low
Hieraaetus morphnoides (Little Eagle)	BC Act = V,P	1	3.8 km (22/02/2008)	3.8 km (22/02/2008)	Low
Ixobrychus flavicollis (Black Bittern)	BC Act = V,P	1	3.1 km (15/06/2016)	3.1 km (15/06/2016)	Low
Lathamus discolor (Swift Parrot)	BC Act = E1,P,3 EPBC Act = CE	2	3.6 km (02/09/2014)	3.6 km (02/09/2014)	Low
Lophoictinia isura (Square-tailed Kite)	BC Act = V,P,3	1	3.6 km (27/01/2016)	3.6 km (27/01/2016)	Low
Ninox strenua (Powerful Owl)	BC Act = V,P,3	2	3.3 km (17/07/2013)	3.3 km (17/07/2013)	Low
Petroica boodang (Scarlet Robin)	BC Act = V,P	1	2.6 km (03/06/1998)	2.6 km (03/06/1998)	Low
Rostratula australis (Australian Painted Snipe)	BC Act = E1,P EPBC Act = E	1	0.8 km (28/01/2015)	0.8 km (28/01/2015)	Low
Stagonopleura guttata (Diamond Firetail)	BC Act = V,P	2	2.4 km (27/03/2012)	2.4 km (27/03/2012)	Low
Stictonetta naevosa (Freckled Duck)	BC Act = V,P	1	4.5 km (25/10/2018)	4.5 km (25/10/2018)	Low
Tringa nebularia (Common Greenshank)	EPBC Act = C,J,K	1	1.3 km (21/04/2006)	1.3 km (21/04/2006)	Low
Tyto novaehollandiae (Masked Owl)	BC Act = V,P,3	1	4.1 km (27/10/2016)	4.1 km (27/10/2016)	Low
FAUNA Class: GASTROPODA					

Scientific name (Common name)	Status	Number of records	Most recent record	Nearest record	Likelihood of occurrence
Meridolum corneovirens (Cumberland Plain Land Snail)	BC Act = E1	69	3.5 km (25/10/2018)	0.4 km (18/02/2014)	Recent record
FAUNA Class: MAMMALIA					
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	BC Act = V,P	9	5 km (30/09/2018)	0 km (17/11/2009)	Moderate
Miniopterus australis (Little Bent-winged Bat)	BC Act = V,P	2	5 km (30/09/2018)	1.6 km (27/10/2008)	Moderate
Miniopterus orianae oceanensis (Large Bent-winged Bat)	BC Act = V,P	8	5 km (30/09/2018)	1.6 km (27/10/2008)	Moderate
Myotis macropus (Southern Myotis)	BC Act = V,P	9	5 km (31/05/2018)	0.4 km (18/02/2014)	Moderate
Petaurus australis (Yellow-bellied Glider)	BC Act = V,P	1	3.8 km (26/09/2018)	3.8 km (26/09/2018)	Low
Pteropus poliocephalus (Grey-headed Flying-fox)	BC Act = V,P EPBC Act = V	52	3 km (23/04/2019)	1.4 km (01/01/1900)	High
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	BC Act = V,P	1	5 km (30/09/2018)	5 km (30/09/2018)	Low
Scoteanax rueppellii (Greater Broad-nosed Bat)	BC Act = V,P	2	5 km (30/09/2018)	0.4 km (18/02/2014)	Moderate