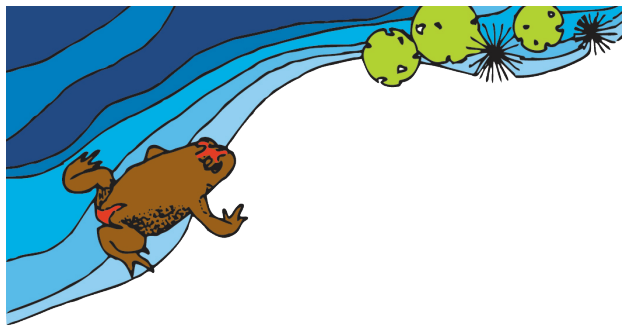# Abel Ecology

Biodiversity Development Assessment Report (BDAR)

for

Address 171 Forest Way, Belrose

Lot 9, DP 737255

Prepared for:	Belrose RB1 Pty Ltd
Offer No:	AE21-2508-BDAR-REP-ISS-1
Prepared by:	Abel Ecology
Date:	9 November 2022

Disclaimer

This report has been prepared in accordance with the scope of services described in agreement between Abel Ecology and the Client.

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I confirm that I have read the NSW Land and Environment Court Practice Note commencing on 14 May 2007, Division 2, Part 31 of the Uniform Civil Procedure Rules 2005 and the Expert Witness Code of Conduct in Schedule 7 to the Uniform Civil Procedure Rules 2005. I have prepared this advice in accordance with the requirements of the Practice Note and Code of Conduct and believe this report is consistent with the requirements of the Practice Note and the Code of Conduct. I agree to be bound by the Practice Note and Code of Conduct.

Document History

Report	Version	Prepared by	Checked by	Submission	
				Method	Date
Report 2345	Issue 1	Dr Daniel McDonald	Jane Bonwick	Dropbox	12 October 2021
Report 2508	Issue 1	Elizabeth Ashby	Janelle Merry	Dropbox	9 November 2022

Biodiversity Assessment Method Accreditation (BAM) – BDAR authorship

Prepared by	BAM Assessor Accreditation Number	Date	Role – lead assessor or BAM contributor
Dr Daniel McDonald	BAAS17056	12 October 2021	Lead
Elizabeth Ashby	BAAS17045	19 October 2022	Co-lead under contract to Abel Ecology for redrafting and finalisation

I certify that this report has been prepared on the basis of the requirements of, and information provided under, the Biodiversity Assessment Method and s6.15 of the BC Act.

In preparing this assessment I have acted in accordance with the **Accredited BAM Assessor Code of Conduct.**

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.
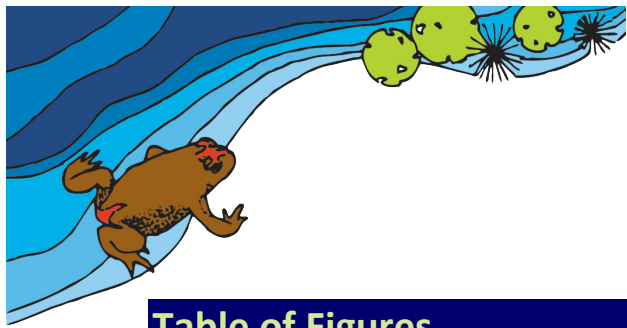
Signature:

Date: 12 October 2021

BAM Assessor Accreditation no: BAAS17056

I certify that this report has been prepared on the basis of the requirements of, and information provided under, the Biodiversity Assessment Method and s6.15 of the BC Act.

In preparing this assessment I have acted in accordance with the **Accredited BAM Assessor Code of Conduct.**

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

Signature:

Date: 24 October 2022

BAM Assessor Accreditation no: BAAS17045

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List of Abbreviations

APZ   Asset Protection Zone

BAM   Biodiversity Assessment Method

BC Act   Biodiversity Conservation Act 2016

BCR   Biodiversity Conservation Regulation 2017

BDAR   Biodiversity Development Assessment Report

d.b.h.   Diameter at breast height (~1.4 metres)

EEC   Endangered Ecological Community

ESD   Ecologically Sustainable Development

Note regarding maps in this report

The diagrams/site maps used in this report have been supplied by and are used with the permission of Belrose RB1 Pty Ltd.
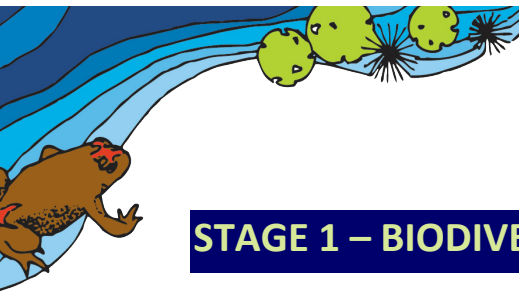
STAGE 1 – BIODIVERSITY ASSESSMENT

1. Introduction

Abel Ecology has been contracted to prepare a Biodiversity Development Assessment Report (BDAR) in accordance with the Biodiversity Conservation (BC) Act 2016 to assess the likely impacts of a proposed development upon state-listed flora and fauna, and their habitats at Lot 9 DP 737255, 171 Forest Way Belrose in the Northern Beaches Local Government Area (LGA).

The development site is a large rural residential block with an area of 1.085 ha (see Figure 1). It comprises a single lot with a trapezoidal shape and a frontage of 72 metres along Forest Way. A recently constructed Aged Care development occurs immediately to the south and another large rural residential lot is adjacent to the north. Bushland associated with Snake Creek occurs to the east, with the residential part of central Belrose to the west on the other side of Forest Way.

It is proposed to construct an senior's living development comprising several pavilions stepping down the steep east facing slope, with basement parking and landscaped areas. Being bushfire-prone land, an Asset Protection Zone (APZ) will also need to be implemented. The layout of the proposed development is shown in Figure 2.

A site-based development assessment has been applied per the Biodiversity Assessment Method (BAM) 2020, and the Biodiversity Values (BV) Map is the only relevant trigger for the Biodiversity Offset Scheme (BOS) and consequently this BDAR – see Figure 3. The particular "high value" area mapped on site is defined as representing "threatened species or communities with potential for serious and irreversible impacts".

In order to determine the type of BDAR to apply, the Minimum Lot Size (MLS) and the type and area of vegetation to be impacted must be addressed. There is no Minimum Lot Size assigned to this site in the Warringah Local Environmental Plan 2011 (with the zoning being a Deferred Matter), therefore the actual lot size of 1.085 hectares is used. Being greater than 1 hectare but less than 40 hectares, an impact on less than or equal to 2 hectares of native vegetation allows for the application of a Streamlined Assessment, if it is not impacting core Koala habitat identified in a plan of management under the State Environmental Planning Policy (Koala Habitat Protection) 2019.[1]

In this case, the area of native vegetation to be removed is 0.24 ha and an additional 0.25 ha managed as an Asset Protection Zone (APZ), totalling 0.49 ha. The development site does not include core Koala Habitat (see further discussion in Section 4.4 of this BDAR). Therefore, a Small Area Assessment is appropriate per Table 12 in Appendix C in BAM 2020. Specifically, the procedures have been followed

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[1] On 17th March 2021 the 2019 SEPP was superseded by *State Environmental Planning Policy (Koala Habitat Protection) 2021*. The controls, definitions and procedures detailed in the 2021 SEPP are applied in this BDAR.

AE21 2508 BDAR REP ISS 1 09NOV22.docx   © BAM Ecology Pty Ltd, 2021 AD (T/A Abel Ecology)
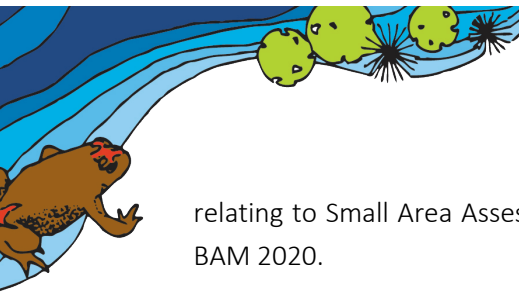
relating to Small Area Assessments detailed in Table 13 in Appendix C and Table 27 in Appendix L in BAM 2020.

The following information sources were relied upon for this BDAR:

- Biodiversity Assessment Method 2020.
- The Biodiversity Assessment Method Operational Manual – Stages 1 and 2.
- BioNet Vegetation Classification (formerly known as the NSW Vegetation Information System Classification Database).
- BioNet Threatened Biodiversity Data Collection (TBDC, formerly known as the Threatened Species Profile Database).
- BioNet Atlas (formerly known as the NSW Wildlife Atlas).
- Directory of Important Wetlands in Australia.
- BioNet NSW (Mitchell) Landscapes – Version 3.1.
- NSW Interim Biogeographic Regions of Australia (IBRA region and subregion) – Version 7.
- NearMaps (2022) NearMaps aerial imagery tool. Latest imagery available being 12th September 2022 (http://maps.au.nearmap.com/).
- NSW Government (2022) SIXMaps Aerial Imagery Tool. Latest access of imagery 7th October 2022 (https://maps.six.nsw.gov.au/).
- SEED (2022) Sharing and enabling environmental data online portal. NSW Government, Sydney. (https://www.seed.nsw.gov.au/edphome/home.aspx).
- Published databases identified in section 1.4.1 of the BAM (2020).

The following plans prepared by Barry Rush and Associates, version DA, dated 8th December 2021 for the proponent were relied upon for this BDAR:

- Location diagram
- Site plan
- Levels 1 to 9 plans
- Roof plan
- Elevations
- Sections
- Typical units
- Demolition plan
- Site analysis plan
- External colour schedule
- Driveway plan and section
- Landscape area plan
- Excavation plan
- Sediment control plan
- Accessible footpath to bus stop plan

The bushfire hazard assessment prepared by Abel Ecology (AE21 2272 BAL REP ISS 1, dated 2nd October 2022) was relied upon for this BDAR.

Figure 1: Aerial imagery of the proposed development site (red). Nearmap photomap, 25th January 202

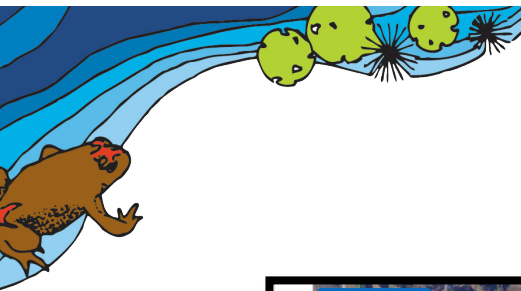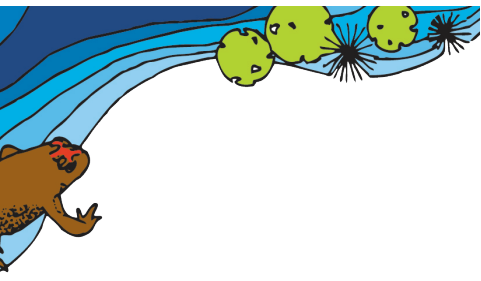Figure 2: The proposal superimposed over an aerial photograp

Figure 3: Biodiversity Values map.

2. Landscape context

Relevant landscape features are mapped in Figure 4.

The site is located within the Pittwater IBRA subregion in the Sydney Basin IBRA region.

The centre of the site is approximately at **grid reference** 335291 E 6266464 N (GDA 2020 – MGA 56) on the 9130-4S Hornsby 1:25,000 topographic map sheet.

It occupies a long steep slope from 168 metres ASL to 127 metres ASL, with the western part of the site being at the upper slope – ridge top.

The site occurs within the **Belrose Coastal Slopes NSW (Mitchell) Landscape** and the majority of the site is mapped as being on the **Somersby soil landscape**. At the bottom of the site on the lower slope, the **Gymea soil landscape** intrudes for a distance of approximately 33 metres in from the western boundary of the lot. However, the observation of significant rock sandstone outcropping near the top of the site directly below the existing house indicates that the Gymea soil landscape is more extensive and dominant than the mapping suggests.

The extent of **native vegetation within the assessment area (1500 m buffer)** is estimated to be 461 hectares, equivalent to 58% of the total assessment area (798 hectares). Thus, the percentage native cover is assigned to the 30-70% class.

Patch size for the assessment area has been assessed in accordance with BAM and is estimated to be 490 hectares. once the patch size is larger than 100 ha, it is part of the maximum patch class and assigned as ≥ 100 ha in the BAM Calculator (BAM-C).

Rivers and streams are classified according to the Strahler system which is in essence defined by the number and types of upper branches. The streams in the assessment area are shown in Figure 4.

No **waterways** occur on site, with it being situated at the top of the landscape. A first order stream tributary of Snake Creek is present off site near the Lot's south-eastern corner.

No wetlands occur on site or within the assessment area. The **nearest wetland habitats occur approximately 4.5 km to the east, associated with Narrabeen Lagoon.**

The developed parts of Belrose are concentrated on the main central ridgeline, with large vegetated areas confined to the lower slopes to the east and west. Within the buffer area, **habitat connectivity** has high integrity along the north-south corridor of bushland along Snake Creek at the bottom of the east facing slope. The western side of Forest Way is more highly intensively developed and supports fewer and more fragmented patches of vegetation. The subject lot is connected directly to the Snake Creek corridor at its eastern boundary. There is little connectivity across the ridgeline over Forest Way.

The site occupies a steep east facing slope that is punctuated by a rocky outcrop approximately 40 metres from the western boundary that contains overhangs, crevices, and caves. This **geological feature** is typical of the underlying Hawkesbury Sandstone.

At the time of preparation of this BDAR, declared **Areas of Outstanding Biodiversity Values** (AOBVs) are confined to those already declared as Critical Habitat under the *Threatened Species Conservation Act 1995* (now repealed), being:

- Cabbage Tree Island, critical breeding habitat for Gould's Petrel near Port Stephens;
- Manly Cove, critical breeding habitat for Little Penguins;
- Stotts Island Nature Reserve, critical habitat for Mitchell's Rainforest Snail near Murwillumbah; and
- All known extant areas of the Wollemi Pine and the surrounding habitat in the catchment, occupying some 5,000 hectares within Wollemi National Park.
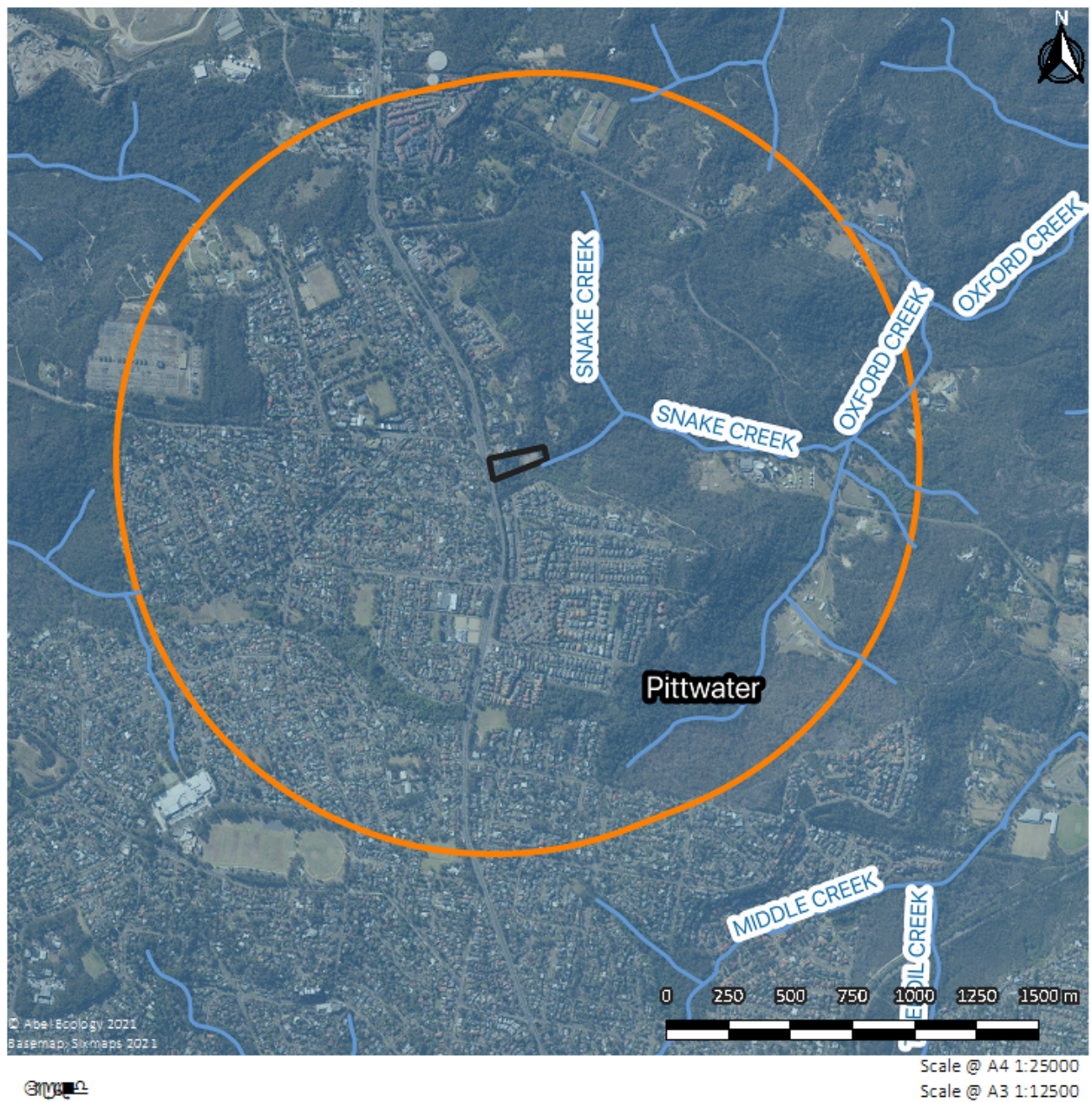
Figure 4: Landscape features.

3. Native vegetation

3.1 Data collection

Flora survey in accordance with the BAM was undertaken by Abel Ecology[2] and is relied upon for this BDAR. Data collected included:

- species present;
- foliage cover;
- the number of large trees;
- tree stem size diversity;
- tree regeneration;
- presence of hollows; and
- length of fallen logs and litter cover.

Survey comprised the following:

- two BAM plots were measured on 5th May 2021;
- random meander on 5th May 2021 and 1st October 2021; and
- targeted survey for threatened flora species.

As part of finalisation of the BDAR, Elizabeth Ashby of Keystone Ecological undertook supplementary site survey on 1st September 2022, noting all flora species encountered in and near the locations of the two BAM plots.

Data collected for each of the BAM plots are provided in Appendix 1. The locations of the BAM plots are shown in Figure 5. All of the floristic species recorded on site during survey are detailed in Table 1. Photographs of BAM plot 1 and BAM plot 2 are provided at Figures 6 and 7.

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[2] Dr Alison Hewitt and Jesse Cass.
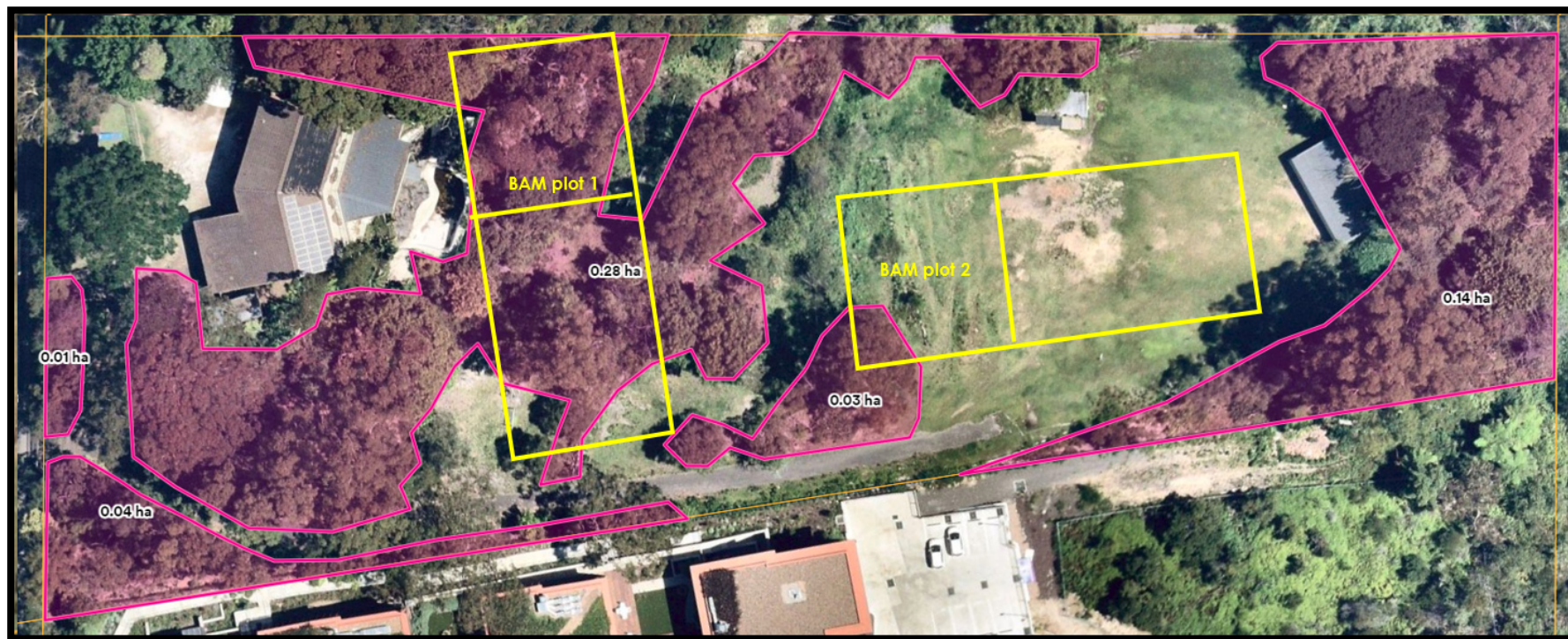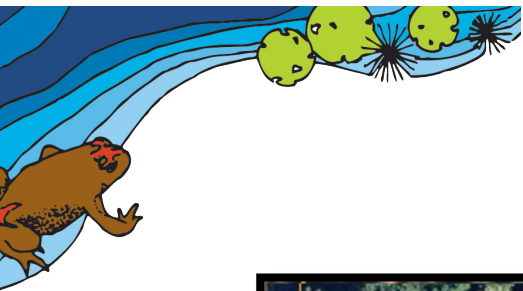
Figure 5: Location of two BAM plots (yellow) and Vegetation Zone 1 (pink).
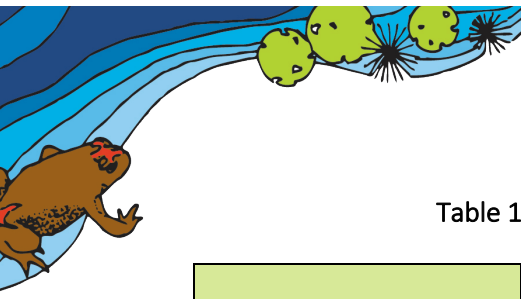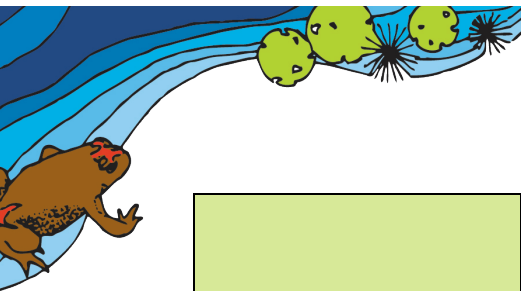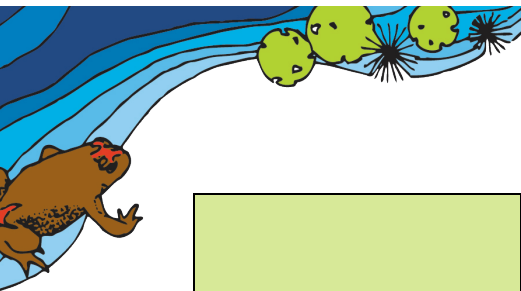
Table 1: All flora species observed across the site and within the plots, and their affinity with candidate communities.

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Acacia floribunda	x										
Acacia longifolia var. longifolia		x	x		x		Uninformative				
Acacia parramattensis		x		x	x						
Acacia saligna	x										
Acacia terminalis	x						Positive Diagnostic	Uninformative			
Acmena smithii				x	x						
Agapanthus praecox*	x										
Ageratina adenophora*				x		x					
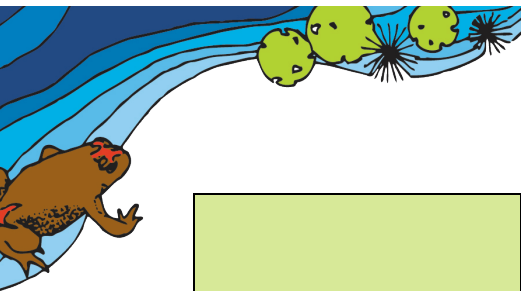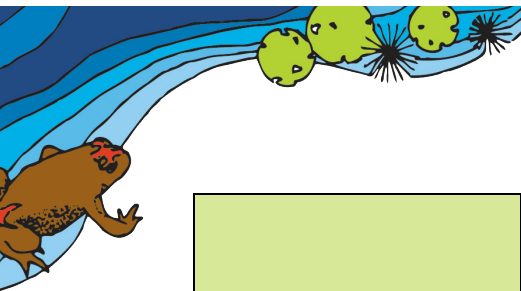
Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Albizia julibrissin *				x							
Allocasuarina torulosa				x							
Aloe vera *	x										
Angophora costata		x		x		x	Positive Diagnostic	Constant	Constant	Characteristic	
Anthoxanthum odoratum*				x							
Arbutus unedo *	x										
Archontophoenix alexandrae	x										
Aristea ecklonii *	x										
Asparagus aethiopicus*		x	x	x	x						
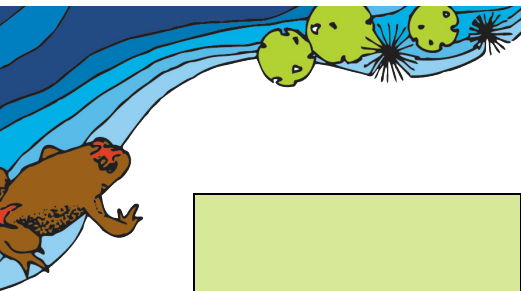
Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Asparagus densiflorus*	x										
Asplenium australasicum		x		x	x						
Banksia ericifolia						x	Positive Diagnostic	Positive Diagnostic	Constant	Characteristic	
Banksia serrata		x					Positive Diagnostic	Positive Diagnostic	Positive Diagnostic	Characteristic	
Bidens pilosa*						x					
Blechnum brasiliense *	x										
Briza subaristata*	x										
Bromus catharticus*	x										
Bryophyllum delagoense*		x									
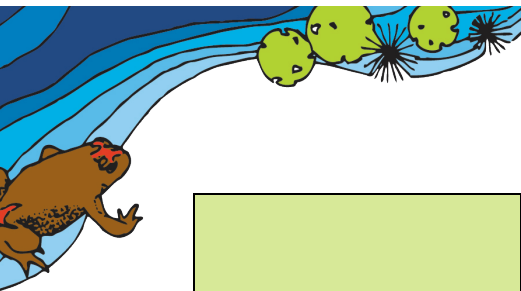
Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Buxus sempervirens *				x							
Calliandra sp. *	x										
Callistemon salignus	x										
Callistemon viminalis				x	x						
Callitriche stagnalis *	x										
Calochlaena dubia		x		x			Uninformative				
Camellia japonica *				x							
Camellia sasanqua *	x										
Capsella bursa-pastoris*			x		x						
Casuarina glauca				x							

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Cenchrus clandestinus *			x		x						
Centella asiatica	x										
Cestrum parqui*						x					
Chlorophytum comosum*				x		x					
Christella dentata				x		x					
Cinnamomum camphora*		x		x	x						
Clivia miniata*	x	x									
Commelina cyanea		x	x	x	x						
Conyza sumatrensis *		x	x		x						
Cordyline australis*				x							
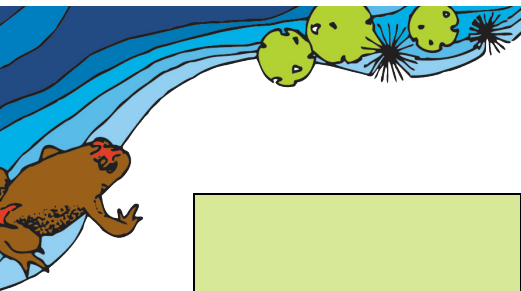
Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Cortaderia selloana*				x							
Corymbia citriodora	x										
Corymbia gummifera		x		x			Positive Diagnostic	Positive Diagnostic	Positive Diagnostic	Characteristic	
Cotoneaster sp *				x							
Cotula australis	x										
Cryptostylis sp.		x		x	x						
Cupaniopsis anacardioides		x			x						
Cupressocyparis leylandii *	x										
Cupressus sp*	x										

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Cyathea cooperi						x					
Cynodon dactylon			x		x						
Cyperus eragrostis*	x										
Davallia pyxidata	x										
Davallia solida var. pyxidata		x									
Delairea odorata*						x					
Dianella caerulea		x					Positive Diagnostic			Characteristic	
Dianella caerulea var. producta	x										
Dichondra repens			x		x						

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Dietes bicolor*				x							
Ehrharta erecta*		x	x	x	x	x					
Elaeocarpus reticulatus		x					Positive Diagnostic	Uninformative			
Empodisma minus		x					Positive Diagnostic				
Entolasia stricta		x					Positive Diagnostic	Constant	Positive Diagnostic	Characteristic	
Eriobotrya japonica*	x										
Erythrina X sykesii*						x					
Eucalyptus grandis		x	x	x	x						

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Eucalyptus resinifera		x									
Eucalyptus sieberi		x				x	Positive Diagnostic	Uninformative	Positive Diagnostic	Characteristic	
Fraxinus griffithii *	x										
Furcraea foetida *	x										
Gamochaeta purpurea *	x										
Geranium sp.	x										
Gleichenia dicarpa						x	Positive Diagnostic				
Gleichenia microphylla	x						Positive Diagnostic				

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Grevillea robusta		x									
Grevillea sp. (cultivar)				x							
Hakea salicifolia	x						Positive Diagnostic				
Hedera helix*				x							
Hedychium gardnerianum*		x									
Hibbertia scandens		x	x		x						
Hypochaeris radicata*			x		x						
Hypolepis muelleri		x									
Imperata cylindrica var. major	x								Uninformative		

| Species | Location | | | | | | Affinity with vegetation community / PCT | | | Affinity with Duffys Forest EEC | |
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Isolepis inundata	x										
Jacaranda mimosifolia*				x							
Juncus sp.	x										
Kennedia rubicunda	x										
Kunzea ambigua		x	x	x	x					Characteristic	
Lambertia formosa		x					Positive Diagnostic	Positive Diagnostic	Positive Diagnostic	Characteristic	
Lantana camara*		x	x	x	x	x					
Leptospermum petersonii	x										
Leptospermum polygalifolium		x					Positive Diagnostic				

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Ligustrum sinense*		x									
Lilium formosanum*		x									
Liquidambar styraciflua*				x							
Livistona australis	x										
Lolium multiflorum *	x										
Lomandra longifolia		x		x			Positive Diagnostic				
Lotus angustissimus *	x										
Magnolia grandiflora*	x										
Magnolia sp.*				x							

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Malva parviflora*			x		x						
Malvaviscus arboreus *	x										
Melaleuca bracteata	x										
Melaleuca quinquenervia	x										
Microsorum pustulatum	x										
Modiola caroliniana*	x										
Monstera deliciosa*	x										
Morus alba*	x										
Murraya paniculata*				x							
Nephrolepis cordifolia		x		x							

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Nothoscordum borbonicum*			x		x						
Ochna serrulata*	x										
Olea europaea*	x										
Oplismenus imbecillis		x		x		x					
Oxalis pes-caprae*			x		x						
Pandorea pandorana		x		x							
Passiflora edulis*		x									
Persicaria capitata*	x										
Persoonia linearis		x		x			Uninformative				
Philodendron sp. (cultivar)*	x										

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Phoenix roebelenii *	x										
Phyllostachys aurea*				x							
Phytolacca octandra*			x		x						
Pinus radiata*				x		x					
Pittosporum eugenioides*	x										
Pittosporum undulatum		x	x	x	x		Uninformative		Uninformative	Characteristic	
Plantago lanceolata*	x										
Platycladus orientalis*	x										
Plectranthus ornatus *	x										
Poa annua*	x										

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Prunus persica*	x										
Pteridium esculentum	x						Positive Diagnostic		Positive Diagnostic	Characteristic	
Pultenaea stipularis	x						Positive Diagnostic	Positive Diagnostic			
Rhaphiolepis indica*	x										
Rhododendron sp. *	x										
Rubus fruticosis sp. agg.*			x		x						
Salix babylonica*	x										
Salix sp*					x	x					

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Schoenus melanostachys						x	Positive Diagnostic				
Scutellaria racemosa *	x										
Senecio madagascariensis*			x		x						
Senna pendula var. glabrata*		x	x	x	x	x					
Sherardia arvensis *	x										
Smilax glyciphylla		x					Positive Diagnostic	Uninformative	Uninformative		
Solanum mauritianum*	x										
Solanum nigrum*			x		x						
Solanum pseudocapsicum*	x										

| Species | Location | | | | | | Affinity with vegetation community / PCT | | | Affinity with Duffys Forest EEC | |
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Sonchus oleraceus*	x										
Syagrus romanzoffiana*	x			x							
Syzygium australe	x										
Syzygium luehmannii	x										
Tecoma capensis*	x										
Todea barbara	x										
Trachelospermum jasminoides*	x										
Tradescantia fluminensis*	x			x							
Trifolium repens*			x		x						

Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Urtica urens *	x										
Veronica persica*	x										
Viola odorata*	x										
Westringia fruticosa	x										
Wisteria sinensis*	x										
Xanthorrhoea media		x					Positive Diagnostic	Positive Diagnostic	Positive Diagnostic	Characteristic	
Xanthosia pilosa		x					Positive Diagnostic	Uninformative			
Xanthosia tridentata	x						Positive Diagnostic	Positive Diagnostic	Positive Diagnostic		

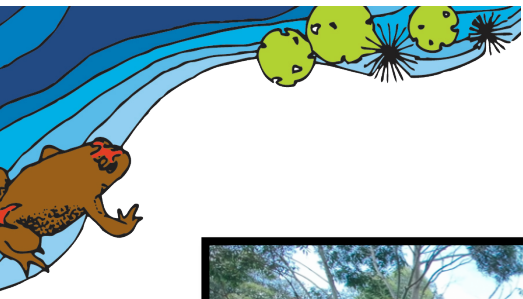| Species	Location						Affinity with vegetation community / PCT			Affinity with Duffys Forest EEC	
	Random Meander	BAM Plot 1	BAM Plot 2	Garden	Paddock	Degraded Forest	DSF09 (PCT1250)	DSF11 (PCT1783)	DSF14 (PCT1786)	Final Determination	Smith and Smith (2000)
Yucca sp. *	x										
Zantedeschia aethiopica*	x										

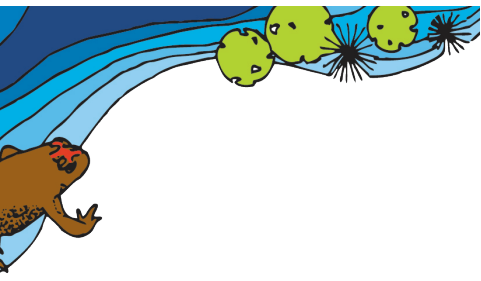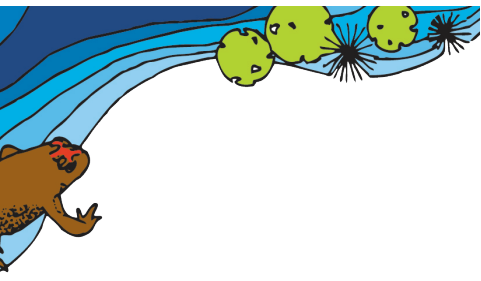Figure 6: BAM plot 1, located below the house and pool.

Figure 7: Looking into the horse paddock within which BAM plot 2 was located.

3.2   Vegetation type analysis

For a Small Areas Assessment, BAM 2020 requires only the dominant vegetation type to be identified. The vegetation of the lot comprises a mix of planted Australian native and exotic garden close to the house, weedy natural vegetation (mostly across the centre of the lot), and cleared paddock (for horses) at the rear with fringing woody vegetation around the paddock's edges.

BAM plot 1 was located within the central patch of natural vegetation, and BAM plot 2 was located at the rear, sampling the paddock and its surrounds.

Table 1 shows that BAM plots 1 and 2 contained 32 and 9 native species respectively.

Given the very low number of native species in BAM plot 2, the fact that they are a subset of native species in BAM plot 1, and the highly disturbed nature of the native vegetation in that part of the site, the data collected in BAM plot 2 were not relied upon to elucidate the Plant Community Type (PCT) present on site.

The vegetation analysis relies on the following set of procedures applied to the data collected from BAM plot 1:
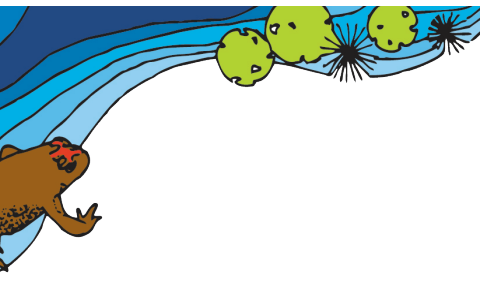
- Use of the PCT filter function available on the BioNet Vegetation Classification portal;
- Comparison of the plot data with the attributes ascribed to the most likely candidate PCTs in the BioNet Vegetation Classification portal;
- Consideration of extant vegetation mapping of the site and surrounds (OEH 2016) for additional candidate PCTs; and
- Use of the diagnostic tests defining the mapped vegetation communities as provided in *Native Vegetation of the Sydney Metropolitan Area* (OEH 2016) that are equivalent to each of the candidate PCTs.

It is noted that the adoption in June 2022 in BioNet of the Eastern NSW PCT Classification and the decommissioning of previous PCTs has imposed an additional level of complexity in determining the appropriate PCT for the site.

PCT Filter function. To identify candidate PCTs applicable to the sample BAM plot, the BioNet Vegetation Database was interrogated by filtering for the IBRA Bioregion (Sydney), the IBRA subregion (Pittwater), and all of the native species observed in BAM plot 1 (n = 32). This is the procedure required by the BAM.

This analysis returned 77 PCTs that matched both geographic variables and between 1 and 24 species of the 32 species entered. The top 5 PCTs, with matches of between 68% and 76% are:

- PCT 3592 Sydney Coastal Enriched Sandstone Forest (76% match);
- PCT 3595 Sydney Coastal Sandstone Gully Forest (76% match);
- PCT 3040 Sydney Coastal Foreshores Gully Rainforest (68% match);
- PCT 3176 Sydney Enriched Sandstone Moist Forest (68% match); and
- PCT 3594 Sydney Coastal Sandstone Foreshores Forest (68% match).

PCT 3040 comprises rainforest vegetation that occurs in sandstone gullies and sheltered escarpments fringing Sydney and Central Coast salt water lakes and harbours. The vegetation structure and geographic location of the site do not match these fundamental characteristics. Therefore, PCT 3040 is precluded from being further consideration as a candidate PCT.

PCT 3594 is similarly restricted to littoral zones and is therefore precluded from further analysis. Notably, with increased elevation and distance from waterways, PCT 3594 typically grades into PCT 3592, which is one of the three remaining candidate PCTs (3592, 3595, 3176).

<u>PCT descriptions.</u> To determine the applicability of the three remaining PCTs, the community profile details on the BioNet Vegetation Classification portal for these PCTs were examined and compared with the attributes in BAM plot 1.
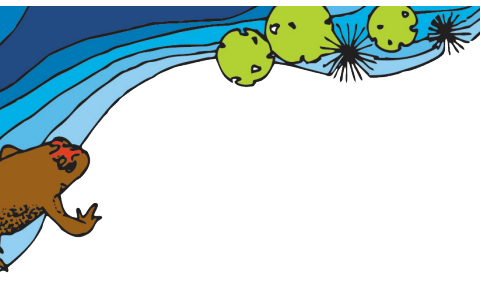
The species listed for each PCT are not further explored here, as each returned a high degree of coincidence with BAM plot 1 (68% and 76% matched), and therefore do not provide characters that can be relied upon to differentiate the PCTs. Instead, other variables were explored.

In summary, **PCT 3592** is described as:

- A tall to very tall shrubby sclerophyll open forest found on slightly enriched Hawkesbury sandstone soils on sheltered slopes and occasionally crests on the Sydney coastal sandstone plateaus.
- This PCT is primarily distributed at elevations of less than 200 metres ASL downslope of shale soils.
- It grades into a heathy forest PCT 3595 on rocky Hawkesbury sandstone gullies or moist shrub and fern forest PCT 3176 with increased shelter in deeper gullies.
- It is not associated with any Threatened Ecological Community (TEC).
- It is associated with a number of threatened flora and fauna species.
- This PCT has emerged from a complex split of previous PCTs 1841, 1778, and 1776. PCT 3592 has a strong relationship with PCTs 1778 and 1776, but only a weak relationship with PCT 1841.

In summary, PCT **3595** is described as:

- A tall to very tall heathy sclerophyll open forest associated with Hawkesbury sandstone gullies found along the eastern extent of the Sydney sandstone plateaus.
- This PCT is widespread and occurs at elevations of 40-410 metres ASL, and in higher coastal rainfall zones of over 1000 mm mean annual rainfall.
- On ridges and exposed slopes, it is replaced by sandstone heathy woodlands PCT 3590 south of Sydney and by PCT 3586 north of Sydney.
- It is not associated with any Threatened Ecological Community (TEC).
- It is associated with a number of threatened flora and fauna species.
- This PCT has emerged from a complex split of previous PCTs 1780, 1776, 1642, 1782, 1250, and 1183. PCT 3595 has a strong relationship with PCTs 1780, 1776, 1642, 1782, and 1250, but only a weak relationship with PCT 1183.

In summary, **PCT 3176** is described as:

- A very tall, occasionally extremely tall moist shrubby and ferny sclerophyll open forest found in enriched sandstone gullies of the Sydney coastal sandstone plateaus.
- This PCT is most extensively distributed within the low elevation gullies that incise the shale rich landscapes of the north shore of Sydney where rainfall exceeds 1100 mm per annum.
- However, the degree of shale influence and sheltering also sustains the persistence of the PCT in lower rainfall outliers near Campbelltown and Menai.
- This community grades into PCT 3592 on exposed adjoining slopes and occasionally into rainforest PCT 3038 in narrow bands along creek lines.
- PCT 3176 has an associated TEC, the Critically Endangered Ecological Community *Hygrocybae Community of Lane Cove Bushland Park.* However, this relates only to areas within the catchment of Gore Creek including Lane Cove Bushland Park.
- It is associated with a number of threatened flora and fauna species.
- This PCT has emerged from a single split of previous PCT 1841, albeit with a weak relationship. The remaining half of residual PCT 1841 plots have been reassigned to PCTs 3592, 3230, and 3040.

Based on these descriptions, the best candidate PCT is PCT 3595. PCT 3592 and 3176 are both reliant on an influence of upslope shale, and there is no evidence of shale occurring in the ridgeline of which the site is a part. The four nearest soil profile reports[3] detail evidence of alluvial sand in one and laterite / ironstone in others, but no shale or shale influences were detected.

Map interrogation. The vegetation map of the site and buffer area produced by OEH (2016) is reproduced at Figure 8. The PCTs shown are the now decommissioned PCTs, arising from a classification based on vegetation communities.

In general, the dominant vegetation types mapped in the assessment area are PCT 1250 and PCT 1783. These occur along the east and west facing slopes on either side of the central ridge. The broad ridge supports small fragmented patches of PCT 1786. More restricted vegetation types are PCT 1824, PCT 1841, and PCT 1803, associated with more restricted habitat features such as skeletal soils, riparian zones, or swamps.

The subject site is shown as supporting one of the small patches of PCT 1786, which is equivalent to the Endangered Ecological Community (EEC) Duffys Forest.[4] PCT 1824 is mapped along the southern and western boundaries of the subject lot, with PCT 1250 nearby.

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[3] Soil profile numbers 69 (Linden Avenue Belrose), 824 (Hakea Avenue Belrose), 950 (Forest Showground Belrose), and 949 (Corner Adams St and Forest Way Belrose), available at eSpade website (https://www.environment.nsw.gov.au/eSpade2Webapp/#)

[4] Notably, this patch reflects the shape of the Biodiversity Values map polygon on stie – see Figure 3. Given the equivalence of PCT 1786 and Duffys Forest EEC, it is presumably the catalyst for its inclusion on the BV map.

<u>Diagnostic tests.</u> Due to the scale of the project (covering the entire Sydney metropolitan area), much of the mapping by OEH (2016) was based primarily on interpretation of aerial photograph patterns, with little to no ground-truthing on private land. Therefore, mapping errors are common, most particularly in the classification of small and disturbed patches in urbanised landscapes such as on the subject lot.

Thus, the potential that the vegetation of the subject site has been classified as PCT 1786 in error is further explored, with the focus being on the four PCTs mapped on and around the site and in similar topographic positions nearby.

Multivariate analysis of this large data set allowed for the definition of a set of diagnostic species for each of the vegetation communities recognised (OEH 2016). Each diagnostic species has been assigned to a "fidelity class", reflecting the influence that its presence has on delineating one vegetation community from another.

There are 3 fidelity classes (OEH 2016):

a. <u>Positive diagnostic</u> – species that have a higher probability of occurring in the target community. Their frequency of occurrence in the target community is greater than that across the whole data set, and less than 0.1 % per cent likelihood to have occurred by chance alone.

b. <u>Constant</u> – species that are characteristic of the target community as well as other communities, and occur with a frequency in the target group of at least 35%, and are not already identified as a positive diagnostic species.

c. <u>Uninformative</u> – these species have been included to provide a fuller description of the community and are restricted to those species with a frequency of occurrence of greater that 10%, but are not recognised as constant or positive diagnostic species.

For each vegetation community in the Sydney Metropolitan data set, an estimate has been made (at the 95% confidence interval) of the minimum number of Positive Diagnostic species expected to occur in a 0.4 hectare sample site of the community (the standard size for the floristic component of a BAM plot). This is called a **diagnostic test** and can only be applied reliably when the total number of native species recorded in the sample site exceeds a specified minimum, which is derived for each community and is based on the mean native species richness of each communit

LEGEND

PCT 1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion

PCT 1780 Sydney Peppermint / Coachwood - Water Gum open forest in protected sandstone gullies around Sydney and the Central Coast

PCT 1783 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast

PCT 1786 Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region

PCT 1803 Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin

PCT 1824 Mallee - Banksia - Tea-tree - Hakea heathwoodland of the coastal sandstone plateaus of the Sydney basin

PCT 1841 Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region

PCT 1845 Smooth-barked Apple - Red Bloodwood - Blackbutt tall open forest on shale sandstone transition soils in eastern Sydney
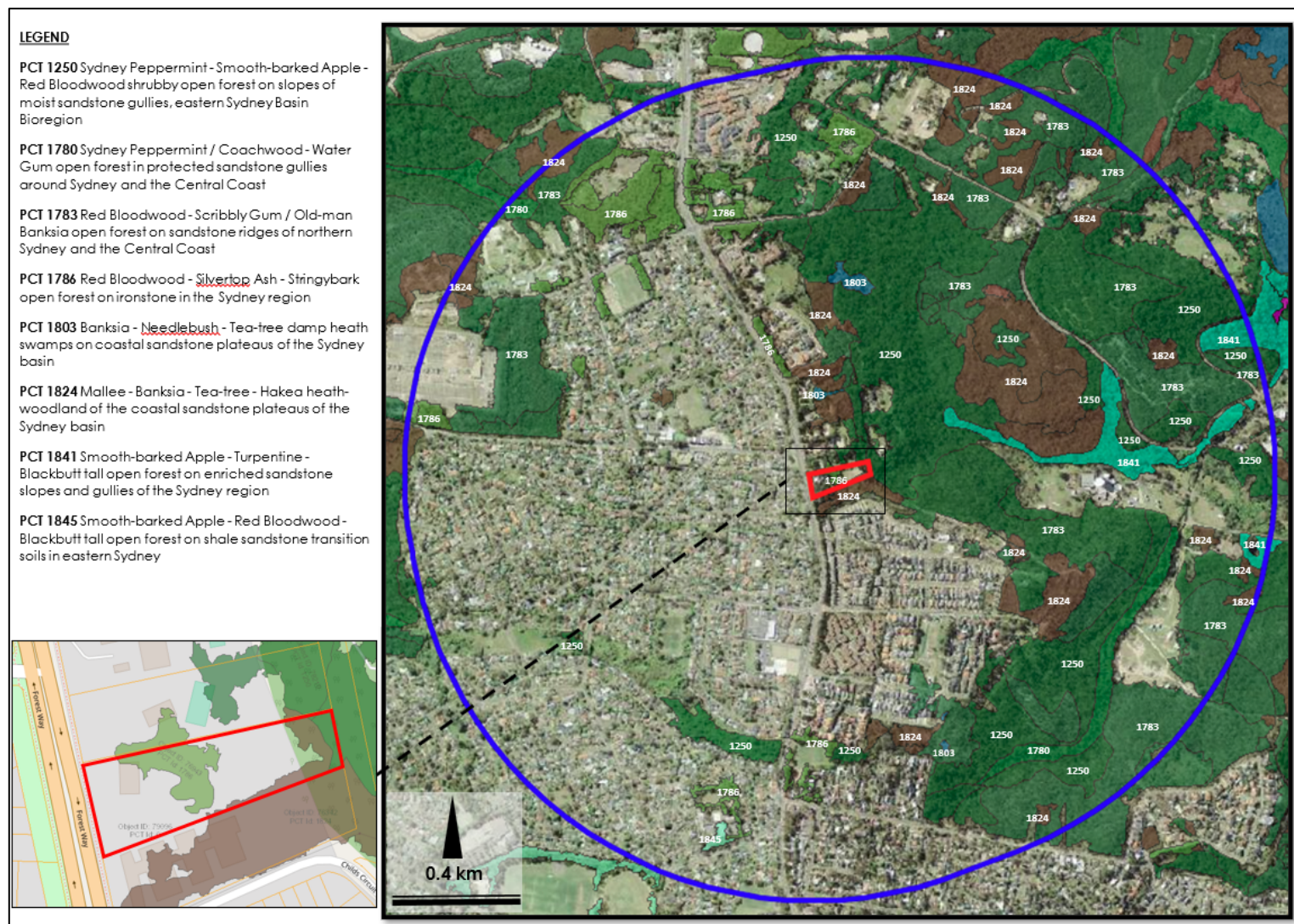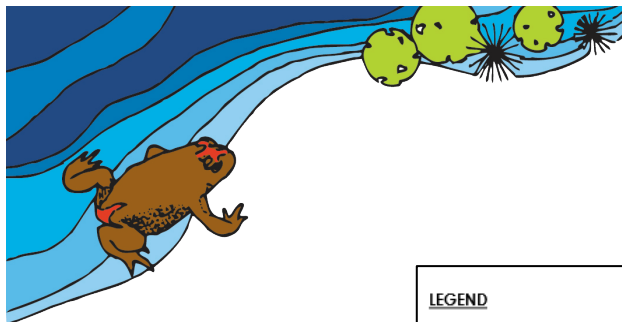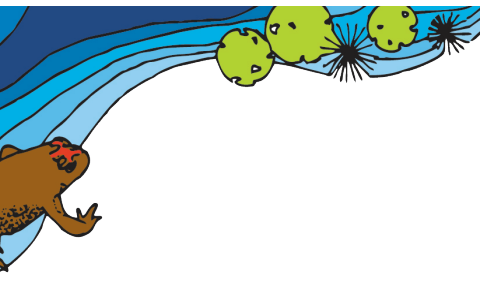
Figure 8: Native vegetation mapped by OEH (2016) within the 1.5 km buffer area.

The technical reports that accompany the vegetation map reproduced at Figure 8 detail the vegetation community-PCT equivalencies, with the 4 (now decommissioned) PCTs of interest being:

- PCT 1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion is equivalent to the vegetation type S_DSF09 Coastal Sandstone Gully Forest;
- PCT 1783 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast is equivalent to the vegetation type S_DSF11 Sydney North Exposed Sandstone Woodland;
- PCT 1786 Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region is equivalent to the vegetation type S_DSF14 Sydney Ironstone Bloodwood-Silvertop Ash Forest; and
- PCT 1824 Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin is equivalent to the vegetation type S_HL08 Coastal Sandstone Heath-Mallee.
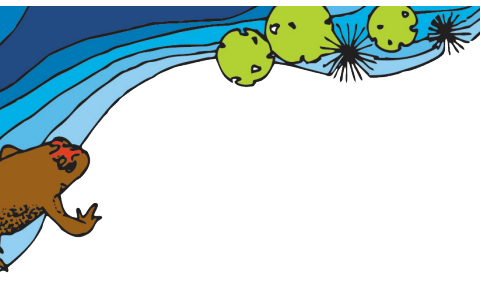
The natural vegetation on site exhibits the structure of a forest - open forest or woodland. Heathland and mallee-form trees were not in evidence on site and so PCT 1824 is therefore not explored further.

PCTs 1250, 1783, and 1786 are analysed below, by applying the diagnostic tests appropriate for their vegetation community equivalents to the data collected in BAM plot 1. The relevant fidelity classes for each of the native species observed are provided in Table 1, and the thresholds and results in Table 2.

Table 2: Diagnostic tests per OEH (2016) for the vegetation communities potentially present.

Candidate community	Thresholds		BAM plot 1	
	# Native spp	# Positive Diagnostic spp	# Native spp	# Positive Diagnostic spp
S_DSF09 (PCT 1250)	≥45	≥32	32	14
S_DSF11 (PCT 1783)	≥42	≥29	32	4
S_DSF14 (PCT 1786)	≥41	≥27	32	6

These data indicate that the diagnostic tests cannot be strictly applied because the initial threshold of the number of native species recorded is not reached: there were only 32 native species in the plot, where the minimum number needs to be 45, 42, or 41 for PCTs 1250, 1783, and 1786 respectively.

However, notwithstanding that the pool threshold number falls short, the numbers are still quite high for PCT 1250. The BAM plot reached 71% of the minimum species pool (32 species of a minimum of 45), within which almost half (44% or 14 of the required 32) of Positive Diagnostic species were observed. In addition, 4 Uninformative species attributable to PCT 1250 occurred in BAM plot 1.

By comparison, the thresholds for the other candidate PCTs fell much shorter. For PCT 1783, the plot had 78% of the pool threshold, but only 15% of the Positive Diagnostic species; and for PCT 1786 the same statistics were 76% and 21%.

Duffys Forest EEC Final Determination. PCT 1786 is shown by the OEH (2016) mapping as occurring on site. This PCT is equivalent to Duffys Forest endangered ecological community and its identification in the OEH (2016) mapping is presumably driving the Biodiversity Values layer. Therefore, in addition to the analysis above, the vegetation data were compared with the legal and scientific definitions of this endangered ecological community.

The features that define this community per the Final Determination (NSW Scientific Committee 2002) are shown in Table 3, with a response regarding the compliance of the site's vegetation.
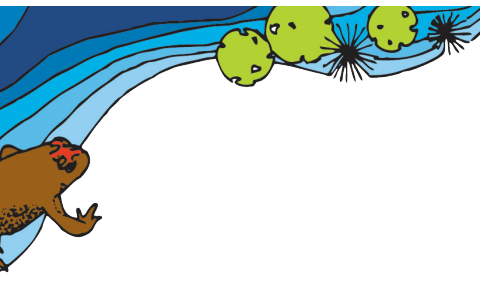
Table 3: Duffys Forest EEC.

Diagnostic feature	Site compliance
Occurs on the ridgetops, plateaus, upper slopes and occasionally mid slopes on Hawkesbury sandstone geology.	✓
Typically in association with laterite soils and soils derived from shale and laminite lenses	✗
It has the structural form predominantly of open-forest to woodland.	✓
Characterised by a listed assemblage of vascular plant species.	Partial ✓ Of the 73 native species observed on the subject lot, only 12 are listed as characteristic of the EEC (see Table 1). Of those 12 species, only *Kunzea ambigua* is not shared with any of the other candidate vegetation types.
A list of diagnostic plant species for Duffys Forest Ecological Community give and descriptions how the community can be distinguished from surrounding ecological communities are provided in Smith and Smith (2000).	✗ Not one of the diagnostic species listed by Smith and Smith were recorded in the BAM plot or anywhere on site.
The endangered shrub *Grevillea caleyi* is largely restricted to Duffys Forest Ecological Community though it is not present at all locations of the community. Other threatened plant species known from the community include *Persoonia hirsuta*, *Tetratheca glandulosa*, *Pimelea curviflora* var. *curviflora*, *Epacris purpurascens* var. *purpurascens.*	✗ None of these associated threatened species were recorded on site.

These data do not indicate that Duffys Forest EEC as the best-fit for the classification of the site's vegetation.

In summary, all of the investigations undertaken indicate that the vegetation on site is more like PCT 1250 than the other PCTs explored. This conclusion is supported by both quantitative and qualitative analysis, although it does not have statistical rigour. The lack of sufficient native species to confidently assign communities based on these data is likely to be greatly influenced by the long history of disturbances to the site.

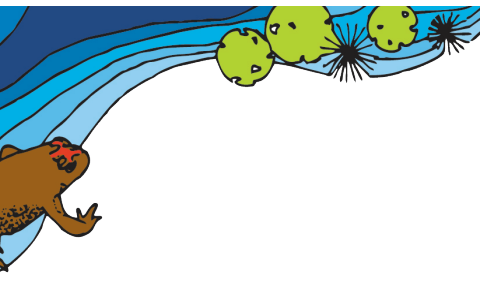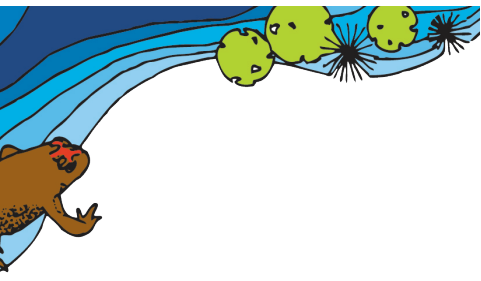The outcome of the vegetation analysis is summarised in Table 4.

Table 4: Vegetation classification.

Variable	Response
PCT	PCT 1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion. This is now decommissioned and is equivalent to PCT 3595 Sydney Coastal Sandstone Gully Forest.
Vegetation Formation	Dry Sclerophyll Forest (shrubby sub-formation).
Vegetation Class	Sydney Coastal Dry Sclerophyll Forest.
Estimate % cleared value of PCT	30%
TEC status	No associated TEC.
Extent (ha) identified within subject lot	0.49 ha, plus 0.17 ha in adjacent property to the north.
Short list of PCTs identified through VIS assessment	• PCT 3592 Sydney Coastal Enriched Sandstone Forest. • PCT 3595 Sydney Coastal Sandstone Gully Forest. • PCT 3040 Sydney Coastal Foreshores Gully Rainforest. • PCT 3176 Sydney Enriched Sandstone Moist Forest. • PCT 3594 Sydney Coastal Sandstone Foreshores.
Other resources relied upon	• OEH (2016) The Native Vegetation Sydney of the Metropolitan Area Volume 2: Vegetation Community Profiles. Version 3.0. • NSW Scientific Committee (2002) Duffys Forest endangered ecological community listing - Final Determination. • Peter Smith and Judy Smith (2000) Survey of Duffys Forest Vegetation Community. Report to NSW National Parks and Wildlife Service and Warringah Council. • Soil profile numbers 69 (Linden Avenue Belrose), 824 (Hakea Avenue Belrose), 950 (Forest Showground Belrose), and 949 (Corner Adams St and Forest Way Belrose), available at eSpade website (https://www.environment.nsw.gov.au/eSpade2Webapp/#)

3.3 Vegetation integrity assessment

Vegetation across the subject Lot comprises one Vegetation Zone (VZ 1) that qualifies for analysis within the BAM-C:

- VZ 1 – PCT 1250 Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion. It occupies approximately 0.50 ha on the subject lot with an additional 0.26 ha in adjacent properties within the proposed APZ.

Its extent is shown in Figure 5 and a typical depiction shown in Figure 6.

The data from BAM plot 1 were used to calculate the Vegetation Integrity (VI) of VZ 1.

For VZ 1, the overall VI score calculated from BAM plot 1 is 28.6 and is based on the component scores for:

- Composition = 45.6
- Structure = 13.3
- Function = 38.7 (with no hollow-bearing trees)

The underlying data that produced these Vegetation Integrity statistics are shown in Table 5.
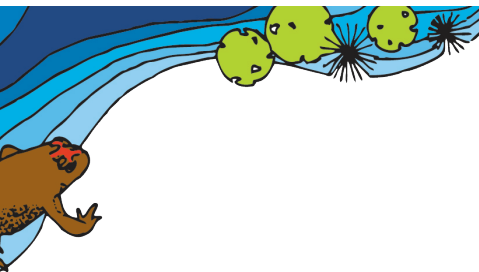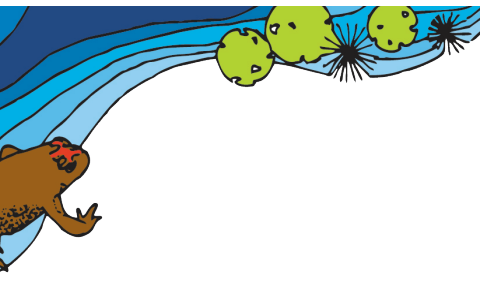
Table 5: Vegetation integrity data (BAM Plot 1).

| COMPOSITION						
Composition condition score = 45.6						
Item	Tree	Shrub	Grass and grass-like	Forb	Fern	Other
Benchmark	7	28	9	8	2	5
Observed mean ($\bar{x}$)	8	7	4	4	5	4
Unweighted composition score (UCS_i)	100	14.6	48.6	59.1	100	94.9
Weighted composition score (WCS_i)	11.9	6.9	7.4	8	3.4	8
Dynamic weighting (w_i)	0.12	0.47	0.15	0.14	0.03	0.08
STRUCTURE						
Structure condition score = 13.3						
Item	Tree	Shrub	Grass and grass-like	Forb	Fern	Other
Benchmark	45	68	36	5	1	4
Observed mean ($\bar{x}$)	16.8	10.4	2.6	1.4	22.1	0.5
Unweighted structure score (USS_i)	34.9	4.5	0.7	18.9	100	2.7
Weighted structure score (WSS_i)	9.9	1.9	0.2	0.6	0.6	0.1
Dynamic weighting (w_i)	0.28	0.43	0.23	0.03	0.01	0.03
FUNCTION						
Function condition score = 38.7						
Item	Number of large trees	Litter cover	Length of fallen logs	Stem size class	Tree regeneration <5cm diameter	High threat weed cover
Benchmark	3	62	47	4	Present	
Observed mean ($\bar{x}$)	1	48	0	4	0	20.1
Weighted function score (WFS_i)	9.7	14	0	15	0	
Weighting (w_i)	0.35	0.15	0.2	0.15	0.15	

Biodiversity offsets must be determined for proposed impacts to each vegetation zone as per Section 9.2.1 of the BAM where vegetation zones have a VI score of:

- ≥15, where the PCT is representative of an EEC or a CEEC
- ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community
- ≥20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

Therefore, as VZ 1 has a VI of 28.6 and provides habitat for threatened species, impacts to VZ 1 will generate offset obligations.
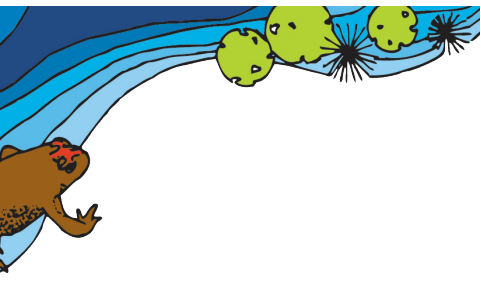
4. Threatened species

Section 5 of BAM 2020 details the process for determining the habitat suitability for threatened species. For the purposes of assessing impact and offset obligations under the BAM, threatened species are separated into two types, 'ecosystem' and 'species' credit species

- **Ecosystem credit species** are those threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The Threatened Biodiversity Data Collection (TBDC) identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species; and
- **Species credit species** are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the subject land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present.

Some threatened species may be identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit. The following sections outline the process for determining the habitat suitability for threatened species within the subject lot and development area, and the results of targeted surveys for candidate threatened species.

Background information was gathered on threatened species known to occur in the local area, comprising an interrogation of BioNet for threatened species recorded within 10 kilometres of the site, further filtered to a buffer area of 1.5 kilometres radius. This was combined with expert habitat assessment of the site and surrounds, and targeted survey where appropriate and possible.

4.1 Predicted species

A list of predicted ecosystem credit species derived from the BAM-C is provided in Table 6. All but two species were retained for the analysis, as habitat attributes relevant to each are present and they therefore could not reasonably be excluded.

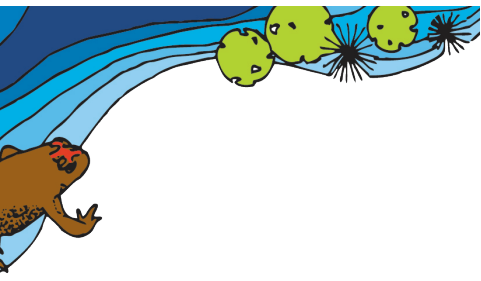No additional predicted species were included in the BAM-C.

Table 6: Predicted threatened species

Species (Habitat element)	Geographic Limitations	Habitat Constraints	Sensitivity to gain
Anthochaera phrygia Regent Honeyeater (foraging)			High
Artamus cyanopterus cyanopterus Dusky Woodswallow			Moderate
Callocephalon fimbriatum Gang-gang Cockatoo (foraging)			Moderate
Calyptorhynchus lathami Glossy Black-Cockatoo		Presence of *Allocasuarina* and *Casuarina* species	Moderate
Daphoenositta chrysoptera Varied Sittella			Moderate
Dasyurus maculatus Spotted-tailed Quoll			High
Falsistrellus tasmaniensis Eastern False Pipistrelle			High
Glossopsitta pusilla Little Lorikeet			High
Haliaeetus leucogaster White-bellied Sea Eagle (foraging)		Waterbodies Within 1 kilometre of a river, lake, large dam, creek, wetlands and coastlines	High
Hieraaetus morphnoides Little Eagle (foraging)			Moderate
Hirundapus caudacutus White-throated Needletail			High
Hoplocephalus bungaroides Broad-headed Snake (foraging)			High
Lathamus discolor Swift Parrot			Moderate
Lophoictinia isura Square-tailed Kite (foraging)			Moderate
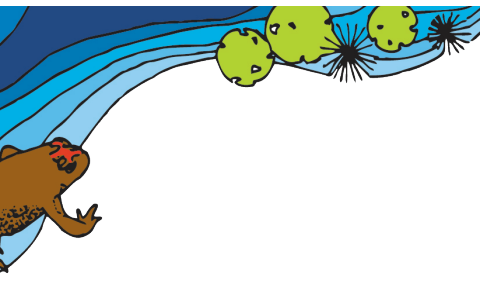
Species (Habitat element)	Geographic Limitations	Habitat Constraints	Sensitivity to gain
Micronomus norfolkensis Eastern Coastal Free-tailed Bat			High
Miniopterus australis Little Bent-winged Bat			High
Miniopterus orianae oceanensis Large Bent-winged Bat			High
Neophema pulchella Turquoise Parrot			High
Ninox connivens Barking Owl			High
Ninox strenua Powerful Owl			High
Pandion cristatus Eastern Osprey (foraging)			Moderate
Petroica boodang Scarlet Robin			Moderate
Petroica phoenicea Flame Robin			Moderate
Phoniscus papuensis Golden-tipped Bat			High
Pseudomys novaehollandiae New Holland Mouse			High
Pteropus poliocephalus Grey-headed Flying-fox			High
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat			High
Scoteanax rueppellii Greater Broad-nosed Bat			High
Tyto novaehollandiae Masked Owl (foraging)			High
Varanus rosenbergi Rosenberg's Goanna			High
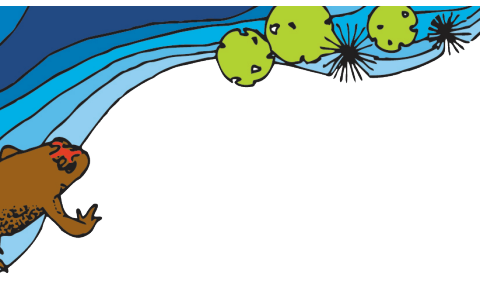
Ixobrychus flavicollis **Black Bittern** was excluded from the Predicted Threatened species as its habitat constraints were not present on site or within the required buffer, being:

- Waterbodies; and / or
- Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation.

Petaurus australis **Yellow-bellied Glider** was excluded from the Predicted Threatened species as its habitat constraints were not present on site or within the required buffer, being:

- Hollow-bearing trees; and
- Hollows >25 cm diameter.

4.2 Candidate species

The potential candidate threatened species are detailed in Table 7, and have arisen from them being associated with PCT 1250, the vegetation type that occurs in the development area.

A number of species have been excluded as Candidate species for the purposes of the BAM-C, and the justifications for these exclusions are provided below.

Allocasuarina portuensis **Nielsen Park She-oak.** The geographic limitations for this species require the site to be east of the Gladesville Bridge and within 5 km of the Sydney Harbour foreshore. The development site is north east of the bridge and at least 12 km from the foreshore. The status of this species was assessed by Silcock et al (2020) in their comprehensive expert review of the likelihood of extinction of Australia's vascular flora. *Allocasuarina portuensis* was the only species concluded to be "Almost certainly extinct" in the wild. This species persists now only as translocated plants at a number of locations within its presumed original natural distribution.

It is therefore excluded as a Candidate species and generates no offset obligation.

Anthochaera phrygia **Regent Honeyeater.** The Threatened Biodiversity Data Collection (TBDC) indicates that this species is a potential candidate species if there is mapped important habitat present or "other", which presumably is the presence of a suitable PCT.

The mapped Important Areas have been based firstly on those areas identified in The National Recovery Plan (Commonwealth of Australia 2016) as critical to the survival of the species. These were then refined to only include areas of suitable habitat based on expert opinion and PCTs associated with the species. In addition, a comprehensive dataset was assembled from all other available datasets and expert opinion of historic, unrecorded breeding. Records were superimposed on the refined areas and all woodland vegetation within 200m of a record was added. Any records of known breeding events that occurred outside of the polygons created above were identified. Radial buffers of either 1 kilometre or 5 kilometres were applied (depending on the frequency of breeding events at the location). All woodland vegetation was selected within 1 kilometre buffers,
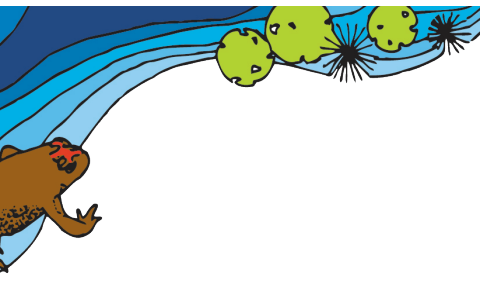
while within 5 kilometre buffers, only PCTs associated with the species were selected, except for woodland vegetation within 200 metres of a record when all such vegetation was mapped.

That thorough examination of habitat for this species did not identify any such Important Areas on or near the site. Important areas for this species have been identified around its breeding stronghold at Capertee Valley, in the Upper Hunter, Lower Hunter, and near Warragamba Dam.

Therefore, it is a potential Candidate species due to an association with PCT 1250.
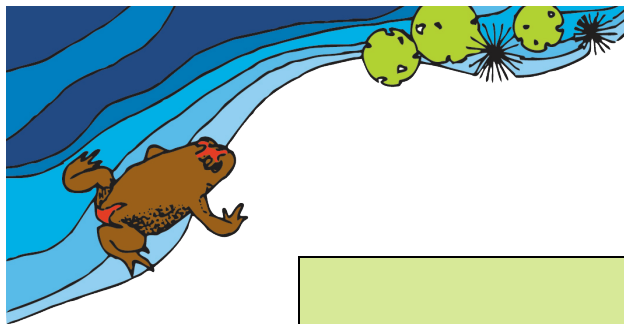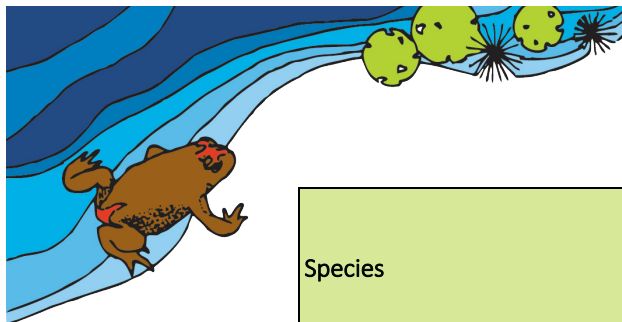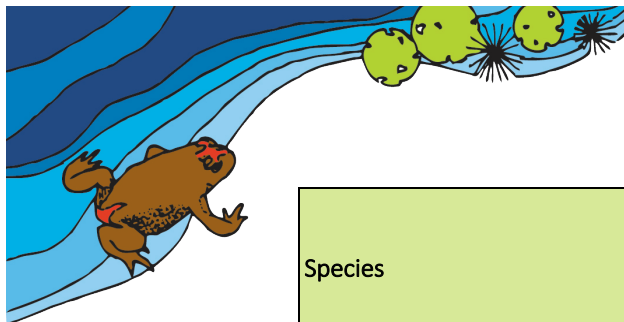
Table 7: Candidate threatened species.

Species	SAII	Sensitivity to Gain	BAM-C analysis		Category of reasons for exclusion	Presence		
			Include	Exclude		Yes (surveyed)	Yes (assumed)	No (surveyed)
Allocasuarina portuensis Nielsen Park She-oak	Yes	High		✓	Geographic limitation	Not applicable		
Anthochaera phrygia Regent Honeyeater	Yes	High		✓	Site not in mapped area	Not applicable		
Asterolasia elegans	Yes	Moderate	✓					✓
Astrotricha crassifolia	Yes	Very High	✓					✓
Caladenia tessellata Thick Lip Spider Orchid	Yes	Moderate	✓					✓
Camarophyllopsis kearneyi	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Chalinolobus dwyeri Large-eared Pied Bat	Yes	Very High	✓				✓	
Darwinia peduncularis	Yes	High	✓					✓
Deyeuxia appressa	Yes	High		✓	Habitat degraded	Not applicable		
Grevillea shiressii	Yes	Moderate		✓	Geographic limitation	Not applicable		
Haloragodendron lucasii	Yes	Very High	✓					✓
Hibbertia spanantha Julian's Hibbertia	Yes	High	✓					✓

Species	SAII	Sensitivity to Gain	BAM-C analysis		Category of reasons for exclusion	Presence		
			Include	Exclude		Yes (surveyed)	Yes (assumed)	No (surveyed)
Hoplocephalus bungaroides Broad-headed Snake	Yes	Very High		✓	Habitat constraint	Not applicable		
Hygrocybe anomala var. ianthinomarginata	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe aurantipes	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe austropratensis	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe griseoramosa	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe lanecovensis	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe reesiae	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Hygrocybe rubronivea	Yes	High		✓	Habitat constraint Geographic constraint	Not applicable		
Lathamus discolor Swift Parrot	Yes	Moderate		✓	Site not in mapped area	Not applicable		
Melaleuca deanei Deane's Paperbark	Yes	Very High	✓					✓

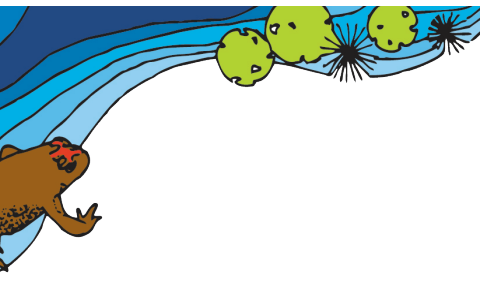| Species	SAII	Sensitivity to Gain	BAM-C analysis		Category of reasons for exclusion	Presence		
			Include	Exclude		Yes (surveyed)	Yes (assumed)	No (surveyed)
Miniopterus australis Little Bent-winged Bat	Yes	Very High		✓	Habitat constraint	Not applicable		
Miniopterus orianae oceanensis Large Bent-winged Bat	Yes	Very High		✓	Habitat constraint	Not applicable		
Persoonia hirsuta Hairy Geebung	Yes	High	✓					✓
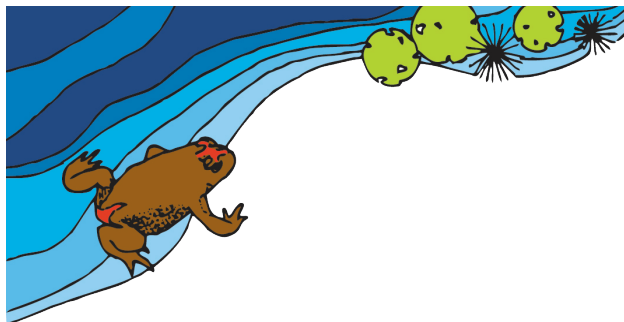
Table 8: Fungi Candidate threatened species and associated PCTs.

Candidate species	Associated PCT																							
	3024	3025	3028	3030	3035	3037	3038	3039	3040	3041	3043	3047	3064	3098	3116	3118	3137	3138	3139	3140	3164	3165	3176	3209
Camarophyllopsis kearneyi							✓	✓	✓	✓													✓	
Hygrocybe anomala var. ianthinomarginata	✓					✓	✓	✓	✓	✓	✓	✓					✓	✓					✓	
Hygrocybe aurantipes						✓	✓	✓	✓	✓	✓						✓	✓		✓	✓		✓	✓
Hygrocybe austropratensis						✓	✓	✓	✓	✓	✓												✓	
Hygrocybe griseoramosa						✓	✓	✓	✓	✓													✓	
Hygrocybe lanecovensis						✓	✓	✓	✓	✓													✓	
Hygrocybe reesiae		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓					✓						✓	
Hygrocybe rubronivea					✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓			✓	✓	

Although it is a generalist forager, the Regent Honeyeater feeds mainly on nectar from relatively small number of eucalypts that produce high volumes of nectar, such as in the Spotted Gum forests of the Hunter or on some mistletoes. The Sydney area in general has not been recognised as an important area for this species, and records are few and patchy through time and space. This is undoubtedly partially due to the high degree of urbanisation and the resultant fragmentation of habitat.

Despite the presence of some winter-flowering plant species on site (e.g. *Banksia ericifolia*) and the potential for lerps to be present, the available habitat is considered generally unsuitable for the Regent Honeyeater as it does not support any of its preferred foraging species and is located within an urban area. Although the BioNet database contains 81 records of this species from within 10 kilometres of the development site dating from the last 20 years, this number is hyper-inflated by 78 observations of the same group of 3 or 4 juveniles reported by enthusiastic birdwatchers in Ku-ring-gai Chase National Park in 2014. Otherwise, the pattern of occupation of the broader study area in the recent and historical data sets is of an occasional single bird, sometimes as part of a group of other honeyeaters, but always within large expanses of bushland.

Although technically suitable in that the vegetation on site is equivalent to a disturbed example of PCT 1250, this species is considered unlikely to occur on site. It is therefore excluded as a Candidate species and generates no offset obligation.

Camarophyllopsis kearneyi, Hygrocybe anomala var. ianthinomarginata, Hygrocybe aurantipes, Hygrocybe austropratensis, Hygrocybe griseoramosa, Hygrocybe lanecovensis, Hygrocybe reesiae, and Hygrocybe rubronivea. This suite of threatened species has arisen from the endangered fungal community recognised at Lane Cove Bushland Park. The habitat constraints detailed within the TBDC capture all moist habitats (e.g. gullies, creeks, swamps, etc.) or areas within 500 m of such habitats. This very broad buffer captures vegetation types and environments that are unsuitable for these species, as is the case in this BDAR.
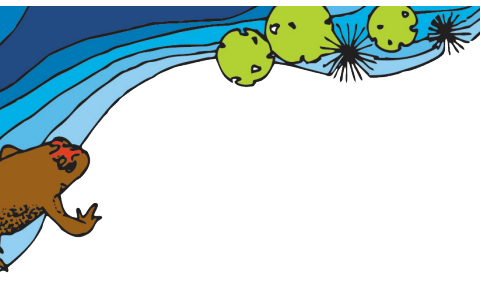
Being a dry east-facing slope, the site does not support suitable environments for these species. Moreover, the PCT identified on site[5] is not among any of the 24 PCTs associated with these species, detailed in Table 8.

Given the absence of suitable micro habitat and the absence of any of the 24 associated PCTs, all of the threatened fungal species above have been excluded as Candidate species and generate no offset obligation.

Deyeuxia appressa. According to the TBDC, this species is only known only from two locations (south of Bankstown and Killara) from specimen collected in 1930 and 1941. The ecological profile for this species in the TBDC states that it may now be extinct, particularly given the degree of habitat loss and development in the metropolitan areas within which it had been found. Under the *Biodiversity Conservation Act 2016*:

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[5] PCT 1250 Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion in the old system, which is equivalent to PCT 3595 Sydney Coastal Sandstone Gully Forest in the current system.

"(1) A species is eligible to be listed as an extinct species at a particular time if, in the opinion of the Scientific Committee, there is no reasonable doubt that the last member of the species in Australia has died.

(2) A species is eligible to be listed as a species extinct in the wild at a particular time if, in the opinion of the Scientific Committee—

(a) it is known only to survive in Australia in cultivation, in captivity or as a naturalised population well outside its past range, or

(b) it has not been recorded in its known or expected habitat in Australia, despite targeted surveys, over a time frame appropriate, in the opinion of the Scientific Committee, to its life cycle and form."
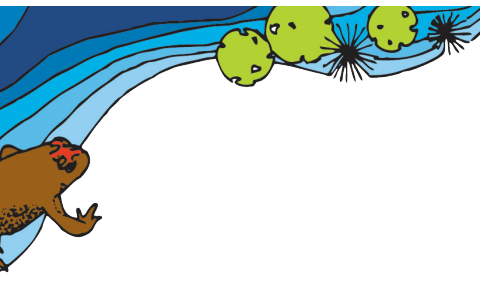
This declaration has not been made, and there is no published Final Determination from the NSW Scientific Committee for this species. However, there is good evidence to suggest that the status of this species needs to be reviewed:

- It has not been collected for over 80 years;
- This species has been a listed threatened entity for 27 years and therefore has been formally addressed in impact assessments over that period;
- The absence of records for over 80 years is despite a great deal of survey within its known natural distribution;
- The survey and assessment work undertaken within its known natural distribution has been both extensive – covering all habitats and communities (e.g. the mapping of natural vegetation across the Sydney metropolitan area) – and intensive (e.g. site-based survey for countless individual Development Applications); and
- Habitats within its known natural distribution has been subject to profound disturbance as part of post-World War 2 urbanisation;

The most recent expert review of the status of Australia's threatened flora species (Silcock et al. 2021, Silcock et al. 2020) listed *Deyeuxia appressa* as "Probably extinct". These publications relied upon a "transparent and uniform ecological framework for assessing plant extinctions, underpinned by expert knowledge of species and habitats".

This recent methodology and the conclusions arising from it are yet to be reflected in the listing of *Deyeuxia appressa* in NSW. Nonetheless, the ramification of this status can be recognised in individual BDAR assessments and in this case *Deyeuxia appressa* has been excluded as a Candidate Species, and generates no offset obligation.

Grevillea shiressii. This species is restricted to the Central Coast Local Government Area. This geographic limitation excludes it from consideration as a Candidate species and it generates no offset obligation.

Hoplocephalus bungaroides Broad-headed Snake. The habitat constraints identified for this species are associated with the geological features of the site, specifically being "rocky areas including escarpments, outcrops and pagodas within the Sydney Sandstone geologies". However, while these features are critical, they do not describe the specific features of the rocky areas that are essential for the presence of this species. The Broad-headed Snake is a habitat specialist, sheltering and foraging beneath loose rocks that sit on top of other rocks in exposed situations. Its main prey species (the Velvet Gecko) also relies on this specialised type of habitat. The removal and disturbance of such rocks by bush rock collectors, cairn builders, reptile poachers, and vandals have all been identified as major contributors to the decline of this species (Webb and Shine 1998, Shine et al. 1998, Webb et al. 2002, Newel and Goldingay 2005).

The house and garden sit atop the sandstone rock outcrop on site, and loose rocks were not observed. The absence of suitable shelter rocks is likely due to their past collection and use in landscaping of the site. For example, a low wall has been built in the horse paddock from rocks sourced on site (see Figure 7).

It is considered therefore that despite the presence of rocky areas the habitat constraints for this species apply. It is on this basis that this species has been excluded as a Candidate species and generates no offset obligation.

Lathamus discolor Swift Parrot. The TBDC indicates that this species is a potential candidate species if there is mapped important habitat present or "other", which presumably is the presence of a suitable PCT. The Swift Parrot migrates from its breeding habitat in Tasmania and overwinters on the mainland; therefore, the presence of winter forage is essential for this species.
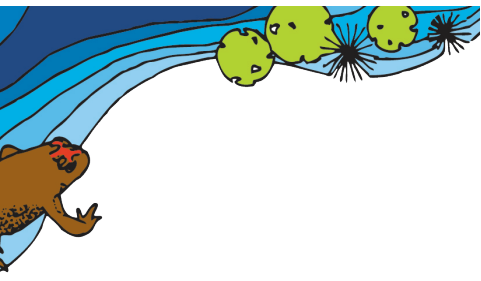
Important Areas were based firstly on a 2 kilometre radial buffer applied to all verified records of the Swift Parrot from 1990 to 2018. Then, areas with sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds, were identified as Important for the species. The NSW State Vegetation Type Map (including the draft East Coast classification) was used to select PCTs associated with the Swift Parrot within those buffers. Any areas less than one hectare were excluded.

That thorough examination of habitat for this species did not identify any such Important Areas on or near the site. Important areas for this species have been identified scattered across the state, and in the Sydney area these are concentrated where *Eucalyptus tereticornis* Forest Red Gum or *Corymbia maculata* Spotted Gum are dominant in the vegetation.

Therefore, it is a potential Candidate species due to an association with PCT 1250.

While overwintering on the mainland, the Swift Parrot frequents woodland and forests that include key foraging tree species *Eucalyptus leucoxylon* Yellow Gum, *Eucalyptus tricarpa* Red Ironbark, *Eucalyptus sideroxylon* Mugga Ironbark, *Eucalyptus macrocarpa* Grey Box, *Eucalyptus albens* White Box, *Eucalyptus melliodora* Yellow Box, *Eucalyptus robusta* Swamp Mahogany, *Eucalyptus tereticornis* Forest Red Gum, *Eucalyptus pilularis* Blackbutt, and *Corymbia maculata* Spotted Gum (Commonwealth of Australia 2019).

None of the key foraging tree species were observed on site.

The Northern Beaches is not a local stronghold for the Swift Parrot, as has been demonstrated regularly in the results of the monitoring program for this species conducted by Birdlife Australia. The latest report from this program (2021 mid year report, available at https://birdlife.org.au/projects/woodland-birds-for-biodiversity/latest-news-wl) detailed the use of box-ironbark woodlands in western Sydney as part of its northward migration. Although there are over 100 BioNet records from within 10 kilometres of the site dating from the last 20 years, interrogation of these records reveal that most are reports of birds flying overhead, or concentrated within large expanses of reserved bushland (such as Garigal National Park), or in littoral areas with key eucalypts (e.g. feeding in *Eucalyptus robusta* in swamp habitats near Narrabeen Lagoon).

This accords with the analysis and identification of important habitat for the Swift Parrot elsewhere. Therefore, this species is considered unlikely to occur on site, is excluded as a Candidate species, and generates no offset obligation.

Miniopterus australis Little Bent-winged Bat and *Miniopterus orianae oceanensis* Large Bent-winged Bat.

The TBDC indicates that these species are potential candidate species when specific breeding habitat features or indications of breeding are present. The habitat features include caves, tunnels, mines, culverts or other structure known or suspected to be used for breeding. Indications include the presence of a record in BioNet with microhabitat code "IC" (in cave) or "E" (nest/roost); an observation of >500 individuals; or information in the scientific literature.

In the Sydney area, there are a number of urban non-breeding roost sites that extend from coastal military sites to drains in western Sydney (White 2011). A number of maternity sites are known across NSW, but all are distant from the Sydney Basin, being in limestone cave systems such as at Willi Willi, Bungonia, and Wee Jasper (Dwyer and Hamilton-Smith 1965).
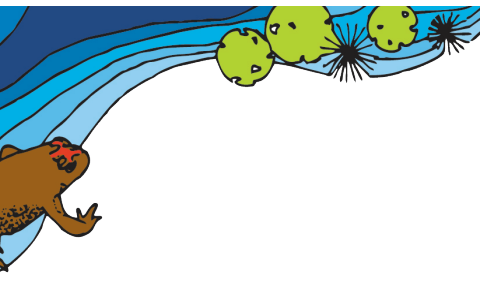
The rock outcrop present on site contain cracks and crevices, but not habitat suitable for a breeding roost for either of these species. They therefore have been excluded as Candidate species and generate no offset obligation.

4.3   Candidate species survey

As a Small Areas Assessment, extensive biodiversity survey is not required but rather may rely on incidental survey. However, survey activities are relevant for the Candidate species that were not excluded from the BAM-C analysis (see Table 7) and requiring further consideration.

- Asterolasia elegans
- Astrotricha crassifolia
- Caladenia tessellata
- Chalinolobus dwyeri
- Darwinia peduncularis
- Haloragodendron lucasii

- Hibbertia spanantha
- Melaleuca deanei
- Persoonia hirsuta

Over the three days of fieldwork a total of 14.08 person hours were spent inspecting the site and surrounding habitat areas, and collecting survey data.

Table 9: Survey dates and weather conditions.

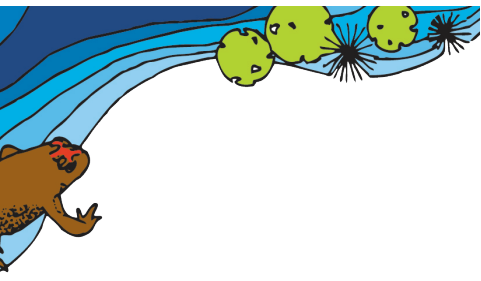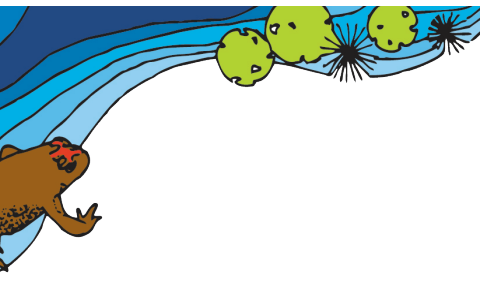| Date	Time	Conditions	Tasks	Person hours (hrs x no. people)
5 May 2021	9:20-13:50	13.0 – 18.0 °C	Random meander method of site survey was used to collect list of flora species found on site. Two BAM plots. Incidental fauna observations.	4.5 hrs x 2 = 9 hrs
1 Oct 2021	10:00 – 13:05	Mild to warm	Random meander method of site survey. Targeted surveys for threatened plant species.	3.08 hrs x 1 = 3.08 hrs
1 Sep 2022	11:00 – 13:00	Dry and still Cool to mild	Spring survey of BAM plots for additional species. Targeted survey and habitat assessment in and around rock outcrops for threatened flora and fauna.	2 hrs x 1 = 2 hrs

Table 10: Survey effort per individual participant.

Individual	Dates and times	Flora fieldwork type	Fauna fieldwork type	Survey method used
Dr Alison Hewitt	5 May 2021 9:20-13:50	Detailed vegetation survey sampling; targeted species survey; structure/habitat data collection; site inspection	Habitat survey; targeted species survey; site inspection. Incidental observations.	Random meander method of site survey was used to collect list of flora species found on site. Two BAM plots. Incidental fauna observations
Jesse Cass	5 May 2021 9:20-13:50	Detailed vegetation survey sampling; targeted species survey; structure/habitat data collection; site inspection	Habitat survey; targeted species survey; site inspection. Incidental observations.	Random meander method of site survey was used to collect list of flora species found on site. Two BAM plots. Incidental fauna observations
Dr Daniel McDonald	1 Oct 2021 10:00 – 13:05	Site inspection, targeted threatened flora species survey	Habitat survey; site inspection. Incidental observations.	Random meander and targeted survey.
Elizabeth Ashby	1 Sep 2022 11:00 – 12:00	Site inspection, targeted threatened flora species survey	habitat survey; site inspection. Incidental observations.	Random meander and targeted survey, particularly in rocky areas.

The area of natural vegetation was searched as thoroughly as possible for the target species. The rocky nature of the site made survey along standard parallel transects impossible and so survey was not carried out strictly in accordance with the survey guidelines.

Nevertheless, as a result of absence during survey, all of the flora species of interest are considered not to occur on site.

Targeted seasonal survey for *Chalinolobus dwyeri* was not undertaken, and so its presence is assumed. This decision is underpinned by both local knowledge and the presence of suitable habitat:

- Foraging calls of this species were recorded over 5 successive nights in a similar property approximately 950 m to the north in autumn 2017 (Elizabeth Ashby, personal observation); and
- The rocky overhangs and potentially deep vertical crevices are considered to offer suitable potential roosting habitat for this species.

4.4   Koala habitat

The presence or absence of **core Koala habitat** within the development area in accordance with State Environmental Planning Policy (Koala Habitat Protection) 2021 (Koala SEPP 2021) is critical in determining the appropriate level of assessment to undertake (see Section 1 in this BDAR) and is an important consideration regarding the potential for the proposal to impact this Endangered species.

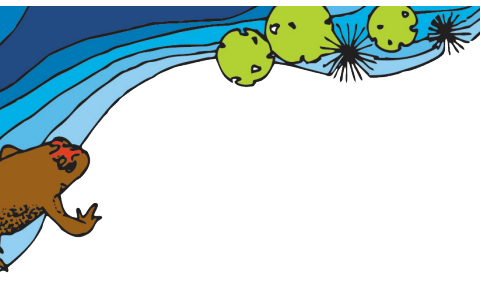Core Koala habitat is defined in Koala SEPP 2021 as:

(a) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or

(b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years.

Schedule 2 of the Koala SEPP 2021 details tree species of regional significance to Koalas; the subject site occurs within the Central Coast Koala Management Area (KMA). Guidelines[6] issued by the (then) Department of Planning, Industry and Environment define highly suitable Koala habitat as vegetation where 15% or more of its constituent trees are listed as Koala use species for the relevant KMA.

Further, these guidelines define relevant Koala records being only those observations in the BioNet database with a locational accuracy of 1,000 m or better, present in the previous 18 years, and within a distance of 2.5 km from the external boundary of the site.

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[6] Available at https://www.planning.nsw.gov.au/-/media/Files/DPE/Factsheets-and-faqs/Policy-and-legislation/Fact-Sheet-Development-Applications-State-Environment-Planning-Policy-Koala-Habitat-Protection-2021.pdf?la=en

The Northern Beaches LGA is within the Central Coast Koala Management Area (KMA). A large number of tree species have been identified in Schedule 2 of Koala SEPP 2021 as *Koala use trees species* in this KMA, including the following species recorded on site:

- Allocasuarina torulosa
- Angophora costata
- Casuarina glauca
- Corymbia gummifera
- Eucalyptus grandis
- Eucalyptus resinifera
- Eucalyptus sieberi

In the formal survey plots, these Koala trees comprise >15% of the trees present and therefore the vegetated part of the site satisfies one of the criteria for Core Koala habitat.

The BioNet database shows no records from within the site itself, and none from within the 2.5 km buffer within the previous 18 years. The two records within the 2.5km buffer – see Figure X - are both from Frenchs Forest to the south east, dating from 1997 and 1940.

Notably, there is a cluster of 3 records to the north, just outside of the buffer, dating from 2020. Inspection of these records reveal that they are actually 3 inaccurately located reports of the same sighting of an individual Koala in January 2020. Other records shown in Figure X outside of the buffer area date from 1940 to 2020.

These records demonstrate that while this species persists in the general area, they occur at a very low density through time and space. Therefore, the site and surrounds do not qualify as core Koala habitat. The distribution of the recent records in and at the edges of bushland further indicate the value of large areas of intact vegetation that contain appropriate species of trees for forage and shelter. While the presence of appropriate trees in gardens provide theoretical potential habitat for this species, the nature and configuration of the developed central ridge present significant barriers to moving through the landscape and accessing such habitat.
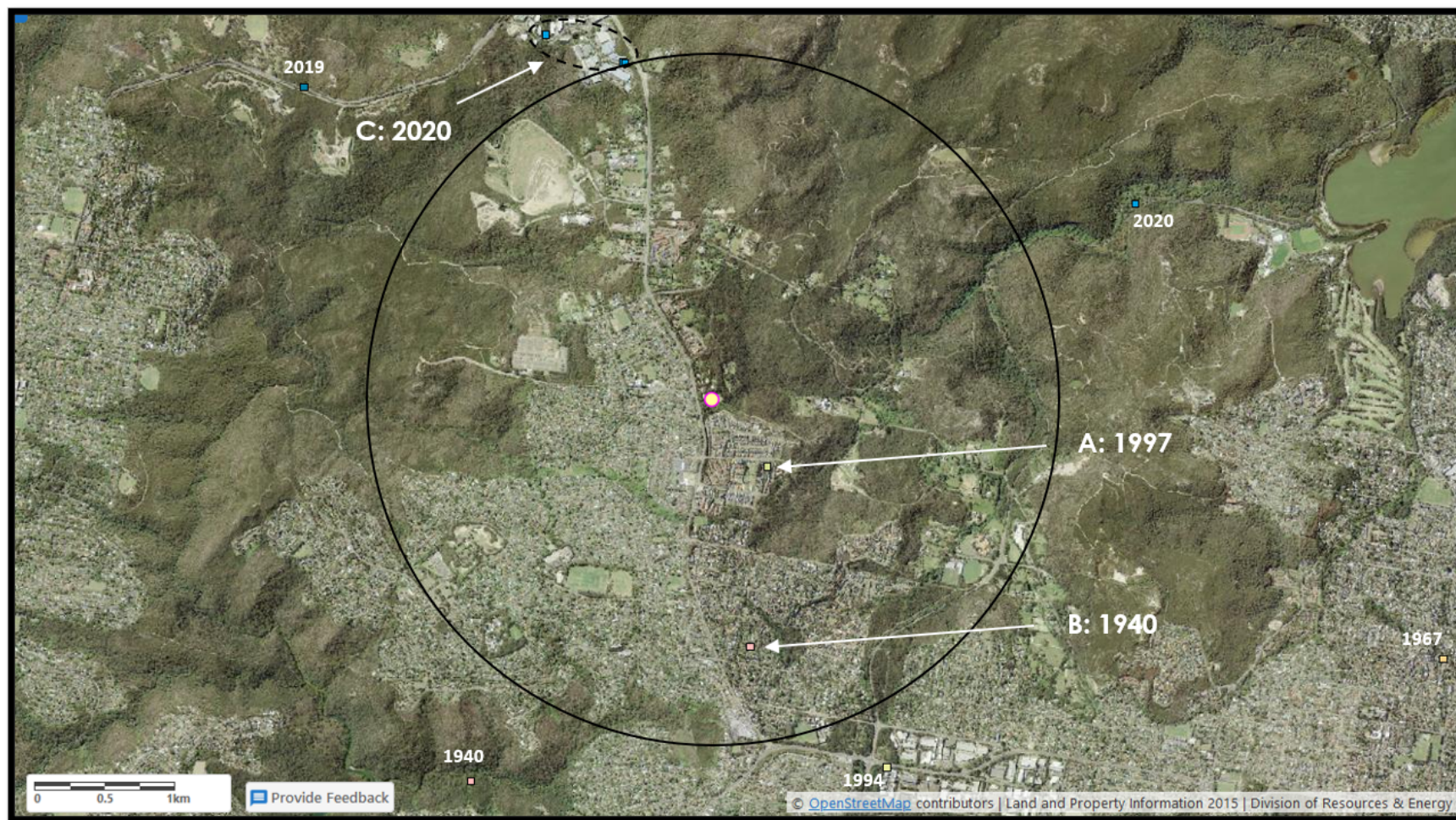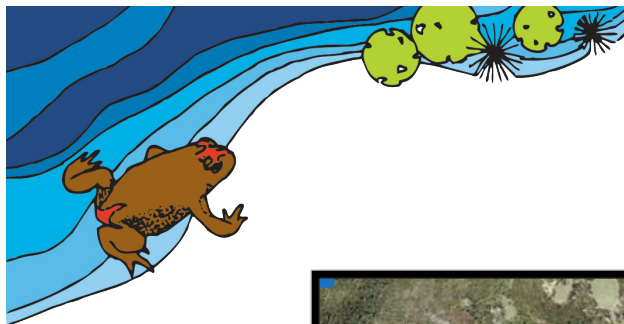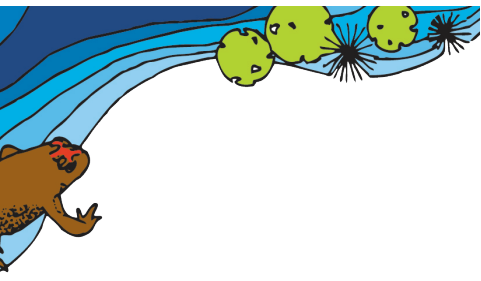
Figure 9: Koala records. Source: BioNet.

5. Prescribed impacts

Impacts for which there is not a formal offset procedure are "prescribed impacts" as per Part 6 Division 6.1 of the BCR 2017. Prescribed impacts are detailed in Chapter 6 of the BAM and each discussed below.

Karst, caves, crevices, cliffs, rocks and other geological features of significance. The slope is punctuated by a significant rock outcrop that is situated directly below the existing house and pool, and stretches across almost the entire width of the lot. This outcrop has overhangs, horizontal and vertical crevices (the largest with an opening 1.5 m high), and large outcropping tilted boulders (see Figures 10 to 13).

The proposed development will threaten the integrity of these features.

Human-made structures and non-native vegetation. There is a large dwelling, pool and (largely native) garden at the top of the site, and stables at the rear. Non-native vegetation is principally represented on site by cleared land and weed infestations (such as Lantana).

All of the man-made structures are occupied and regularly used. The constant disturbance makes them of little value to native fauna. The cleared land may be used by species that feed in open habitats, particularly given the protection afforded by adjacent dense vegetation, including weedy patches. However, the habitats provided by these weedy patches generally favour pest species such as Black Rats, Foxes, or Rabbits.

Habitat connectivity. This is considered to be a minor consideration, as the site is at the edge of the urbanised landscape. The major habitat connectivity in the local area occurs within the riparian corridor associated with Snake Creek to the east. Connectivity of habitat in other directions is already fragmented by developed land, roads, cleared land, and weedy areas. The fragmentation in these directions is of such a scale that only highly mobile species or propagules may exploit this as a movement corridor of separated stepping stones.
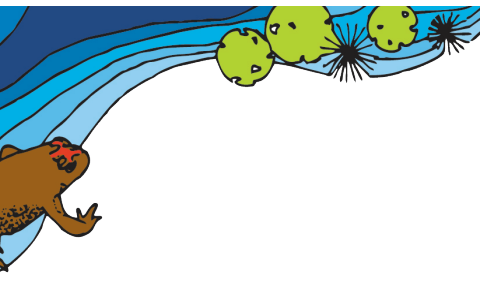
A band of vegetation approximately 20 m wide and 150 m long is proposed to be affected by the APZ along the rear of the site. By definition, vertical and horizontal connectivity of vegetation must be interrupted to mitigate against bushfire hazard in an APZ. A maximum of 15% canopy cover and 20% understorey cover in separated clumps can remain in managed land, and so this will continue to provide habitat for more mobile species of fauna such as birds and bats (microbats and flying-foxes).

The interruption to local north-south connectivity imposed by the development is considered to be minor.

Water bodies, water quality and hydrological processes. The development area occupies part of a broad ridge and the east facing slope below it; no waterways or wetlands occur on site. A first order stream tributary of Snake Creek is present off site approximately 12 metres from the subject lot's southern boundary.

All standard and best practice stormwater and erosion controls will be implemented during construction and water sensitive urban design is an integral component of the project.

Wind farm developments. This is not a wind farm development, and so any such related indirect impacts are not relevant.

Vehicle strikes. The proposed development occurs in an urbanised area with already high traffic loads. While the development will increase the numbers of vehicle movements to a small degree, there are no threatened species likely to use the site that will be adversely affected by traffic movements to and from the site.
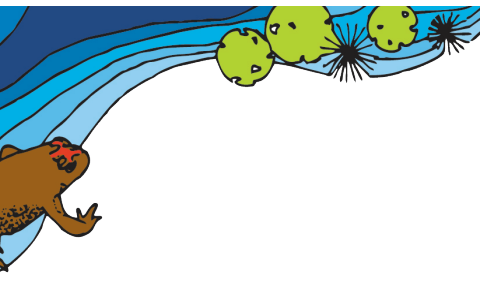

Figure 10: Overhang within the rocky outcrop.

Figure11: Outcrop beneath the pool.
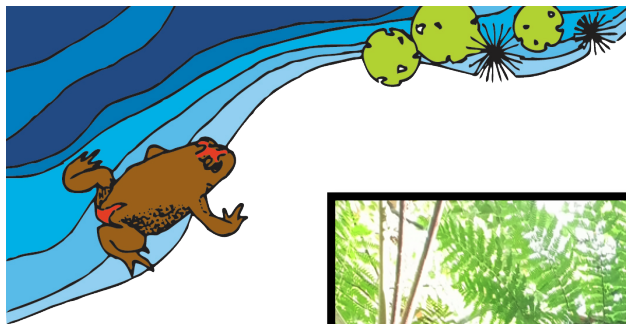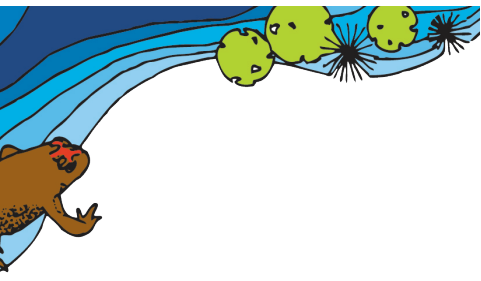

Figure 12: Outcrop beneath the house and garden.

Figure 13: Largest cave / vertical crevice in rock outcrop.

STAGE 2 – IMPACT ASSESSMENT

6. Avoid and minimise impacts

A comparison of the extent of built from in the initial proposal with the current proposal is displayed in **Error! Reference source not found.**. This demonstrates that the proposal has been designed and amended in a number of ways to avoid and minimise impacts:

- The original design had a separate entry and exit at the north western and south western corners of the lot respectively. In the current proposal, the entry and exit have been combined to allow for greater tree retention and landscaped areas at the top of the site;
- The accessway into the site along the southern boundary follows the existing accessway. This allows for greater tree retention;
- The outdoor visitor car park is situated in the Horse paddock being that part of the site that is already cleared and highly modified;
- Building E is located in the area currently occupied by the house, pool, and hardstand;
- The buildings have all been redesigned with a smaller footprint. This allows for the gaps between the buildings to be larger and therefore able to retain a greater number of existing trees and / or provide larger areas of landscaped gardens;
- The outdoor recreation area has been redesigned so that it is dominated by open lawns rather than built form. Although located in the cleared and modified Horse paddock, this more passive treatment is preferred due to its superior heat properties, its retention of natural soil structure, its contribution to a more natural stormwater regime, and the provision of foraging habitat to a number of local fauna species (such as Long-nosed Bandicoot and Swamp Wallaby).

Impacts to the rock outcrop cannot be avoided due to the need for excavation for the buildings' footings and the provision of basement parking facilities.
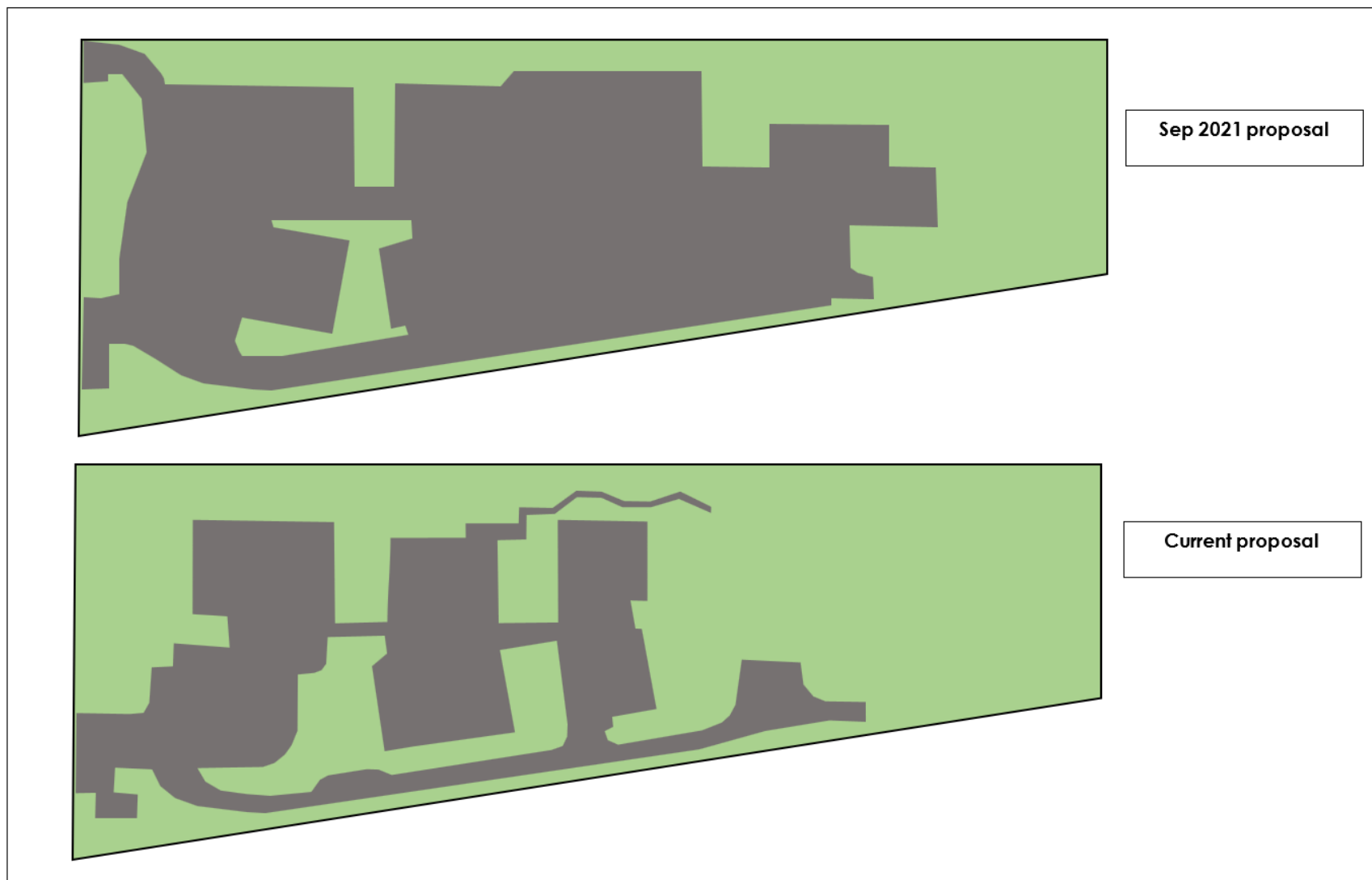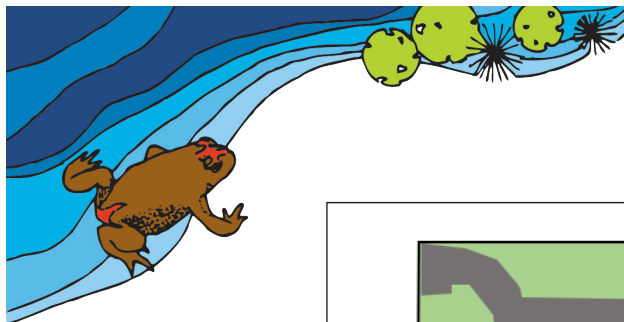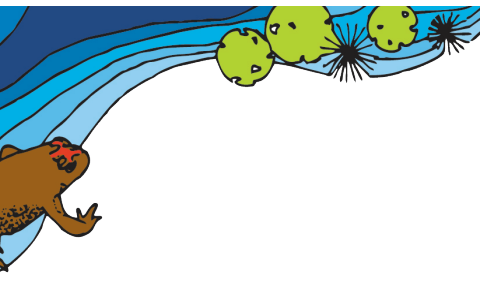
Figure 14: Comparison of earlier proposal with current proposal. Built form footprint shown in grey; retained vegetation and landscaped areas shown in green.

7. Assessment of impacts

7.1 Vegetation

Direct impacts will occur to VZ 1, which is classified as comprising PCT 1250 with a VI of 28.6.

VZ 1 is divided into 2 Management Zones:

- Management Zone 1 (0.24 ha) – the area within which the vegetation will be entirely removed for the footprint. Future VI of zero; and
- Management Zone 2 (0.25 ha)[7] – the area required to be managed for the APZ to the standard required by the bushfire assessment. Includes vegetation on site and in adjoining properties to the north and south. Requires some tree removal and understorey management. Future VI estimated to be 18.8.

Total VI loss = 19.

PCT 1250 is not a potential candidate Serious And Irreversible (SAII) entity.

7.2 Threatened species

Threatened species habitat is limited, with only *Chalinolobus dwyeri* Large-eared Pied Bat assumed to be present because the intensive seasonal survey required for this species was not undertaken and is not required for a Small Areas Assessment under BAM 2020. For the purposes of the BAM-C, this species is considered to have potential roosting habitat in the rocky outcrop (see particularly Figure 13) and associated foraging habitat in all of the native vegetation on site.

The proposal will result in the destruction of the roosting habitat, the removal of 0.24 ha and the disturbance of 0.25 ha of potential foraging habitat.

The species polygon for *Chalinolobus dwyeri* is shown in Figure 15.

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[7] The vegetation on the adjoining lot to the south (169 Forest Way, Belrose) already satisfies APZ requirements and is managed under a VMP. This is described in *Japara Healthcare Limited v Northern Beaches Council [2018] NSWLEC 1670.*
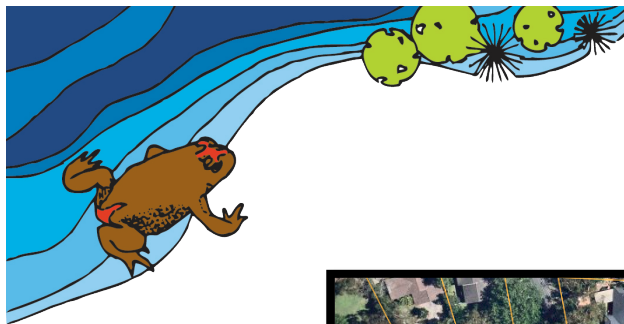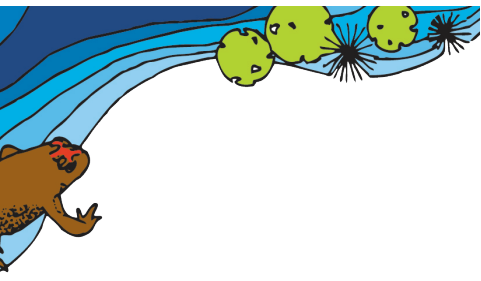
Figure 15: *Chalinolobus dwyeri* species polygon. Note that the area outlined by yellow dashes is already managed as an AP
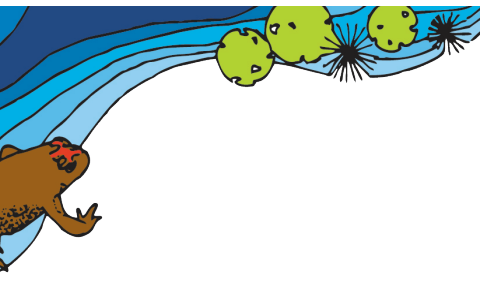
7.3   Indirect impacts

The following indirect impacts have the potential to occur during or as a result of the proposed works:

- Overshadowing of adjacent vegetation.
- Presence of companion animals.
- Potential establishment of nuisance plant species in adjacent bushland from landscape areas.
- Increased disturbance of the bushland habitats by noise, activity, lights, and scent generated during construction and occupation.
- Increased nutrients in runoff from development area into adjacent bushland, producing weed plumes.
- Intensification of stormwater runoff.
- Erosion and mobilisation of soil with stormwater runoff during construction. Such impacts may impact adjacent retained vegetation and habitats.
- Spread of weeds during civil works.
- Introduction of soil pathogens.

It is noted that many of these indirect impacts are already occurring with the current use of the site.

8. Mitigation and management measures

A number of mitigation measures have been identified that will be implemented to minimise impacts of the proposal – see Table 11 for a complete list and detailed description.

The most important on-site mitigation is the retention of native vegetation on site and its ongoing management as part of the implementation of the Landscape Plan.

Appropriate fencing will protect retained trees an other vegetation during works, and will be checked for compliance by the Project Arborist.

Weeds removed as part of the civil works are not to be stockpiled, but instead disposed of at a suitable green waster facility, and covered during transportation. Machinery and other equipment potentially contaminated by weed propagules must be washed down prior to leaving the site. All standard erosion and sediment controls are to be installed and maintained wile there is any potential hazard from exposed soils or mobilisation of pollutants.
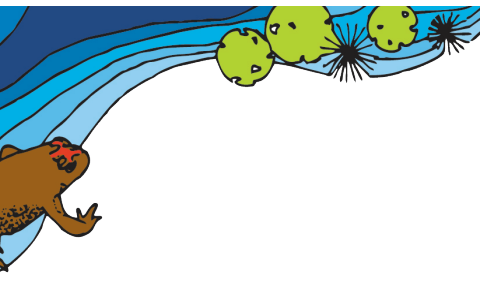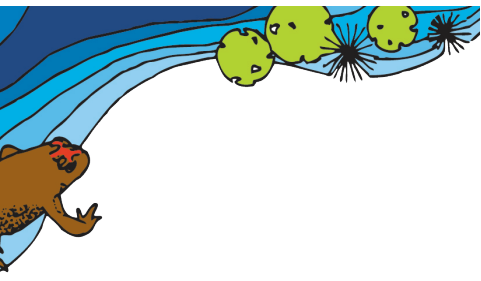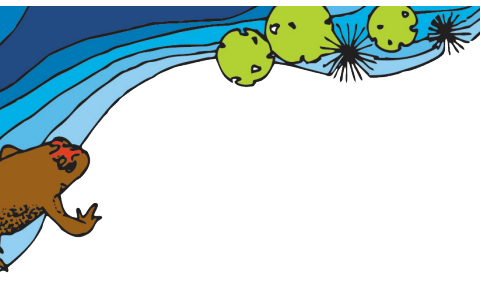
Table 11: Measures to mitigate and manage impacts.

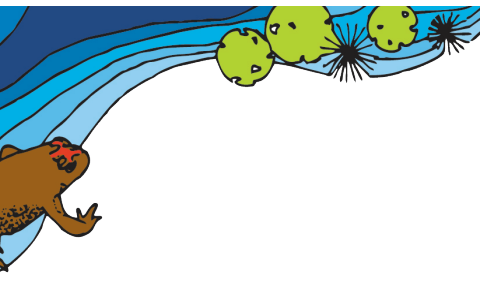| Impact	Extent	Frequency and Timing	Mitigation
Direct impact to resident individuals of other fauna species in the development footprint.	May occur anywhere across the entire works area.	During civil works. Once off.	Clearing to be conducted under ecological supervision. Adaptive management strategies to be employed such as pre-clearing surveys, relocation of individuals, care for injured wildlife, and euthanasia of feral species in accordance with appropriate licenses and approvals.
Potential impact to fauna species potentially occupying tree hollows and / or other specific habitat features.	No hollow-bearing trees were recorded in BAM plots and no other hollows observed. However, the potential for some hollows to occur in the natural vegetation is recognized.	During civil works. Once off.	Clearing to be conducted under ecological supervision. Adaptive management strategies to be employed such as pre-clearing surveys, relocation of individuals, care for injured wildlife, and euthanasia of feral species in accordance with appropriate licenses and approvals. Enrich the habitat for hollow-dependent species by the installation – under ecological supervision - of artificial nesting / roosting sites. These are to be made from robust materials and designed specifically for a range of species such as microbats, gliders, possums, small birds (such as Pardalotes), and larger birds (such as parrots).

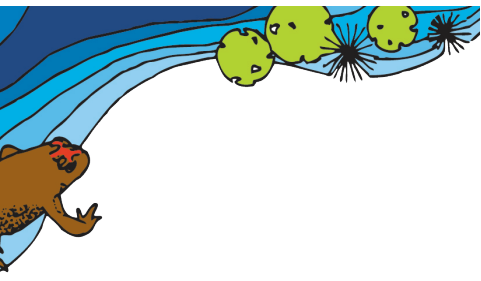| Impact	Extent	Frequency and Timing	Mitigation
Edge effects of weed incursions into the remaining natural habitat areas.	Edge effects are currently in force across the entire area of natural vegetation due to the small size of the existing patches. These effects will continue in the retained vegetation, landscaped areas, and APZ. The distance of the potential effect will be dictated by its type. For example, wind-blown weed seeds may intrude deep into the vegetation while plants that expand by vegetative spread may not impact more than a few centimetres.	Pre- construction. During construction. Post-construction. Ongoing.	Control measures to be employed as part of the Landscape Plan appropriate to the weed species. A major objective is to ensure that edge effects are limited in space and controls may be reduced over time.
Potential adverse impacts on native wildlife due to the increased presence of humans, presence of uncontrolled companion animals (particularly Cats). Potential impacts include abandonment or avoidance of previously occupied or otherwise suitable habitat and retreat into other retained areas. For territorial species, this can further result in antagonistic behaviours with conspecifics.	Potentially relevant to all of the retained vegetation and vegetated landscaped areas on site that provide wildlife habitat.	Any time and infrequent. Ongoing.	In the absence of a prohibition on the keeping of companion animals, educational material is to be provided to all residents and signage for all users of the recreational areas regarding the potential impacts to biodiversity of uncontrolled pets. Residents to be encouraged to keep Cats indoors or within an enclosure at all times and not allowed to roam.

Impact	Extent	Frequency and Timing	Mitigation
Landscaping species becoming a nuisance in the adjacent remnant bushland and retained natural vegetation on site.	The extent of potential incursions of propagules depend on the species present.	Any time and infrequent. Ongoing	It is recommended that the Landscape Plan rely on the planting of species consistent with those that occur naturally in the surrounding vegetation. Regular sweeps for weeds and low impact controls to be implemented as part of the landscape maintenance.
Landscaped areas induce disruptions to foraging guilds of birds, encouraging a super abundance of aggressive Noisy Miners.	This effect may occur across the whole site.	Daily and ongoing. Ongoing	It is recommended that the Landscape Plan replicates in its underplantings a dense heathland-type understorey structure, particularly by the use of spiky shrubs. This will provide refuge for small birds. The Landscape Plan is not to rely heavily on species (e.g. Grevilleas) or vegetation structure (e.g. open woodland) known to favour Noisy Miners.
Increased spill over of noise, activity, scent, and light into the adjacent natural habitat areas.	The adjacent bushland is currently embedded in an urban matrix and so resident fauna are likely to be habituated to these disturbances. However, additional lights can interfere with foraging activities of fauna (particularly bats).	Daily and ongoing. Duration and timing of these disturbances related to seasons and weather. In perpetuity.	Install external lighting only where necessary for safety. Prohibit external uplights, lights directed into the retained bushland, or any lighting that spills into the adjacent bushland.

Impact	Extent	Frequency and Timing	Mitigation
Introduction of soil-borne pathogens, particularly *Phytophthora cinnamomi*.	All native bushland is susceptible to disease to some degree.	During works that involve exposure and movement of soil and vehicles. During landscaping, diseased plant material can be introduced.	Standard hygiene controls are to be observed as part of the civil management works plan. All plant material to be introduced to the site must be certified as disease-free.
Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes.	Likely to have minor impacts on the edges of retained vegetation closest to hard edges.	Anytime and infrequent. More likely after heavy rainfall events. Ongoing.	As part of the implementation of the Landscape Plan and ongoing maintenance, a more stringent weeding protocol may be required at the edges.
Concentrated stormwater runoff from solid surfaces and subsequent increased flows.	Likely to have minor impacts on the edges of retained vegetation closest to hard edges. Extra moisture may promote species more tolerant of wetter soils, such as Crofton Weed.	Anytime and infrequent. More likely after heavy rainfall events. Ongoing.	As part of the implementation of the Landscape Plan and ongoing maintenance, a more stringent weeding protocol may be required at the edges, but particularly in moist areas.
Possible impacts on water quality in remaining native habitats, with pollutants in runoff (herbicides / fertilisers) carried from landscaped areas to nearby habitats.	Likely to have minor impacts on the edges of retained vegetation closest to landscape zone.	Anytime and infrequent. Ongoing.	Restrict / minimize use of fertilisers and herbicides across the site. A locally-native planting palette will require fewer chemical inputs and therefore an appropriate planting list in the Landscape Plan will serve to mitigate this potential impact at its source.

9. Thresholds

The potential for Serious and Irreversible Impacts (SAIIs) to arise from the proposed development works must be considered in terms of the following four SAII principles:

- Principle 1 – Species or ecological community currently in a rapid rate of decline;
- Principle 2 – Species or ecological communities with very small population size;
- Principle 3 – Species or area of ecological community with very limited geographic distribution; and
- Principle 4 - Species or ecological community that is unlikely to respond to management and is therefore irreplaceable.

BAM 2020 requires additional information to be provided to help guide the decision maker in their determination whether the proposal will result in a SAII.

The only entity included in the analysis that is classified as at risk of a SAII is *Chalinolobus dwyeri* Large-eared Pied Bat.
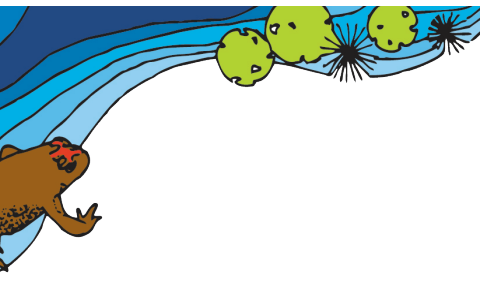
The SAII threshold for this species is potential breeding habitat and presence of breeding individuals. Potential breeding habitat is defined as PCTs associated with the species within 100 metres of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Such potential habitat features occur within the rocky escarpment directly below the existing house and pool. Seasonal survey could not be conducted to establish its presence or absence and therefore the potential for SAII is further explored.

In order to determine the likelihood of a SAII, the decision maker requires guidance as to the current status of the species including:

a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:
   i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or
   ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites

Response

This is a data deficient species. Both a reduction in numbers and generation length have not been established (Threatened Species Scientific Committee 2012). There are no good data to indicate a decline in geographic distribution and anecdotal evidence could indicate the opposite in the Sydney area, with a population expansion per increasing numbers of records being reported as part of the development

assessment process (Mark Chidel, personal communication and personal observation). However, this could also be an artefact of increased survey effort.
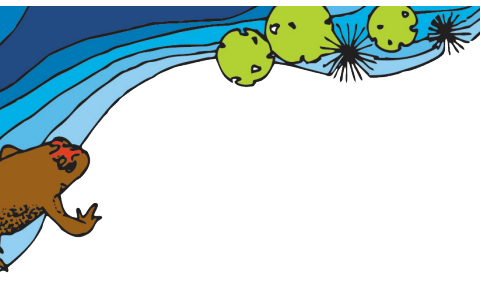
b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:
    i.   an estimate of the species' current population size in NSW, and
    ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and
    iii. where such data is [sic] available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations

Response

This is a data deficient species, and its conservation status has been inferred (Threatened Species Scientific Committee 2012) from the following information:

- observations of only a small number of known maternity sites
- the presence of only small numbers of animals at these maternity roosts
- low fecundity
- restricted habitat preferences
- the major habitat areas are under intensifying clearing pressure for agriculture and residential subdivision
- the first known maternity site was flooded for the construction of Copeton Dam, and other roosting sites in disused mines are equally insecure.

There are no reliable estimates of population size in the scientific literature.

c.   evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:

     i.   extent of occurrence

     ii.   area of occupancy

     iii.   number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and

     iv.   whether the species' population is likely to undergo extreme fluctuations

Response

This is a data deficient species but the Threatened Species Scientific Committee (2012) concludes that it has a very restricted geographic distribution. In the scientific literature, the extent of occurrence was estimated as 570,000 square kilometre (Hoye and Dwyer 1995), but this was prior to current knowledge of restricted habitat preferences and is therefore likely to be an overestimate.
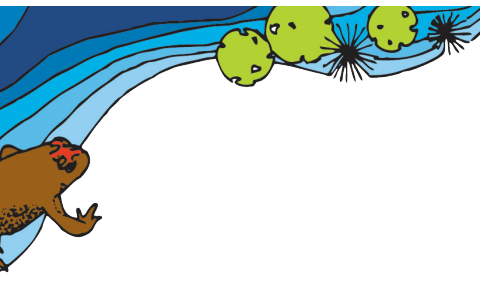
Despite extensive surveys throughout NSW, only three nursery roosts are known, and only one of these is currently being used (Threatened Species Scientific Committee 2012), which is located north west of Coonabarabran (Pennay 2008). The area of occupancy in NSW during the breeding season is likely to be limited to this one site, which is therefore less than 1 square kilometre.

Any impacts to maternity sites – especially during the breeding season - is likely to result in a catastrophic decline in the population.

Given its low reproductive rate, its population size is unlikely to undergo extreme fluctuations.

Its susceptibility to changes in habitat as a result of climate change is unknown. However, its propensity to roost in relatively shallow caves may expose them to heat and smoke hazards from more frequent and higher intensity bushfires, and perhaps increased ambient temperature and / or drought.

d.   evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:

     i.   known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

     ii.   the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

     iii.   life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).

Response

Critical habitat for this species is provided by suitable sandstone escarpment country for breeding and roosting. The loss of these resources cannot be replaced by the setting aside of a stewardship site.

However, other conservation management actions may favour this species in and around roosting and breeding sites (such as control of feral goats or predators), as well as in their foraging habitat (such as weed control).
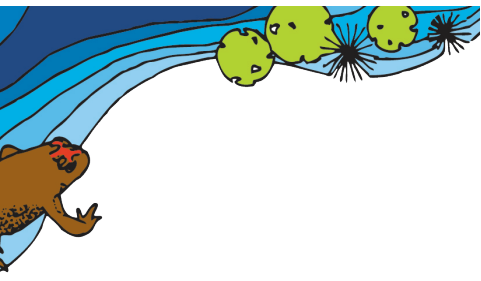
The decision maker also requires guidance as to the impacts of the proposal on the subject species, given the information provided above. In particular:

a. the impact on the species' population (Principles 1 and 2) presented by:
   i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and
   ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or
   iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal

Response

This species is data deficient, and there is no estimate available of the sizes or locations of populations and sub-populations. However, this species has been detected foraging 950 m to the north on 5 consecutive nights during survey in 2017, and examination of the surrounding records within 5 km of the subject site reveal that it has been repeatedly recorded in the bushland to the north west in Garigal National Park and Ku-ring-gai Chase National Park. These individuals presumably roost in caves and crevices of the more rugged parts of these sandstone reserves, but may also use the rocky outcrop on site.

The proposal will destroy the potential roosting habitat, remove 0.24 ha of potential foraging habitat, and disturb 0.25 ha of potential foraging habitat within the APZ.
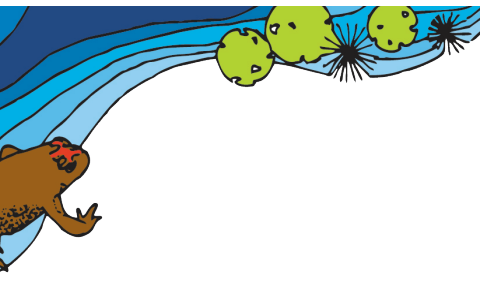
b. impact on geographic range (Principles 1 and 3) presented by:

    i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW

    ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted

    iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species

    iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target specie

Response

It is unknown of this species is using the rocky outcrop, and as a data deficient species it is unknown if the removal of the potential roosting habitat and removal and disturbance of associated potential foraging habitat will have an impact on the local geographic range of this species.

10. No net loss

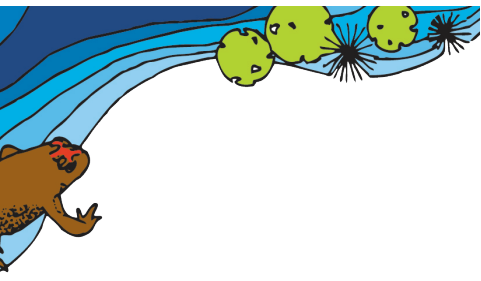The proposal will result in the following impacts:

- Clearing of 0.24 ha of PCT 1250 (equivalent to PCT 3595);
- Clearing of 0.24 ha of potential foraging habitat for *Chalinolobus dwyeri* Large-eared Pied Bat; and
- Management of 0.25 ha of potential foraging habitat for *Chalinolobus dwyeri* Large-eared Pied Bat.

The proposal has been assessed in accordance with BAM 2020 and in order to achieve no net loss for the above list of impacts, the following biodiversity credit obligations need to be retired:

- 3 x Ecosystem credits for the impact on PCT 1250 : Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (Biodiversity Risk Weighting = 1.5); and
- 7 x Species credits for the impact on *Chalinolobus dwyeri* Large-eared Pied Bat habitat (Biodiversity Risk Weighting = 3).
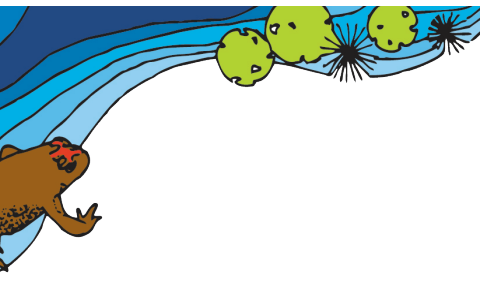
The BAM-C credit reports are provided at Appendix 2.

There are no offsets available for the loss of potential roost sites for *Chalinolobus dwyeri* Large-eared Pied Bat in the rocky outcrop to be impacted by the construction.
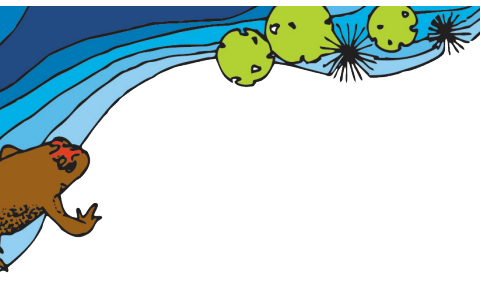
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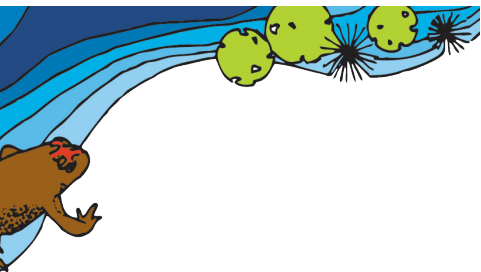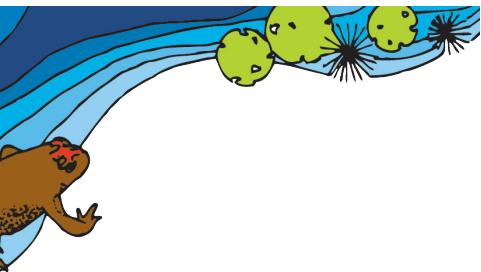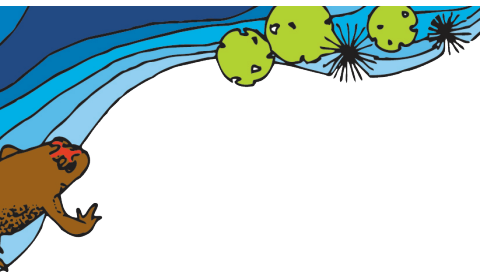
Appendix 1: BAM field data

BAM field data - Plot 1

400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier	Recorders	
Date	05/05/2021	Belrose	1-below pool	Hewitt	
GF/BAM GF Code	Top 3 native species in each growth form group: Full species name mandatory			N, E or H.T.E	Cover
	All other native and exotic species: Full species name where practicable				
T/TG	Eucalyptus grandis			N	6
T/TG	Eucalyptus sieberi			N	1
T/TG	Angophora costata			N	6
E/EG	Calochlaena dubia			N	5
E/EG	Davallia solida			N	5
T/TG	Corymbia gummifera			N	1
R/GG	Lomandra longifolia			N	1
S/SG	Kunzea ambigua			N	1
S/SG	Acacia longifolia			N	2
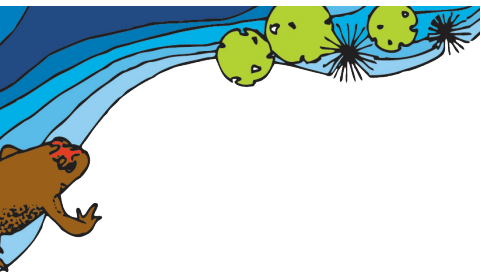
400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier	Recorders	
Date	05/05/2021	Belrose	1-below pool	Hewitt	
GF/BAM GF Code	Top 3 native species in each growth form group: Full species name mandatory			N, E or H.T.E	Cover
	All other native and exotic species: Full species name where practicable				
F/FG	Commelina cyanea			N	1
	Ehrharta erecta			HTE	2
	Hedychium gardnerianum			E	1
	Asparagus aethiopicus			HTE	5
G/GG	Entolasia stricta			N	1
F/FG	Cryptostylis sp.			N	0.1
E/EG	Hypolepis muelleri			N	10
	Conyza sumatrensis			E	0.1
E/EG	Asplenium australasicum			N	0.1
	Lilium formosanum			E	0.1
F/FG	Xanthosia pilosa			N	0.1

400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier	Recorders	
Date	05/05/2021	Belrose	1-below pool	Hewitt	
GF/BAM GF Code	Top 3 native species in each growth form group: Full species name mandatory			N, E or H.T.E	Cover
	All other native and exotic species: Full species name where practicable				
S/SG	Lambertia formosa			N	0.2
T/TG	Acacia parramattensis			N	2
S/SG	Pittosporum undulatum			N	6
X/OG	Xanthorrhoea media			N	0.2
L/OG	Smilax glyciphylla			N	0.1
	Bryophyllum delagoense			HTE	0.1
E/EG	Nephrolepis cordifolia			N	2
T/TG	Eucalyptus resinifera			N	0.5
T/TG	Banksia serrata			N	0.2
	Senna pendula			HTE	5
R/GG	Empodisma minus			N	0.1

400 m² plot: Sheet ___ of ___			Survey Name	Plot Identifier	Recorders	
Date	05/05/2021		Belrose	1-below pool	Hewitt	
GF/BAM GF Code	Top 3 native species in each growth form group: Full species name mandatory				N, E or H.T.E	Cover
	All other native and exotic species: Full species name where practicable					
	Ligustrum sinense				HTE	1
L/OG	Pandorea pandorana				N	0.1
	Cinnamomum camphor				HTE	5
	Lantana camara				HTE	2
S/SG	Elaeocarpus reticulatus				N	1
L/OG	Hibbertia scandens				N	0.1
F/FG	Dianella caerulea				N	0.2
	Clivia miniata				E	0.1
	Passiflora edulis				E	0.2
S/SG	Persoonia linearis				N	0.1
G/GG	Oplismenus imbecillis				N	0.5

400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier	Recorders	
Date	05/05/2021	Belrose	1-below pool	Hewitt	
GF/BAM GF Code	Top 3 native species in each growth form group: Full species name mandatory			N, E or H.T.E	Cover
	All other native and exotic species: Full species name where practicable				
S/SG	Leptospermum polygalifolium			N	0.1
T/TG	Grevillea robusta			N	0.1

BAM Site - Field Survey Form				Site Sheet no:					
		Survey Name	Plot Identifier	Recorders					
Date	5th April 2021	Belrose	1 - below pool	AH & JC					
Zone	Datum	IBRA region	Sydney Basin	Photo #		Zone ID			
Easting	Northing	Dimensions	20 x 20		Orientation of midlinefrom the 0 m point				
Vegetation Class							Confidence: H M L		
Plant Community Type	Native plus weeds					EEC:	Confidence: H M L		
BAM Attribute (400 m² plot)	Sum values		BAM Attribute (20 x 50 m plot)		# Tree Stems Count				
Trees	8		dbh	Euc*	Non Euc	Hollows			
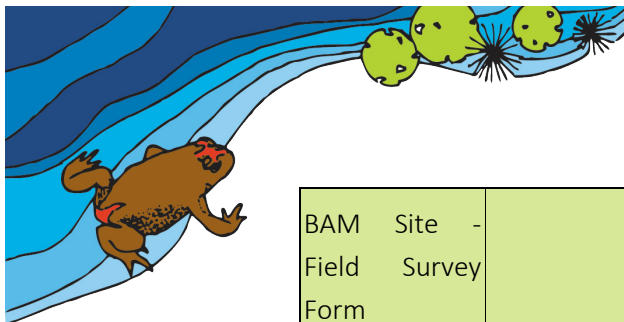
BAM Site - Field Survey Form				Site Sheet no:					
Shrubs	7		large trees for Euc* & Non Euc - 80 + cm						
Grasses etc.	4		50-79 cm	1(59cm)					
Forbs	4		30 - 49 cm	2(30cm,38cm)					
Ferns	5		20 - 29 cm	3(23cm,28cm,21cm)	1(26cm)				
Other	4		10 - 19 cm	1(17cm)					
Trees	16.8		5 - 9 cm	1(5cm)		n/a			
Shrubs	10.4		< 5 cm			n/a			
Grasses etc.	2.6						total		
Forbs	1.4			3					
Ferns	22.1								
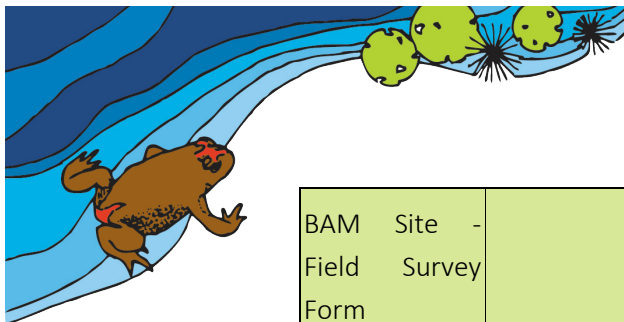
BAM Site - Field Survey Form				Site Sheet no:					
Other	0.5								
High Threat Weed cover	20.1								
BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)					
Subplot score (% in each)	a b c d e	a b c d e	a b c d e	a b c d e					
Average of the 5 subplots	75-80-15-10-60	5-10-15-10-5	0--0-0-5-5	100-50-40-10-90					
	48	9	2	58					

BAM field data - Plot 2

400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier		Recorders	
Date	5APR21	Belrose	2 horse paddock		AH & JC	
GF Code	Top 3 native species in each growth form group: Full species name mandatory				N, E or H.T.E	Cover
	All other native and exotic species: Full species name wher practicable					
T	Eucalyptus grandis				N	0.5
Sh	Acacia longifolia				N	0.1
Fo	Dichondra repens				N	0.5
Sh	Pittosporum undulatum				N	0.6
	Scenna pendula				HTE	0.5
	Asparagas aethiopicus				HTE	0.4
Fo	Commelina cyanea				N	0.1

	Rubus anglocandicans	HTE	0.2
	Phytolacca octandra	E	0.3
	Malva parviflora	E	2
Sh	Kunzea ambigua	N	0.4
	Trifolium repens	E	2
	Senecio madagascariensis	HTE	0.1
	Oxalis pes-caprae	E	2
	Lantana camara	HTE	1
	Solanum nigrum	E	1
G	Cynodon dactylon	N	65
	Cenchrus clandestinus	HTE	10
	Capsella bursa-pastors	E	1
T	Cupaniopsis anacardioides	N	0.2
V	Hibbertia scandens	N	0.3
	Conyza sumatrensis	E	0.1
	Nothoscordum gracile	E	0.1
	Hypochareis radicata	E	0.2
	Ehrharta erecta	HTE	4

BAM Site - Field Survey Form				Site Sheet no:					
		Survey Name	Plot Identifier	Recorders					
Date	5/5/21	Belrose	Horse paddock - 2	AH and JC					
Zone	Datum	IBRA region	Sydney Basin	Photo #		Zone ID			
Easting	Northing	Dimensions		Orientation of midlinefrom the 0 m point					
Vegetation Class						Confidence: H M L			
Plant Community Type	pasture				EEC:	Confidence: H M L			
BAM Attribute (400 m² plot)	Sum values		BAM Attribute (20 x 50 m plot)		# Tree Stems Count				
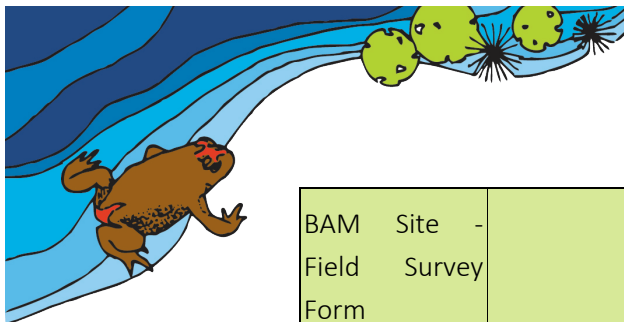
BAM Site - Field Survey Form				Site Sheet no:					
Trees	2		dbh	Euc*	Non Euc	Hollows			
Shrubs	3		large trees for Euc* & Non Euc - 80 + cm						
Grasses etc.	1		50-79 cm						
Forbs	2		30 - 49 cm	45					
Ferns			20 - 29 cm						
Other	1		10 - 19 cm						
Trees	0.7		5 - 9 cm			n/a			
Shrubs	1.1		< 5 cm			n/a			
Grasses etc.	65						total		
Forbs	0.6			0					
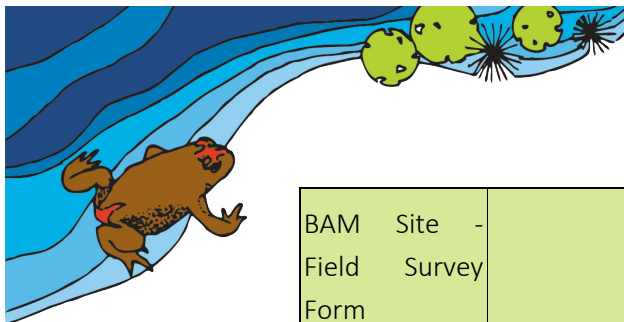
BAM Site - Field Survey Form				Site Sheet no:					
Ferns									
Other	0.3								
High Threat Weed cover	16.2								
BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)					
Subplot score (% in each)	a b c d e	a b c d e	a b c d e	a b c d e					
Average of the 5 subplots	15, 5, 5, 2, 2	40, 5, 30, 60, 5	0,0, 0, 0, 0	0,0, 0, 0, 0					
	6	28	0	0					
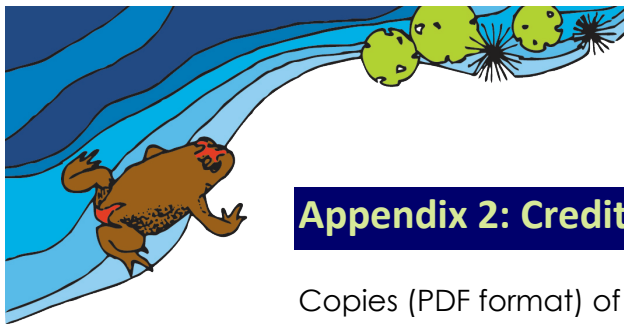
Appendix 2: Credit Reports

Copies (PDF format) of the following BAM-C credit reports with finalised status are provided below:
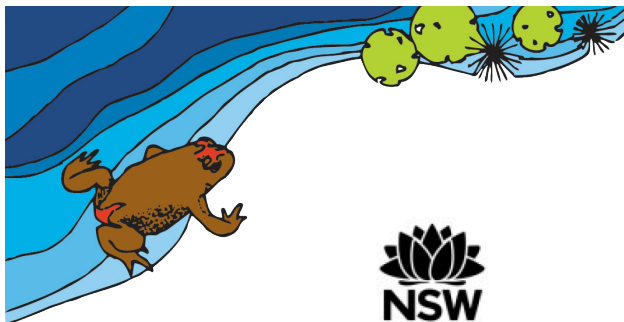
BAM Credit Summary Report

Proposal Details

Assessment Id	**Proposal Name**	**BAM data last updated ***
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	**Report Created**	**BAM Data version ***
Elizabeth Ashby	31/10/2022	55
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17045	Finalised	31/10/2022
Assessment Revision	**Assessment Type**	**BOS entry trigger**
1	Part 4 Developments (Small Area)	BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

| Assessment Id | Proposal Name | Page 1 of 2 |
| 00035930/BAAS17045/22/00035931 | 171 Forest Way Belrose | |

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BAM Credit Summary Report

Coastal sandstone gully forest

1	1250_Moderate	Not a TEC	28.6	19.0	0.49	PCT Cleared - 30%	High Sensitivity to Gain			1.50	3
										Subtotal	**3**
										Total	**3**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
1250_Moderate	19.0	19.0	0.49	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	7
								Subtotal	**7**

BAM Candidate Species Report

Proposal Details

Assessment Id	**Proposal Name**	**BAM data last updated ***
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	**Report Created**	**BAM Data version ***
Elizabeth Ashby	31/10/2022	55
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17045	Part 4 Developments (Small Area)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
1	31/10/2022	BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
Asterolasia elegans Asterolasia elegans	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Astrotricha crassifolia Thick-leaf Star-hair	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Caladenia tessellata Thick Lip Spider Orchid	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?

BAM Candidate Species Report

Chalinolobus dwyeri Large-eared Pied Bat	Yes (assumed present)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Darwinia peduncularis Darwinia peduncularis	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Haloragodendron lucasii Haloragodendron lucasii	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hibbertia spanantha Julian's Hibbertia	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Melaleuca deanei Deane's Paperbark	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Persoonia hirsuta Hairy Geebung	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

BAM Candidate Species Report

Threatened species Manually Added
None added

Threatened species assessed as not on site
Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Broad-headed Snake	Hoplocephalus bungaroides	Habitat constraints
Camarophyllopsis kearneyi	Camarophyllopsis kearneyi	Habitat constraints
Deyeuxia appressa	Deyeuxia appressa	Habitat degraded
Grevillea shiressii	Grevillea shiressii	Refer to BAR
Hygrocybe anomala var. ianthinomarginata	Hygrocybe anomala var. ianthinomarginata	Habitat constraints
Hygrocybe aurantipes	Hygrocybe aurantipes	Habitat constraints
Hygrocybe austropratensis	Hygrocybe austropratensis	Habitat constraints
Hygrocybe collucera	Hygrocybe collucera	Habitat constraints
Hygrocybe griseoramosa	Hygrocybe griseoramosa	Habitat constraints
Hygrocybe lanecovensis	Hygrocybe lanecovensis	Habitat constraints
Hygrocybe reesiae	Hygrocybe reesiae	Habitat constraints
Hygrocybe rubronivea	Hygrocybe rubronivea	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Nielsen Park She-oak	Allocasuarina portuensis	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints

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BAM Predicted Species Report

Proposal Details

Assessment Id	**Proposal Name**	**BAM data last updated ***
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	**Report Created**	**BAM Data version ***
Elizabeth Ashby	31/10/2022	55
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17045	Part 4 Developments (Small Area)	Finalised
Assessment Revision	**BOS entry trigger**	**Date Finalised**
1	BOS Threshold: Biodiversity Values Map	31/10/2022

*Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1250-Coastal sandstone gully forest
Broad-headed Snake	Hoplocephalus bungaroides	1250-Coastal sandstone gully forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1250-Coastal sandstone gully forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1250-Coastal sandstone gully forest
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1250-Coastal sandstone gully forest
Eastern Osprey	Pandion cristatus	1250-Coastal sandstone gully forest
Flame Robin	Petroica phoenicea	1250-Coastal sandstone gully forest
Gang-gang Cockatoo	Callocephalon fimbriatum	1250-Coastal sandstone gully forest
Glossy Black-Cockatoo	Calyptorhynchus lathami	1250-Coastal sandstone gully forest
Golden-tipped Bat	Phoniscus papuensis	1250-Coastal sandstone gully forest
Greater Broad-nosed Bat	Scoteanax rueppellii	1250-Coastal sandstone gully forest
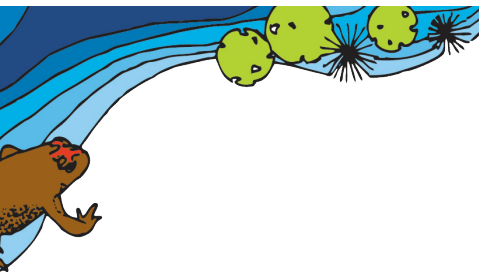
BAM Predicted Species Report

Grey-headed Flying-fox	Pteropus poliocephalus	1250-Coastal sandstone gully forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	1250-Coastal sandstone gully forest
Little Bent-winged Bat	Miniopterus australis	1250-Coastal sandstone gully forest
Little Eagle	Hieraaetus morphnoides	1250-Coastal sandstone gully forest
Little Lorikeet	Glossopsitta pusilla	1250-Coastal sandstone gully forest
Masked Owl	Tyto novaehollandiae	1250-Coastal sandstone gully forest
New Holland Mouse	Pseudomys novaehollandiae	1250-Coastal sandstone gully forest
Powerful Owl	Ninox strenua	1250-Coastal sandstone gully forest
Regent Honeyeater	Anthochaera phrygia	1250-Coastal sandstone gully forest
Rosenberg's Goanna	Varanus rosenbergi	1250-Coastal sandstone gully forest
Scarlet Robin	Petroica boodang	1250-Coastal sandstone gully forest
Spotted-tailed Quoll	Dasyurus maculatus	1250-Coastal sandstone gully forest
Square-tailed Kite	Lophoictinia isura	1250-Coastal sandstone gully forest
Swift Parrot	Lathamus discolor	1250-Coastal sandstone gully forest
Turquoise Parrot	Neophema pulchella	1250-Coastal sandstone gully forest
Varied Sittella	Daphoenositta chrysoptera	1250-Coastal sandstone gully forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	1250-Coastal sandstone gully forest
White-throated Needletail	Hirundapus caudacutus	1250-Coastal sandstone gully forest
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1250-Coastal sandstone gully forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Black Bittern	Ixobrychus flavicollis	1250-Coastal sandstone gully forest
Yellow-bellied Glider	Petaurus australis	1250-Coastal sandstone gully forest

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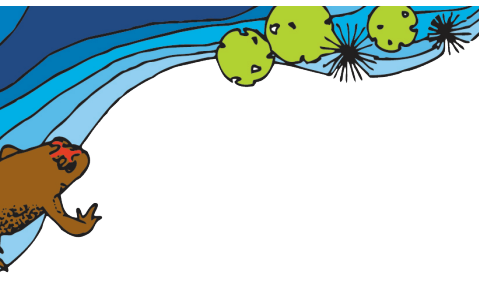
BAM Predicted Species Report

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

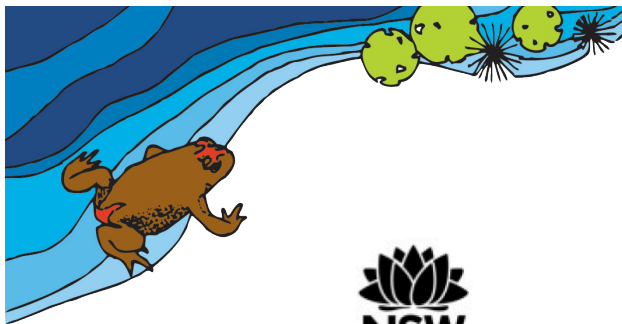Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Black Bittern	Ixobrychus flavicollis	Habitat constraints
Yellow-bellied Glider	Petaurus australis	Refer to BAR

BAM Vegetation Zones Report

Proposal Details

Assessment Id	**Assessment name**	**BAM data last updated ***
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	**Report Created**	**BAM Data version ***
Elizabeth Ashby	31/10/2022	55
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17045	Part 4 Developments (Small Area)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
1	31/10/2022	BOS Threshold: Biodiversity Values Map

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Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	1250_Moderate	1250-Coastal sandstone gully forest	Moderate	0.49	1	MZ1Ftprnt (0.24 ha) MZ2APZ (0.25 ha)

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BAM Biodiversity Credit Report (Like for like)

Proposal Details

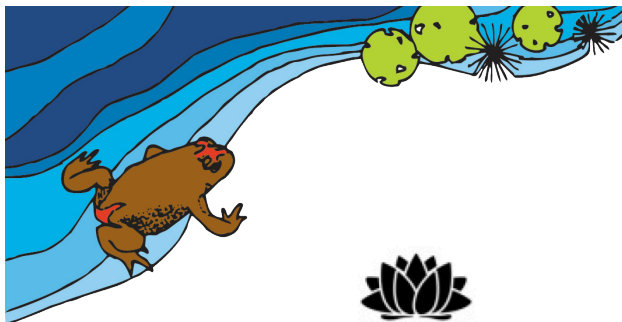|		
Assessment Id	Proposal Name	BAM data last updated *
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	Assessor Number	BAM Data version *
Elizabeth Ashby	BAAS17045	55
Proponent Names	Report Created	BAM Case Status
	31/10/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (Small Area)	31/10/2022
BOS entry trigger		
BOS Threshold: Biodiversity Values Map		

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Chalinolobus dwyeri / Large-eared Pied Bat

Additional Information for Approval

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PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Ixobrychus flavicollis / Black Bittern
Petaurus australis / Yellow-bellied Glider

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1250-Coastal sandstone gully forest	Not a TEC	0.5	0	3	3

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1250-Coastal sandstone gully forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1250_Moderate	No	3	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	**1250_Moderate**	0.5	7.00

Credit Retirement Options

Like-for-like credit retirement options

Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion

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	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00035930/BAAS17045/22/00035931	171 Forest Way Belrose	14/10/2022
Assessor Name	Assessor Number	BAM Data version *
Elizabeth Ashby	BAAS17045	55
Proponent Name(s)	Report Created	BAM Case Status
	31/10/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (Small Area)	31/10/2022
BOS entry trigger		
BOS Threshold: Biodiversity Values Map		

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Chalinolobus dwyeri / Large-eared Pied Bat		

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

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PCT
No Changes

Predicted Threatened Species Not On Site
Name
Ixobrychus flavicollis / Black Bittern
Petaurus australis / Yellow-bellied Glider

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1250-Coastal sandstone gully forest	Not a TEC	0.5	0	3	3.00

1250-Coastal sandstone gully forest	**Like-for-like credit retirement options**				
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1250_Moderate	No	3	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options				
	Formation	Trading group	Zone	HBT	Credits	IBRA region

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	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1250_Moderate	No	3	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	**1250_Moderate**	0.5	7.00

Credit Retirement Options   Like-for-like options

Chalinolobus dwyeri/ Large-eared Pied Bat	Spp		IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

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