5 Assessment of Impacts

5.1 Impacts on Native Vegetation and Habitat

5.1.1 Direct Impacts

The development of the Project will result in direct impacts on biodiversity values. Direct impacts include the loss of vegetation and fauna habitats as a result of clearance works and subsequent operation of the wind farm. The Development Corridors contains a range of habitat features (such as hollow-bearing trees, fallen logs and threatened flora species habitat) and species-credit species have been identified to occur within the Development Corridors.

Table 5.1 below outlines the direct impacts on native vegetation, which totals approximately 392.32 hectares. This does not include a further 103.17 hectares of impact on Non-native Vegetation (Vegetation Zone 10) The Indicative Development Footprints are shown in **Figure 1.4**. Avoidance and minimisation measures associated with minimising the impacts of these direct impacts are discussed in **Section 4.0** above.

Table 5.1 Direct Impacts of the Proposed Modification on Biodiversity Features

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
Plant Community Type																					
VZ 1 - 289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	0.05	-	0.05	-	-	-	**0.05**	-	**0.05**	0.05	-	0.05	-	-	-	0.73	-	0.73	**0.78**	-	**0.78**
VZ 2 - 335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	12.78	1.80	14.58	-	-	-	**12.78**	**1.80**	**14.58**	4.77	0.73	5.50	-	-	-	-	-	-	**4.77**	**0.73**	**5.50**

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
VZ 3 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Moderate to Good*	14.36	21.97	36.33	-	-	-	**14.36**	**21.97**	**36.33**	8.60	10.15	18.75	-	-	-	1.33	-	1.33	**9.93**	**10.15**	**20.08**
VZ 4 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Derived Native Grassland*	22.36	10.35	32.71	-	-	-	**22.36**	**10.35**	**32.71**	11.22	5.63	16.85	-	-	-	0.67	-	0.67	**11.89**	**5.63**	**17.52**

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
VZ 5 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Moderate to Good*	129.11	88.15	217.26	10.17	2.23	12.40	**139.28**	**90.38**	**229.66**	52.39	31.20	83.59	0.42	0.05	0.47	0.75	-	0.75	**53.56**	**31.25**	**84.81**
VZ 6 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Derived Native Grassland*	315.02	134.73	449.75	14.78	3.15	17.93	**329.80**	**137.88**	**467.68**	125.39	43.69	169.08	3.16	1.60	4.76	0.15	-	0.15	**128.70**	**45.29**	**173.99**

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
VZ 7 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Acacia Shrubland*	6.11	15.88	21.99	2.80	3.88	6.68	**8.91**	**19.76**	**28.67**	2.40	4.85	7.25	0.55	0.70	1.25	0.03	-	0.03	**2.98**	**5.55**	**8.53**
VZ 8 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Sifton Bush Shrubland*	194.97	54.16	249.13	9.07	0.87	9.94	**204.04**	**55.03**	**259.07**	64.79	18.01	82.80	1.10	0.02	1.12	0.26	-	0.26	**66.15**	**18.03**	**84.18**

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
VZ 9 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Argyle Apple Forest*	3.79	-	3.79	-	-	-	3.79	-	3.79	0.61	-	0.61	-	-	-	0.01	-	0.01	0.62	-	0.62
VZ 10 - Non-Native Vegetation	141.84	87.87	229.71	0.37	3.70	4.07	142.21	91.57	233.78	56.23	34.00	90.23	0.73	0.62	1.35	13.60	-	13.60	70.56	34.62	105.18
Species-credit Species Habitats																					
striped legless lizard *Delma impar*	13.97	-	**13.97**	-	-	-	13.97	-	13.97	3.58	-	**3.58**	-	-	-	-	-	-	3.58	-	3.58
southern myotis *Myotis macropus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	**0.03**	0.03	-	0.03
squirrel glider *Petaurus norfolcensis*	138.17	108.23	**246.40**	10.00	2.23	12.23	148.17	110.46	258.63	59.42	40.75	**100.17**	0.35	0.05	**0.40**	**2.40**	-	**2.40**	62.17	40.80	102.97
superb parrot (breeding habitat) *Polytelis swainsonii*	14.36	21.97	**36.33**	-	-	-	14.36	21.97	36.33	8.60	10.15	**18.76**	-	-	-	**1.33**	-	**1.33**	9.93	10.15	20.08

Ecosystem/ Species	Area within the Development Corridor – Wind Farm (ha)			Area within the Development Corridor – Permanent Met Masts (ha)			Total Area within the Development Corridors (ha)			Area within the Indicative Development Footprint – Wind Farms (ha)			Area within the Indicative Development Footprint – Permanent Met Masts (ha)			Area within the Indicative Development Footprint – External Roads (ha)			Area within the Indicative Development Footprints (ha)		
	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total	SWS IBRA	SEH IBRA	Total
golden sun moth *Synemon plana*	56.82	56.97	**113.79**	0.01	0.09	0.10	**56.83**	**57.06**	**113.89**	21.45	20.84	**42.29**	0.18	0.73	**0.91**	-	-	-	**21.63**	**21.57**	**43.20**

The summary of change in direct impacts associated with the modified project compared with the approved project is presented below in **Table 5.2**.

Table 5.2 Summary of Change Between Approved and Modified Project

PCT / Species	Original Area of Impact (ha)	Area of Indicative Development Footprint – Wind Farm	Area of Indicative Development Footprint – Permanent Met Masts	Area of Indicative Development Footprint – External Roads	Total Area of Indicative Development Footprints	Order of Change
Ecosystem						
VZ 1 - 289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	Not previously assessed	0.05	-	0.73	0.78	Vegetation not previously identified or assessed.
VZ 2 - 335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	Not previously assessed	5.50	-	-	5.50	Vegetation not previously identified or assessed.

PCT / Species	Original Area of Impact (ha)	Area of Indicative Development Footprint – Wind Farm	Area of Indicative Development Footprint – Permanent Met Masts	Area of Indicative Development Footprint – External Roads	Total Area of Indicative Development Footprints	Order of Change
VZ 3 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Moderate to Good*	24.9	18.75	-	1.33	20.08	Avoidance of 4.82 hectares
VZ 4 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Derived Native Grassland*	25.3	16.85	-	0.67	17.52	Avoidance of 7.78 hectares
VZ 5 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Moderate to Good*	87.7	83.59	0.47	0.75	84.81	Avoidance of 2.89 hectares

PCT / Species	Original Area of Impact (ha)	Area of Indicative Development Footprint – Wind Farm	Area of Indicative Development Footprint – Permanent Met Masts	Area of Indicative Development Footprint – External Roads	Total Area of Indicative Development Footprints	Order of Change
VZ 6 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Derived Native Grassland*	71.6	169.08	4.76	0.15	173.99	Increase of 102.39 hectares
VZ 7 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Acacia Shrubland*	1.3	7.25	1.25	0.03	8.53	Increase of 7.23 hectares
VZ 8 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Sifton Bush Shrubland*	29.6	82.80	1.12	0.26	84.18	Increase of 54.58 hectares

PCT / Species	Original Area of Impact (ha)	Area of Indicative Development Footprint – Wind Farm	Area of Indicative Development Footprint – Permanent Met Masts	Area of Indicative Development Footprint – External Roads	Total Area of Indicative Development Footprints	Order of Change
VZ 9 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Argyle Apple Forest*	0.4	0.61	-	0.01	0.62	Increase of 0.22 hectares
VZ 10 - Non-native Vegetation	20.0	90.23	1.35	13.60	105.18	Increase of 85.18 hectares
Species						
striped legless lizard *Delma impar*	49.5	3.58	-	-	3.58	Avoidance of 45.92 ha
southern myotis *Myotis macropus*	Not previously recorded	-	-	0.03	0.03	Species not previously identified or assessed.
squirrel glider *Petaurus norfolcensis*	Not previously recorded	100.17	0.40	2.40	102.97	Species not previously identified or assessed.
superb parrot (breeding habitat) *Polytelis swainsonii*	24.9	18.76	-	1.32	20.08	Avoidance of 4.82 ha
golden sun moth *Synemon plana*	66.94	42.29	0.91	-	43.20	Avoidance of 23.74 ha

5.1.1.1 Direct Removal of Hollow Bearing Trees

As per Section 9.1.2.6 of the BAM (OEH 2017) **Table 5.3** presents the number of hollow bearing trees in each vegetation zone that are directly impacted by the Project. As per Section 5.3.4.29 of the BAM (OEH 2017), the number of trees with hollows that are visible from the ground were calculated in the 20 x 50 metre plot as part of the BAM Vegetation Integrity Plot. However, as detailed in **Section 5.5.4**, additional hollow bearing tree surveys were completed specifically for the superb parrot. While **Table 5.3** presents the number of hollow bearing trees recorded for Vegetation Zone 3 within the BAM Vegetation Integrity Plots, the average number of HBTs per hectare and total number of HBTs to be removed is based on the outcomes presented in **Section 5.5.4**.

Table 5.3 Hollow Bearing Trees Recorded per Vegetation Zone

Vegetation Zone / PCT / Condition	BAM Vegetation Integrity Plots	Total No. HBTs Recorded	Average No. HBTs per ha[1]	Total HBTs to be Removed[1, 2]
VZ 1 - 289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	1	1	10	8
VZ 2 - 335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	3	0	0	0
VZ 3 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Moderate to Good*	n/a	n/a	10.7[3]	215
VZ 4 - 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Derived Native Grassland*	5	0	1[#]	18
VZ 5 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Moderate to Good*	8	29	36.25	3,063
VZ 6 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Derived Native Grassland*	10	1	0.1	17

Vegetation Zone / PCT / Condition	BAM Vegetation Integrity Plots	Total No. HBTs Recorded	Average No. HBTs per ha[1]	Total HBTs to be Removed[1, 2]
VZ 7 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Acacia Shrubland*	4	3	10	85
VZ 8 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Sifton Bush Shrubland*	5	0	0	0
VZ 9 - 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Argyle Apple Forest*	2	6	30	19
Non-native Vegetation	7	0	0	0

[1] Averages are rounded up or down to the nearest whole number.

[2] Averages are calculated based on the total area of the vegetation zone in the Indicative Development Footprints (Wind Farm and External Roads).

[3] average number of HBTs per hectare and total number of HBTs to be removed is based on the outcomes presented in **Section 5.5.4.**

[#] Consistent with the Biodiversity Assessment Addendum (NGH Environmental 2016a), despite not recording any Hollow Bearing Trees in the BAM Vegetation Integrity Plots for Vegetation Zone 4, 1 hollow bearing tree per hectare has been assumed in recognition of scattered trees occurring throughout.

5.1.1.2 Direct Partial Impacts

RPRE confirmed through Transgrid the easement specifications required for the project for the future operation of the proposed transmission lines, including 132kV and 33kV. Transgrid is the operator of the grid in this part of NSW, however it has not been confirmed that they will be building the transmission line for the Project.

Transgrid confirmed that a 40 m wide easement would be required for 132kV and a 20 m wide easement would be required for 30kV within vegetation that is currently, or can grow equal to or greater than, 4 metres tall. For vegetation zones that meet these characteristics, partial direct impacts have been calculated within the 40 m wide or 20 m wide easement (excluding the pole and string locations) as per Section 9.1.2.3 of the BAM [OEH 2017]). This means that the future vegetation integrity score for these applicable areas are not reduced to the default score of 0 (no biodiversity value).

Within these easements, a proportion of biodiversity values will remain within select vegetation zones. Canopy species, understorey and ground stratum flora species persist in these environments and also provide substantial cover. The following vegetation zones were assessed against partial impact parameters where they occurred within the transmission lines:

- 9.04 hectares of VZ 3, comprising 4.27 hectares in SWS IBRA and 4.77 hectares in SEH IBRA.
- 17.81 hectares of VZ 5, comprising 9.63 hectares in SWS IBRA and 8.18 hectares in SEH IBRA.

- 2.81 hectares of VZ 7, comprising 2.81 hectares in SEH IBRA.

Vegetation Zones 1 and 9 were also considered for the application of Direct Partial Impacts, however they do not intersect with any sections of the proposed transmission lines.

For vegetation zones < 4 metres tall, direct impacts have been calculated for the transmission line poles and string lines specifically (i.e. not the easement) and the future vegetation integrity score has been reduced to the default of 0.

The values used for partial impacts are presented below in **Table 5.4**.

Table 5.4 Partial Impact Values

Attribute	CCS	SCS	FCS
Tree	Same as original	5 per cent of original	
Shrub	Same as original	25 per cent of original	
Grass and Grass Like	50 per cent of original	50 per cent of original	
Forb	50 per cent of original	5 per cent of original	
Fern	50 per cent of original	5 per cent of original	
Other	50 per cent of original	5 per cent of original	
Number of Large Trees			Default
Litter Cover			Same as original
Coarse Woody Debris			Same as original
Stem Size Class			1
Regeneration stems <5cm DBH			Present
High Threat Weed Cover			Same as original

Full detail of the partial assessment for each of the applicable vegetation zones is presented below, initially for those that occur within the NSW Southern West Slopes IBRA Region (**Table 5.5**) and then for those that occur within the South East Highlands IBRA Region (**Table 5.6**).

Table 5.5 Current and Future Score for Partial Impacts in Transmission (SWS IBRA)

	VZ 3		VZ 5	
	Current Score	Future Score	Current Score	Future Score
CCS				
Tree	2.4	2.4	3.4	3.4
Shrub	1	1	4.6	4.6
Grass and Grass Like	6.9	3.5	6.3	3.2
Forb	4	2.0	4.5	2.3
Fern	0	0	0.1	0
Other	0.4	0.2	0.8	0.4

	VZ 3		VZ 5	
	Current Score	Future Score	Current Score	Future Score
SCS				
Tree	35.3	1.8	43.4	2.2
Shrub	5.3	1.3	14.5	3.6
Grass and Grass Like	29.6	14.8	25.3	12.7
Forb	2.4	0.1	3.6	0.2
Fern	0	0	0.1	0
Other	1	0	1.3	0
FCS				
Number of Large Trees	2	0	1.9	0
Litter Cover	59.1	59.1	54.1	54.1
Coarse Woody Debris	48.1	48.1	125.7	125.7
Stem Size Class	3.1	1	3.5	1
Regeneration stems <5cm DBH	1	1	0.9	1
High Threat Weed Cover	1.7	1.7	0.1	0.1

Table 5.6 Current and Future Score for Partial Impacts in Transmission (SEH IBRA)

	VZ 3		VZ 5		VZ 7	
	Current Score	Future Score	Current Score	Future Score	Current Score	Future Score
CCS						
Tree	2.4	2.4	3.4	3.4	1	1
Shrub	1	1	4.6	4.6	4.5	4.5
Grass and Grass Like	6.9	3.5	6.3	3.2	6.5	3.3
Forb	4.0	2	4.5	2.3	4	2
Fern	0	0	0.1	0	1	0.5
Other	0.4	0.2	0.8	0.4	0.8	0.4
SCS						
Tree	35.3	1.8	43.4	2.2	24	1.2
Shrub	5.3	1.3	14.5	3.6	13.1	3.3
Grass and Grass Like	29.6	14.8	25.3	12.6	58.3	29.2
Forb	2.4	0.1	3.6	0.2	1	0
Fern	0	0	0.1	0	0.3	0
Other	1	0	1.3	0	0.2	0

	VZ 3		VZ 5		VZ 7	
	Current Score	Future Score	Current Score	Future Score	Current Score	Future Score
FCS						
Number of Large Trees	2	0	1.9	0	0.3	0
Litter Cover	59.1	59.1	54.1	54.1	30.7	30.7
Coarse Woody Debris	48.1	48.1	125.7	125.7	18.5	18.5
Stem Size Class	3.1	1	3.5	1	2.5	1
Regeneration stems <5cm DBH	1	1	0.9	1	1	1
High Threat Weed Cover	1.7	1.7	0.1	0.1	0.1	0.1

5.1.2 Indirect Impacts

The Project is likely to result in additional indirect impacts on biodiversity values of surrounding lands. In particular:

- erosion
- dust pollution
- noise, vibration and activity during construction works
- pollution risks associated with use of concrete, fuels and lubricants and construction chemicals
- weed and feral animal encroachment.

These potential impacts on biodiversity will vary depending on the type of impact, the duration and frequency of the impact and the ability of the biodiversity features to respond to these changes. However, these indirect impacts are considered to be manageable with appropriate management and mitigation measures that would be formalised through the required management plans, many of which are described above in **Section 4.0**.

Given the extensive spread of the project design (some 36 kilometres in length from the northern to southern tip) the indirect impacts listed above are likely to be of low magnitude temporally and spatially.

This position remains consistent with the original assessment of indirect and peripheral impacts considered as part of the original Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a). Despite the Project undergoing a modification, the components of indirect and peripheral impacts remain unchanged in nature and extent.

Further detail on the indirect impacts is provided below, and in the Modification Application Report where relevant.

5.1.2.1 Erosion

The extent of works proposed as part of the Project has the potential to result in indirect impacts to biodiversity values through erosion. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan that will be required prior to construction. The proposed changes to the Project as part of the modification do not present an increased risk of these indirect impacts.

The extent and risk of indirect impacts from erosion associated with the Project is considered to be consistent with those presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.1.2.2 Dust Pollution

The extent of works proposed as part of the Project has the potential to result in indirect impacts from dust pollution. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan that will be required prior to construction. The proposed changes to the Project as part of the modification do not present an increased risk to biodiversity values from dust pollution.

The extent and risk of indirect impacts from the dust pollution associated with the Project is considered to be consistent with those presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.1.2.3 Noise, Vibration and Activity During Construction

The extent of works proposed as part of the Project has the potential to result in indirectly impact fauna that may be nesting, foraging or migrating through noise, vibration and activity during construction. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan that will be required prior to construction. The proposed changes to the Project as part of the modification do not present an increased risk of such indirect impacts.

The extent and risk of indirect impacts from the noise, vibration and activity during construction associated with the Project is considered to be consistent with those presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.1.2.4 Pollution

The extent of works proposed as part of the Project has the potential to result in indirect impacts to biodiversity values through the inadvertent or accidental pollution of concrete, fuels, lubricants and other construction chemicals and materials. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan that will be required prior to construction. The proposed changes to the Project as part of the modification do not present an increased risk of indirect impacts from pollution.

The extent and risk of indirect impacts from pollutions of chemicals and materials associated with the Project is considered to be consistent with those presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.1.2.5 Weed and Feral Animal Encroachment

New weed species could be inadvertently brought into the Indicative Development Footprints on construction vehicles and machinery, within imported materials, or could invade naturally through removal of native vegetation. The presence of weed species within the Indicative Development Footprints has the potential to decrease the value of extant vegetation to native species, however we note a large number of pasture weeds (including forbs and grasses) already occur throughout the Indicative Development Footprints as a result of the historical land use. Mitigation measures outlined in **Section 4.0** will be implemented to minimise the potential for weed encroachment into areas surrounding the Indicative Development Footprints.

Populations of feral fauna species such as foxes, rabbits and cats can increase and quickly populate new areas as a result of disturbance. Clearing, thinning of vegetation and the creation of tracks have the ability to assist the establishment and spread of feral fauna species. However, foxes, rabbits and wild dogs already occur throughout the Indicative Development Footprints as a result of the historical land use. Mitigation measures outlined in **Section 4.0** will minimise the potential for feral animal spread and impacts into surrounding areas around the Indicative Development Footprints.

There will be no substantial change to impacts from weeds or feral animals, given that the Project is located within, and adjacent to, a landscape exposed to historical and current agricultural land uses. Any additional impacts resulting from weeds or feral animals are not expected to be of any level of significance in relation to threatened species, populations and communities.

In conclusion, the indirect impacts to weed and feral animal encroachment that will result from the Project are not considered to be different to those that were presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.2 Impacts on Threatened Ecological Communities

Despite a range of avoidance and minimisation measures (refer to **Section 4.0**) the Project will impact a total of 37.50 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act within Vegetation Zones 3 (20.08 hectares) and 4 (17.42 hectares); and 35.73hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act within Vegetation Zones 3 (19.38 hectares) and 4 (16.35 hectares). See **Figure 3.4**. **Table 5.7** presents a summary of these impacts in relation to the applicable vegetation zones, which IBRA region it occurs in (necessary for offsetting purposes) and proportion of TECs within the Development Corridors and Indicative Development Footprints (Wind Farm, Permanent Met Masts and External Roads).

Impact to the CEEC under the BC Act is less (**12.70 hectares**) than the impact threshold of 50.2 hectares for this TEC as identified in Consent Condition 19(a) of the existing State Approval. While the Project does impact on the CEEC, it has successfully avoided 12.70 hectares of CEEC threshold. Approximately 69.04 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act was identified within the wider Development Corridors. Therefore, 31.54 hectares of the CEEC (BC Act) in the Development Corridors has been avoided by the Project and considerable amounts of the CEEC (BC Act) occur beyond the Development Corridors in the local region.

Impacts to the CEEC under the EPBC Act is 26.23 hectares more than the impact threshold of 9.5 hectares for this TEC as identified in Condition 3 of the existing Federal Approval (EPBC 2014/7163). It is noted that 67.64 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act was identified within the Development Corridors. Therefore, 31.91 hectares of the CEEC (EPBC Act) has been avoided by the Project and will persist within the wider Development Corridors,

and considerable amounts of the CEEC (EPBC Act) occur beyond the Development Corridors in the local region.

Table 5.7 Summary of Threatened Ecological Communities

	Area of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC – BC Act (ha)	Area of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC – EPBC Act (ha)
SWS IBRA		
Vegetation Zone 3		
Development Corridor – Wind Farm	14.36	14.36
Development Corridor – Permanent Met Masts	-	-
Indicative Development Footprint – Wind Farm	8.60	8.60
Indicative Development Footprint – Permanent Met Masts	-	-
Indicative Development Footprint – External Roads	1.33	0.64
Vegetation Zone 4		
Development Corridor – Wind Farm	22.36	21.86
Development Corridor – Permanent Met Masts	-	-
Indicative Development Footprint – Wind Farm	11.22	11.01
Indicative Development Footprint – Permanent Met Masts	-	-
Indicative Development Footprint –External Roads	0.57	0.10
SEH IBRA		
Vegetation Zone 3		
Development Corridor – Wind Farm	21.98	21.95
Development Corridor – Permanent Met Masts	-	-
Indicative Development Footprint – Wind Farm	10.15	10.14
Indicative Development Footprint – Permanent Met Masts	-	-
Indicative Development Footprint – External Roads	-	-

	Area of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC – BC Act (ha)	Area of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC – EPBC Act (ha)
Vegetation Zone 4		
Development Corridor – Wind Farm	10.35	9.48
Development Corridor – Permanent Met Masts	-	-
Indicative Development Footprint – Wind Farm	5.63	5.24
Indicative Development Footprint – Permanent Met Masts	-	-
Indicative Development Footprint –External Roads	-	-

5.3 Prescribed Impacts

Consistent with the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016) no prescribed impacts are expected to occur to threatened ecological community habitat as none of those which occur within the Indicative Development Footprints are associated with karst, caves, crevices, cliffs and other geological features of significance, rocks or human-made structures. Furthermore, no prescribed impacts are expected to occur to threatened species associated with karsts, crevices, cliffs and other geological features of significance, rocks or human-made structures as these do not occur within the Indicative Development Footprints.

Consistent with the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016) no impacts on water quality or hydrological processes that sustain threatened species and threatened ecological communities are likely to occur.

Consistent with the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016) a number of prescribed impacts have been considered for the Project, being impacts of threatened microbat species associated with caves (**Section 5.3.1**), impacts from risk of vehicle strike (**Section 5.3.2**), impacts of turbine strikes (**Section 5.3.3**) and the interruption and fragmentation to connectivity of native vegetation and associated habitat corridors (**Section 5.3.4**).

5.3.1 Threatened Microbat Species Associated With Caves

Umwelt completed extensive surveys across the Development Corridor to facilitate the preparation of the Bird and Bat Adaptive Management Plan. This scope of works included the deployment of Anabat recorders across the Development Corridor, at ground level as well as at height (installed on the existing meteorological masts). These surveys were completed across the four seasons of the year, with the timing of one of the survey programs selected in consultation with BCD to capture the northern migration of the large bent-wing bat from their known breeding cave in Wee Jasper, NSW (approximately 70 km south-west of the Development Corridor).

Umwelt used this package of bird and bat survey work, along with the extensive surveys and associated results that were captured by NGH Environmental (2014 and 2016) as part of the existing approval process, and available literature to facilitate the preparation of Prescribed Impact Assessment for the Project in relation to turbine strike on bird and bats (refer to **Appendix E**).

This assessment addressed four species of microbat recorded either by Umwelt or previously by NGH Environmental (2014 and 2016), being large bent-wing bat (*Miniopterus orainae oceanensis*), eastern false pipistrelle (*Falsistrellus tasmaniensis*), yellow-bellied sheathtail bat (*Saccolaimus flaviventrus*) and southern myotis (*Myotis macropus*). Profiles for each of these species were reviewed on the TBDC (BCD 2020b), confirming that just one of these species is associated with caves, being the large bent-wing bat. The other three species are not considered further in this section of Prescribed Impacts, they are discussed further in **Section 5.3.3**.

No caves, or cave-like structures, were recorded within the Indicative Development Footprints. However, an old mine shaft was recorded in proximity to the Indicative Development Footprint – Wind Farm (see **Figure 2.1**). The project will have no impact on this old mine shaft. It is expected however to provide habitat consistent with a cave and therefore supports likely habitat for the large bent-wing bat.

Umwelt visited the old mine shaft on multiple occasions during our field surveys, there was no visible sign of recent or current usage by bats, based on bats or bat droppings being visible, or odour from bat droppings. Furthermore, Anabat detectors did not suggest the old mine shaft was being used for roosting or breeding purposes by any species. The entry/exit point to the old mine shaft was surveyed over five

nights with an Anabat detector in February 2018. The results of this analysis determined there was no roosting or breeding numbers of individuals for any species.

It is recognised that other threatened species of microbat in NSW use caves and cave like structures for breeding or roosting habitat. However, none of these species were recorded as part of the extensive surveys for the Bird and Bat Adaptive Management Plan, or previously through the extensive surveys completed by NGH Environmental (2014 and 2016). Thus, none of these species have been considered further.

In summary prescribed impacts associated with threatened microbat species associated with caves remains consistent with the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016).

5.3.2 Impacts from Increased Risk of Vehicle Strike

The Project will result in an increase of vehicle activity within the Indicative Development Footprints through construction of a network of internal access tracks, predominantly between turbine locations but also within transmission lines for servicing purposes. These internal access tracks will not be open for public use as they are restricted to the private properties of landholders involved with the Project. Use of these access tracks will be restricted to landholders, wind farm employees and associated contractors. Internal access tracks will have enforced speed restrictions to adequately reduce the risk of interaction between animals and vehicles.

No new public roads will be constructed for the Project, however multiple sections of public roads will be upgraded for the Project. The upgrade works will be the responsibility of RPRE but have been designed in consultation with BCD and relevant LGAs.

Due to the disturbed condition of the Indicative Development Footprints, it is unlikely that any threatened species or animals that are part of a TEC would be adversely impacted by the increase in vehicle movement in the Indicative Development Footprints.

In summary prescribed impacts associated with impacts from increased risk of vehicle strike remains consistent with the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016).

5.3.3 Impacts from Turbine Strikes

Umwelt has prepared detailed Prescribed Impact Assessments to consider the potential impacts from turbine strikes on significant avifauna species. These assessments have been prepared in accordance with Section 9.2.1.8 of the BAM (OEH 2017a) and through careful and detailed consultation with BCD . They are provided in full in **Appendix E**.

Species considered to be the most aerial threatened species and therefore the most likely to be impacted by the Project were selected for inclusion in this assessment based on the results of bird utilisation surveys conducted in the survey area by NGH in 2012/13 and Umwelt in 2018/19. One non-threatened species, the wedge-tailed eagle was also assessed due to its known susceptibility to blade strike. At the request of the BCD, 14 species were considered in this assessment comprising 13 threatened species (nine bird and four bat species) and one non-threatened bird species (wedge-tailed eagle). Threatened species assessed include:

- little eagle (*Hieraaetus morphnoides*)
- black falcon (*Falco subniger*)

- superb parrot (*Polytelis swainsonii*)
- white-throated needletail (*Hirundapus caudacutus*)
- white-fronted chat (*Epthianura albifrons*)
- brown treecreeper (*Climacteris picumnus victoriae*)
- varied sittella (*Daphoenositta chrysoptera*)
- painted honeyeater (*Grantiella picta*)
- dusky woodswallow (*Artamus cyanopterus*)
- large bent-winged bat (*Miniopterus schreibersii oceanensis*)
- yellow-bellied sheathtail bat (*Saccolaimus flaviventris*)
- southern myotis (*Myotis macropus*) and
- eastern false pipistrelle (*Falsistrellus tasmaniensis*).

5.3.4 Connectivity of Native Vegetation and Habitat Corridors

As described in **Section 1.1.1**, the Development Corridors are located in a region of NSW that has been extensively modified and disturbed as a result of a long history of agricultural land uses. Specifically, the Development Corridor is occupied by agricultural landscapes on the valley floors and low slopes, with substantial areas of intact vegetation associated with the network of public reserves, upper slopes and ridgetops.

Broadly speaking, much of the Indicative Development Footprints occur where the connectivity of native vegetation and habitat corridors has been previously compromised by historical agricultural land uses. However, there are specific locations of the Indicative Development Footprints where it is considered likely that the Project will interrupt the connectivity of native vegetation and fauna habitat. These are summarised below in **Table 5.8** and presented in **Figure 3.2**.

Table 5.8 Interruption of Native Vegetation and Fauna Habitat Connectivity

Location within Indicative Development Footprints	Summary of Interruption
• Turbines 17 and 20 • Associated access tracks	• Despite there being an existing farm track here, as it is very thin and used infrequently it does not currently interrupt the connectivity of native vegetation or fauna habitat. • A large patch of Vegetation Zone 5 will be intersected. • A patch of Vegetation Zone 9 will be intersected. **Note that this is a previously disturbed vegetation community.** • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 30 and 70 m.

Location within Indicative Development Footprints	Summary of Interruption
• Turbines 34, 37, 39, 41, 42, 48, 49, 50, 51, 56, 58, 61, 62, 63, 67, 139 and 141 • Associated access tracks • Transmission line	• There are some existing farm tracks in this location of the Indicative Development Footprints, however as they are very thin and used infrequently, they do not currently interrupt the connectivity of native vegetation or fauna habitat. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 8 will be intersected. **Note that this is a previously disturbed vegetation community.** • A small patch of Vegetation Zone 9 will be intersected. • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 30 and 200 m.
• Turbines 65, 68, 146, 147 and 148 • Access tracks	• Despite there being an existing farm track here, as it is very thin and used infrequently it does not currently interrupt the connectivity of native vegetation or fauna habitat. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 8 will be intersected. **Note that this is a previously disturbed vegetation community.** • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 30 and 130 m.
• Turbines 150 • Access tracks • Transmission line	• Despite there being an existing farm track here, as it is very thin and used infrequently it does not currently interrupt the connectivity of native vegetation or fauna habitat. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 7 will be intersected. **Note that this is a previously disturbed vegetation community.** • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 20 and 100 m.
• Turbines 84, 85, 86, 87, 143 • Transmission line	• There is a reasonably sized access track along the ridgeline that is being utilised. However, there will be particular sections that will require redesign for construction works. This track upgrade is not considered to modify the existing interruption of connectivity of native vegetation or fauna habitat beyond the current level. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 3 will be intersected. • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 10 and 130 m.

Location within Indicative Development Footprints	Summary of Interruption
• Access tracks and transmission line north of Turbine 145	• There are existing farm tracks in this location of the Indicative Development Footprints, however as they are very thin and used infrequently, they do not currently interrupt the connectivity of native vegetation or fauna habitat. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 8 will be intersected. **Note that this is a previously disturbed vegetation community.** • Large patches of Vegetation Zone 3 will be intersected. • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 10 and 30 m.
• Turbines 125, 127 and 142 • Access tracks	• There is an existing farm track in this location of the Indicative Development Footprints, however as it is very thin and used infrequently it does not currently interrupt the connectivity of native vegetation or fauna habitat. • Large patches of Vegetation Zone 5 will be intersected. • Large patches of Vegetation Zone 7 will be intersected. **Note that this is a previously disturbed vegetation community.** • The Project will interrupt the connectivity of native vegetation and fauna habitat to a width of between 20 and 150 m.

The overall indirect impacts on connectivity of native vegetation and habitat corridors described above are not considered to be significant. While the Project will enhance levels of fragmentation within the region, it will occur to the extent where species or communities are significantly impacted.

The most substantial impacts to connectivity of native vegetation and habitat corridors will occur during the construction phase of the Project. During this time the movement of species will be discouraged from travelling across the Indicative Development Footprints as a result of the substantial works being undertaken. However following completion of the construction, it is expected that native vegetation will recover to the edge of the permanent above ground infrastructure naturally as well as through rehabilitation efforts committed to by RPRE. Full extent of this will be detailed in the future BMP required for the Project and implemented by RPRE.

The turbine hardstands contain the necessary clearing between adjacent native vegetation and the turbine as a mechanism to deter fauna species (i.e. birds and bats) from being impacted by blade strike, they will persist as permanent disruptions to the connectivity. Over time, native vegetation and fauna habitat will return to the access tracks, underground cabling and transmission line disturbance areas and adjoining land. In such circumstances the indirect impacts on connectivity and habitat corridors is considered to be reduced.

Umwelt have experience on multiple major projects that have involved access tracks, underground cabling and transmission lines where over time native flora and fauna species return to the previously disturbed landscapes. We acknowledge that the vegetation will never return to its original state, however we believe it is important to acknowledge that some form of habitat does persist.

The following threatened species, threatened ecological communities and habitats are those considered likely to be affected by the aforementioned indirect impacts.

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland, CEEC (BC Act)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, CEEC (EPBC Act)
- Squirrel glider (*Petaurus norfolcensis*), Vulnerable (BC Act).

In conclusion, the indirect impacts to connectivity and fragmentation that will result from the Project are not considered to be different to those that were presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a).

5.3.5 Prescribed Impacts from Removal of Non-native Vegetation Supporting Golden Sun Moth

Non-native Vegetation makes up 105.18 hectares within the Indicative Development Footprints and is described in **Section 3.2.2**. An assessment of prescribed impacts has been conducted for the removal of non-native vegetation within the Indicative Development Footprints with potential to support the golden sun moth (*Synemon plana*). Umwelt have completed a careful and detailed analysis in assigning the GSM species polygon as part of this BDAR, this is described in **Section 3.3.3.** A total of 19.68 hectares of Non-native Vegetation occurs within the GSM Species Polygon.

This is presented below in Table 5.9. This assessment has been undertaken in accordance with Section 9.2.1.4 of the BAM.

Table 5.9 Prescribed Impact Assessment of Non-native Vegetation Supporting Golden Sun Moth

Criteria	Response
The assessment of the impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation must:	
a) identify the species and ecological communities likely to use the habitat	The golden sun moth has been recorded at several locations within the Indicative Development Footprints during surveys conducted by NGH and Umwelt. Consistent with the impact assessment for this species in the Biodiversity Assessment and Biodiversity Assessment Addendum (NGH Environmental 2014 and 2016), species habitat polygons were developed based on the extent of Vegetation Zones 4 and 6 (i.e. recorded DNGs) that intersect with 200 m buffers of known records for the species. As a result, 19.68 hectares of non-native vegetation fall within the habitat buffers for the species. This non-native vegetation comprises grassland areas have been extensively cleared of native flora species through intensive and historic agricultural land use. They predominantly support exotic grasses and herbs, the most abundant including squirrel tail fescue (*Vulpia bromoides*), soft brome (*Bromus hordeaceus*), silvery hairgrass (*Aira cupaniana*), prairie grass (*Bromus catharticus*), red brome (*Bromus rubens*) and paspalum (*Paspalum dilatatum*). A full description of this mapping unit is provided in **Section 3.2.2**. While these areas occur within the habitat buffers for the golden sun moth, it is noted that the presence of native grass species utilised by the golden sun moth (i.e. *Rytidosperma* spp. and *Austrostipa* spp.) in these areas generally occur in close proximity to the mapped PCT 350 and PCT 351 DNGs. As distances from these PCTs increase, it is likely that so do occurrences of exotic pasture weeds that

Criteria	Response
	do not facilitate foraging or breeding for the species. Currently, the species is only known to occur in degraded grasslands when they are dominated by the exotic Chilean needlegrass (*Nassella nessiana*) (DEWHA 2009, which has not been recorded within any of the areas of Non-native Vegetation occurring in the Indicative Development Footprints. Therefore, while this assessment includes the total 19.67 hectares of Non-native Vegetation which occurs within the golden sun moth habitat buffers, it is likely that the area of Non-native Vegetation with potential to be utilised by the species is considerably lower. Those areas of Non-native Vegetation used by the species would be based on the sporadic presence of native grass species, and are considered sub-optimal habitat.
b) describe the nature, extent and duration of short and long-term impacts	The Project will result in direct and indirect impacts, which are described in full in **Section 5.1**. Short-term indirect impacts will include Non-native Vegetation within and surrounding golden sun moth habitat buffers being subject to potential increase in erosion, dust pollution, noise and vibration during construction works. These will occur across the Indicative Development Footprints for approximately two years. Much of the Development Corridor is exposed to historical and ongoing disturbances from grazing and other agricultural pressures. The extent and risk of indirect impacts from construction activities associated with the Project is considered to be consistent with those presented, discussed and assessed as part of the original approval, including Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016a). Long-term impacts will include the removal of up to 19.68 hectares of Non-native Vegetation which occurs in areas where the Indicative Development Footprints intersect with golden sun moth habitat buffers. This may result in initial species decline due to mortality of adults and larvae during the clearing process. The removal of vegetation may also lead to (additional) feral weed encroachment to adjacent areas over time. Given the occurrence of existing weeds in habitat areas, the Project is unlikely to introduce invasive species such as weeds that are harmful to the golden sun moth or its habitat. Despite the Project undergoing a modification, the components of indirect and peripheral impacts remain unchanged in nature and extent.
c) describe, with reference to relevant literature and other reliable published sources of information, the importance within the bioregion of the habitat to these species or ecological communities	The Saving Our Species (SOS) report for the golden sun moth (OEH 2020) identifies two key management sites for the species: Site 1 – Upper Lachlan and Site 2 – Gundaroo/Queanbeyan. Areas within the Development Corridor occur in the Upper Lachlan Management Site, which encompasses Rye Park, the town of Kangiara and stretches across to Blakney Creek in the east. This covers a total area of approximately 140, 664 hectares where objectives for minimising the impacts of commercial activities and maintaining low weed densities are in place. The areas of Non-native Vegetation forming potential golden sun moth habitat which will be removed by the Project comprise sub-optimal habitat which is not currently being managed in a way that is consistent with the SOS management objectives (i.e. reducing and maintaining weed densities through active weed control at priority sites). Therefore, although some patches of the Development Corridor fall within the Upper Lachlan Priority Site, it is considered unlikely that the removal of Non-native Vegetation within these areas will significantly affect the SOS objective to secure the species in the long term within this region. The *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana)* (DEWHA 2009) specify that the species is only known to occur in degraded grasslands when they are dominated by the exotic Chilean needlegrass (*Nassella nessiana*). This species was not recorded within any of the Non-native Vegetation areas to be cleared during surveys, and it is likely that these areas

Criteria	Response
	would only be used by the species based on the sporadic presence of native grasses. Furthermore, this species has not been recorded through any ecological surveys completed for the Project. There are extensive areas (i.e. several thousand hectares) of suitable habitat for the golden sun moth mapped as Yellow Box-Apple Box Grassy Woodlands in the NSW – South Western Slopes and South Eastern Highlands IBRA bioregions (Gellie 2005). These have groundcovers dominated by the species' preferred native grasses, including wallaby grass (*Rytidosperma racemosum* var. *racemosum*), kangaroo grass (*Themeda australis*), weeping grass (*Microlaena stipoides* var. *stipoides*) and speargrass (*Austrostipa scabra*), and are likely to be similar to golden sun moth habitat areas found in the Development Corridor. These grasses are essential in the maintenance of important life cycle processes for the species, as golden sun moth larvae feed exclusively on the roots of wallaby grasses (DPIE 2019b). With this abundance of higher quality foraging and breeding habitat for the species in the wider region, areas of Non-native Vegetation would likely be utilised only by very small proportion of the species within the local area, and thus a negligible proportion of the species within the wider region. Additionally, there are several areas where the species is found or considered likely to occur within the relevant bioregions which are protected. These include Goorooyarroo Nature Reserve, Bango Nature Reserve, McLeod's Creek Nature Reserve, Oakdale Nature Reserve (OEH 2015) and the Yass River Gorge Council reserve (Yass Valley Council 2017). Taking into account the above information, it is considered that the Non-native Vegetation to be impacted by the Project may potentially be utilised by local populations of the golden sun moth, but is unlikely to constitute important habitat for the species within the relevant bioregions.
d) predict the consequences of the impacts for the local and bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information	The removal of 19.68 ha of Non-native Vegetation will potentially have impacts on local populations occurring in these areas due to their limited dispersal ability. Clearing works may lead to mortality of both adults and larvae utilising sporadic native grasses within Non-native Vegetation, as females of the species are generally reluctant to fly and males will not fly greater than 100 m (DPIE 2019). However, the number of individuals utilising Non-native Vegetation is expected to be a small proportion of the local population due to the species' preference for intact native grasslands (Kutt *et.al.* 2014; DEWHA 2009). Currently, the species is only known to occur in degraded grasslands when they are dominated by the exotic Chilean needlegrass (*Nassella nessiana*) (DEWHA 2009), which has not been recorded within any of the areas of Non-native Vegetation occurring in the Indicative Development Footprints or the Project as a whole. It is recognised that one of the major threats to the golden sun moth is the loss of their preferred habitat by vigorous exotic pasture grasses introduced for livestock grazing, nutrient enrichment and pasture cultivation (O'Dwyer & Attiwill 2000; DEWHA 2009). As such, the Non-native Vegetation to be removed provides sub-optimal habitat for the species, and the impacts are not expected to affect the persistence of the golden sun moth in the local area. With regards to the wider ACT/NSW population, the areas of Non-native Vegetation are surrounded by vast amounts of higher quality native grassland habitat in the NSW – South Western Slopes, and South Eastern Highlands IBRA bioregions (Gellie 2005). These areas have groundcovers dominated by native grasses which are essential in the maintenance of important life cycle processes for the species, as golden sun moth larvae feed exclusively on the roots of wallaby grasses (DPIE 2019b). Therefore these areas would constitute habitat important to the persistence of the species, and are likely the ones where minimising impacts and actively managing weeds would be of the most value. Additionally, the area of Non-native Vegetation to be removed is negligible when viewed in the regional context. Generally larger areas of connected habitat are considered the priority for

Criteria	Response
	protection of golden sun moth over the long-term (DEHWA 2009). As populations separated by distances of greater than 200 m can be considered effectively isolated (DPIE 2019), regional populations are not expected to be affected by the Project. It is not considered likely that the removal of Non-native Vegetation occurring in golden sun moth habitat buffers will affect any populations in such a way that they will become extinct or have their movement restricted so that existing dispersal patterns are significantly affected. Consequences of the removal of 19.68 hectares of Non-native Vegetation are considered to be minor on both a local and regional scale.

5.4 Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles prescribed in the BC Regulation. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These are impacts that:

- will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

A number of species-credit species, predicted species and threatened ecological communities generating biodiversity credits for the Project are nominated as candidate SAII entities in the *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact* (OEH 2017b). These are presented below in **Table 5.10**, as well as an indication as to whether or not they were recorded within Development Corridors.

Table 5.10 Species and Threatened Ecological Communities at risk of SAIIs

Nominated SAIIs	Recorded within Development Corridor
Threatened Ecological Communities	
White Box Yellow Box Blakely's Red Gum Woodland	✓
Threatened Species	
Acacia meiantha	×
regent honeyeater *Anthochaera phrygia*	×
crimson spider orchid *Caladenia concolor*	×

Nominated SAIIs	Recorded within Development Corridor
large-eared pied bat *Chalinolobus dwyeri*	×
Eucalyptus alligatrix subsp. *alligatrix*	×
Euphrasia arguta	×
swift parrot *Lathamus discolor*	×
yellow-spotted tree frog *Litoria castanea*	×
large bent-winged bat *Miniopterus orianae oceanensis*	✓
brush-tailed rock-wallaby *Petrogale penicillata*	×
golden sun moth *Synemon plana*	✓
Zieria obcordata	×

Assessments have been conducted in accordance with Subsections 10.2.2 and 10.2.3 of the BAM for the three SAII entities recorded within the Indicative Development Footprints, and are provided in **Appendix F**. These assessments provide an outline of the nature and extent of the Project impacts and measures taken to avoid SAII.

5.5 Matters of National Environmental Significance

While not a requirement of the BDAR, this section summarises impacts identified for the project on MNES. Relevant to the project these include:

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, EPBC Act
- Striped legless lizard
- Superb parrot
- Golden sun moth

5.5.1 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

Through the Biodiversity Assessment (NGH Environmental 2014) and the Biodiversity Assessment Addendum (NGH Environmental 2016a) the Federal approval for the project allows up to 9.5 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.

As per **Section 5.2** above, the project will result in impacts to 35.73 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (see **Figure 3.4**). This presents an impact increase of 26.23 hectares for the CEEC (EPBC Act) when compared to the current impact threshold previously mentioned. It is noted that 67.64 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act was identified within the Development Corridors. Therefore, 31.91 hectares of the CEEC (EPBC Act) has been avoided by the Project and will persist within the wider Development Corridors, and considerable amounts of the CEEC (EPBC Act) occur beyond the Development Corridors in the local region.

5.5.2 Striped legless lizard

Through the Biodiversity Assessment (NGH Environmental 2014) and the Biodiversity Assessment Addendum (NGH Environmental 2016a) the Federal approval for the project allows up to 49.5 hectares of habitat for the striped legless lizard.

As per **Section 5.1.1** above, the project will result in impacts to 3.58 hectares of striped legless lizard habitat (see **Figure 3.5**). This presents an impact reduction of 45.92 hectares for the striped legless lizard. Additional habitat will persist for this species beyond the extent of the Indicative Development Footprints. With 13.97 hectares of striped legless lizard habitat identified within the Development Corridors, 10.39 hectares will persist beyond the extent of the Indicative Development Footprints.

5.5.3 Golden sun moth

Through the Biodiversity Assessment (NGH Environmental 2014) and the Biodiversity Assessment Addendum (NGH Environmental 2016a) the Federal approval for the project allows up to 66.94 hectares of habitat for the golden sun moth.

As per **Section 5.1.1** above, the project will result in impacts to 43.20 hectares of golden sun moth habitat (see **Figure 3.5**). This presents an impact reduction of 23.74 hectares for the golden sun moth. With 113.89 hectares of golden sun moth habitat identified within the Development Corridors, 70.69 hectares will persist beyond the extent of the Indicative Development Footprints.

5.5.4 Superb parrot

Through the Biodiversity Assessment (NGH Environmental 2014) and the Biodiversity Assessment Addendum (NGH Environmental 2016a) the Federal approval for the project allows up to 24.9 hectares of foraging habitat for the superb parrot. Importantly, this 24.9 hectares aligns with the Box Gum Woodland, not including the Derived Native Grasslands.

As per **Section 5.1.1** above, the project will result in impacts to 20.08 hectares of superb parrot habitat (see **Figure 3.5**). This presents an impact reduction of 4.82 hectares for the superb parrot. With 36.33 hectares of superb parrot habitat identified within the Development Corridors, 16.25 hectares will persist beyond the extent of the Indicative Development Footprints.

5.5.4.1 Hollow Bearing Tree Impacts

In addition to those Direct Impacts presented above that generate credits under BAM, documented here is a revised assessment of direct impacts to hollow bearing trees (HBTs) by the Project. The original Biodiversity Assessment (NGH Environmental 2014) estimated that 1,029 hollow bearing trees would be cleared. Through the response to submission phase of the existing approval, a more accurate quantitative assessment of hollow bearing trees was completed in the Biodiversity Assessment Addendum (NGH Environmental 2016a). This estimated that 893 hollow bearing trees would be impacted by the project.

The Biodiversity Assessment Addendum (NGH Environmental 2016a) concluded that impacts to 893 hollow bearing trees would be unlikely to result in an unacceptably high loss of habitat, loss of habitat function for native fauna or loss of stand structural complexity. Furthermore, the impacts were considered unlikely to have a population scale impact on common birds that are widely distributed and abundant (NGH Environmental 2016a).

There are no impact thresholds applicable to the removal of hollow bearing trees within the State Development Consent (DPE 2017). However, the EPBC Approval conditions limit the clearing of up to 170 hollow bearing trees within Box Gum Woodland. This assessment of hollow bearing trees being impacted has been limited entirely to those impacts on Vegetation Zones 3 and 4 as these are the only two vegetation zones applicable for the superb parrot.

The Biodiversity Assessment (NGH Environmental 2014) and Biodiversity Assessment Addendum (NGH Environmental 2016) did not discuss the average number of hollow bearing trees per hectare of each vegetation zone. As such, Umwelt has interpreted what information was provided to determine this.

The Biodiversity Assessment Addendum (NGH Environmental 2016a), presents a combined total of 50.2 hectares of Box Gum Woodland and associated derived grasslands were to be impacted by the Project. This includes 24.9 hectares of Box Gum Woodland and 25.3 hectares of Box Gum Woodland Derived Native Grasslands. A total of 170 hollow bearing trees for the superb parrot were to be impacted by the project within these vegetation communities. NGH Environmental (2016) noted that 1 hollow bearing tree had been calculated for each hectare of impact on Box Gum Woodland Derived Native Grasslands, equating to 25 hollow bearing trees (rounded) per hectare of this vegetation community. This therefore leaves 145 hollow bearing trees being impacted within the Box Gum Woodland, equating to 5.8 hollow bearing trees per hectare.

In addition to the hollow bearing tree impacts presented above in **Section 5.1.1.1**, following Umwelt's additional ecological surveys, an updated hollow bearing tree assessment has been prepared for the Project to provide added rigour around the extrapolation of hollow bearing tree impacts within Box Gum Woodland and associated Derived Native Grasslands being calculated for the project.

Umwelt completed numerous hollow bearing tree assessments within Vegetation Zones 3 and 4. These are detailed in **Table 5.11** below. It is important to note that although no hollow bearing trees were recorded in the sampling of Vegetation Zone 3, it is acknowledged that this community does comprise scattered trees and some of these will be hollow bearing trees. Consistent with the Biodiversity Assessment Addendum (NGH Environmental 2016a) Umwelt assumed 1 hollow bearing tree per hectare of Vegetation Zone 4.

Table 5.11 Umwelt Hollow Bearing Tree Assessments

Vegetation Zone	Area of Assessment	Number of HBT	Number of HBT/ha	Average Number of HBT/ha
3	0.1	4	40.0	15.7
3	0.25	2	8.0	
3	0.1	2	20.0	
3	0.1	3	30.0	
3	6.5	9	1.4	
3	0.1	1	10.0	
3	0.1	1	10.0	
3	0.1	4	40.0	
3	0.1	0	0.0	

Vegetation Zone	Area of Assessment	Number of HBT	Number of HBT/ha	Average Number of HBT/ha
3	1.6	26	16.3	
3	1.5	12	8.0	
3	1.8	28	15.6	
3	1.5	33	22.0	
3	1.13	14	12.4	
3	1.78	28	15.7	
3	1.12	1	0.9	
3	0.06	1	16.7	
4	0.1	0	0	1
4	0.1	0	0	
4	0.1	0	0	
4	0.1	0	0	
4	0.1	0	0	

Table 5.12 Box Gum Woodland Hollow Bearing Tree Updated Assessment

PCT and Condition	Vegetation Community[1]	Previous Impact Ratio (HBT/hectare)	Current Impact Ratio (HBT/hectare)	Average Impact Ratio (HBT/hectare)	Area of Impact				Extrapolated Hollow Bearing Tree Impacts [2]				
					DC	IDF - WF	IDF - PMM	IDF - ER	DC	IDF - WF	IDF - PMM	IDF - ER	Total of Indicative Development Footprints
350 *Moderate to Good Condition*	Box Gum Woodland	5.8	15.7	**10.7**	36.33	18.75	-	1.33	389	201	-	14	215
350 *Derived Native Grassland*	Box Gum Woodland Derived Native Grassland	1	1	**1**	32.71	16.85	-	0.67	33	17	-	1	18
Total									**422**	**218**	**-**	**15**	**233**

[1]Biodiversity Assessment Addendum (NGH Environmental 2016a)

[2] Averages are rounded up or down to the nearest whole number.

DC: Development Corridors; **IDF – WF**: Indicative Development Footprint – Wind Farm; **IDF – PMM**: Indicative Development Footprint – Permanent Met Masts; **IDF – ER**: Indicative Development Footprint – External Roads

As per **Table 5.12**, the Project will impact directly on a total of 233 hollow bearing trees, comprising 215 from Vegetation Zone 3 and comprising 18 from Vegetation Zone 4. Compared with the approved 170 hollow bearing trees within consistent vegetation communities, this is an increase of 63 HBTs suitable for superb parrot.

With 422 HBTs suitable for superb parrot calculated within the Development Corridor, 189 of these will be avoided by the Project. Of the 233 hollow bearing trees suitable for superb parrot being impacted by the Project, 15 have been calculated to occur within the Indicative Development Footprint – External Roads. Furthermore, as discussed in **Section 4**, approximately 232 HBTs suitable for the superb parrot identified along High Rock Road, Dalton Road, Rye Park Road and Blakney Creek South Road have been avoided by the modified project.

Offsets associated with these impacts are included within the credit requirement for these vegetation zones as described below in **Section 6.3.** As per Consent Condition 14 of the Federal approval (DoEE 2017), these impacts will need to be offset at a ratio of 10:1. This would total 2,330 hollow bearing trees.

6 Biodiversity Credit Impact Summary

6.1 Impacts Not Requiring Assessment

Under the BAM, impacts to areas of land without native vegetation do not require further assessment. The Indicative Development Footprints contains approximately 105.18 hectares of Non-native Vegetation, and 15.72 hectares of access track/roads, planted vegetation and waterbodies that will be removed as a result of the Project and does not require further assessment as they do not contain native vegetation. All Non-native Vegetation presented in **Figure 3.3** does not require further assessment in accordance with Section 10.4 of the BAM.

As discussed in **Section 3.2.2** and **Section 3.2.4** the extent of Non-native Vegetation within the Indicative Development Footprints was assessed within the South West Slopes and South East Highlands BAMCC cases. This assessment of Non-native Vegetation confirmed a Vegetation Integrity Score of 14.0 for South West Slopes and 11.9 for the South East Highlands, both lower than the threshold at which offsets are required.

6.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of less than 20 (where it is not associated with ecosystem-credit species habitat or a TEC), less than 17 (where it is associated with ecosystem-credit habitat or a VEC) or less than 15 (where it is representative of a EEC or CEEC).

As all native vegetation recorded within the Indicative Development Footprints has a higher vegetation integrity score than the required threshold, there are no areas of native vegetation impact not requiring offset.

6.3 Impacts Requiring Offset

Four PCTs and five species-credit species are considered to require offsetting in accordance with the BAM (OEH 2017a). **Table 6.1** summarises this outcome.

In relation to impacts of the Indicative Development Footprints, associated with Vegetation Zones 3 and 4, it is important to note that a majority of these impacts include TECs (refer to **Table 5.7**). Therefore, particular offset rules will apply. This alignment with TECs does not result in additional credits to those presented below.

For Vegetation Zone 3, 20.08 hectares aligns with White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act (9.93 hectares within SWS IBRA and 10.15 hectares within SEH IBRA) and 19.38 hectares aligns with *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act (9.24 hectares within SWS IBRA and 10.14 hectares within SEH IBRA).

For Vegetation Zone 4, 17.42 hectares aligns with White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act (11.79 hectares within SWS IBRA and 5.63 hectares within SEH IBRA) and 16.35 hectares aligns with *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act (11.11 hectares within SWS IBRA and 5.24 hectares within SEH IBRA).

Table 6.1 Impacts Requiring Offset

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha) [1]	Credits Required
		Current	Future[1]	Change [1]		
Ecosystem Credits						
NSW – South Western Slopes IBRA Bioregion						
1	289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	74.9	0	-74.9	0.78	**26**
2	335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	47.9	0	47.9	4.77	**114**
3	350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Moderate to Good*	76.2	0 (32.9)	-76.2 (-43.3)	5.66 (4.27)	**308**
4	350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Derived Native Grassland*	34.3	0	-34.3	11.89	**204**
5	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Moderate to Good*	81.7	0 (36.9)	-81.7 (-44.7)	43.93 (9.63)	**1,758**
6	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Derived Native Grassland*	20.2	0	-20.2	128.70	**1,137**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha) [1]	Credits Required
		Current	Future[1]	Change [1]		
7	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Acacia Shrubland*	46.7	0	-46.7	2.98	**61**
8	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Sifton Bush Shrubland*	23.4	0	-23.4	66.15	**678**
9	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Argyle Apple Forest*	68.6	0	-68.6	0.62	**19**
South Eastern Highlands IBRA Bioregion						
1	289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	-	-	-	-	**-**
2	335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion *Moderate to Good*	30.4	0	-30.4	0.73	**11**
3	350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Moderate to Good*	65.0	0 (24.8)	-65.0 (-40.2)	5.38 (4.77)	**271**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha) [1]	Credits Required
		Current	Future[1]	Change [1]		
4	350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion *Derived Native Grassland*	35.5	0	-35.5	5.63	**100**
5	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Moderate to Good*	79.6	0 (31.4)	-79.6 (-48.2)	23.07 (8.18)	**976**
6	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Derived Native Grassland*	22.0	0	-22.0	45.29	**436**
7	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Acacia Shrubland*	50.9	0 (28.1)	-50.9 (-22.9)	2.74 (2.81)	**89**
8	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Sifton Bush Shrubland*	25.3	0	-25.3	18.03	**199**
9	351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion *Argyle Apple Forest*	-	-	-	-	**-**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha) [1]	Credits Required
		Current	Future[1]	Change [1]		
Species Credits						
NSW – South Western Slopes IBRA Bioregion						
-	striped legless lizard (*Delma impar*)	-	-	-	3.58	**27**
-	southern myotis (*Myotis macropus*)	-	-	-	0.03	**1**
-	squirrel glider (*Petaurus norfolcensis*)	-	-	-	62.17	**2,270**
-	superb parrot (breeding habitat) (*Polytelis swainsonii*)	-	-	-	9.93	**308**
-	golden sun moth (*Synemon plana*)	-	-	-	21.63	**335**
South Eastern Highlands IBRA Bioregion						
-	squirrel glider (*Petaurus norfolcensis*)	-	-	-	40.80	**1,365**
-	superb parrot (breeding habitat) (*Polytelis swainsonii*)	-	-	-	10.15	**271**
-	golden sun moth (*Synemon plana*)	-	-	-	21.57	**381**

[1] Values in parentheses indicate those assessed as partial impacts within the Transmission Line Corridors refer to **Section 5.1.1**.

7 Biodiversity Credit Report

A full Biodiversity Credit Report is included in **Appendix G**.

8 Biodiversity Offset Strategy

RPRE is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project.

As discussed in **Section 4.0**, RPRE has, where possible, optimised the Project (including the Development Corridors and Indicative Development Footprints) to avoid and minimise ecological impacts in the Project planning stage.

Additionally, the Indicative Development Footprints will be finalised once turbine and contractor(s) are selected by RPRE. In doing so, RPRE will seek to further minimise impacts to biodiversity values. Additionally, a range of impact mitigation strategies are proposed through the future BMP to mitigate the impact on ecological values prior to the consideration of offsetting requirements. The offset requirements for the Project, as calculated in accordance with the BAM are identified in **Section 6.0**.

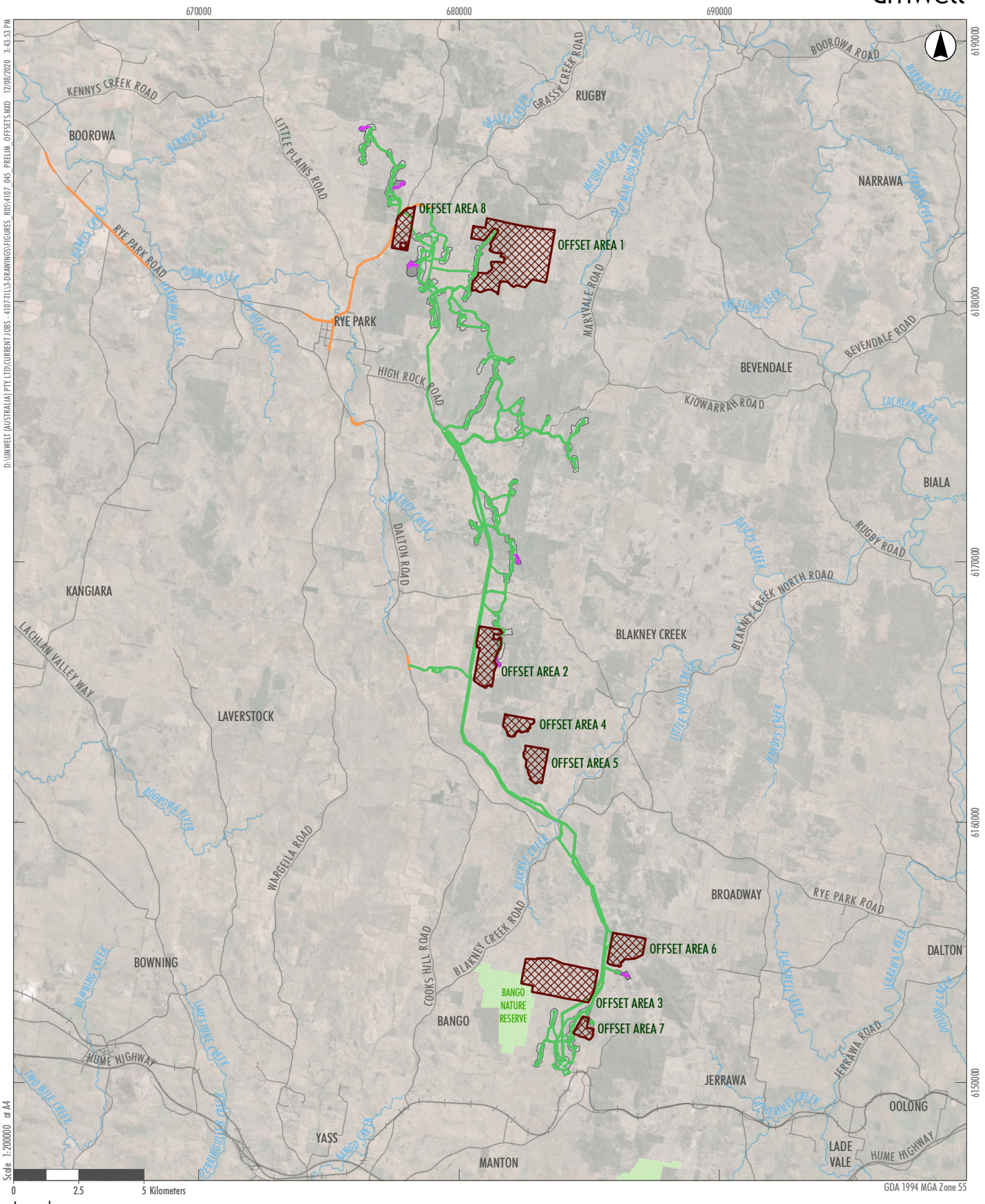
The offset strategy will be implemented in consideration of the process outlined in the BC Act and the final composition of the offset strategy may evolve as the Project progresses.

The biodiversity offset strategy will be developed during the assessment process in consultation with the BCD and DPIE and based on the credits required to be retired to offset the impacts of the Project as specified in **Section 6.3** and the offset options available under the BC Act and BC Regulation including:

- Land based offsets through the establishment of new Stewardship Sites (and subsequent retirement of credits) or by retiring credits from existing Stewardship Sites. RPRE would retire the required number and class of credits determined in accordance with the BDAR and the offset rules in the BC Regulation.
- Securing (purchasing) credits through the open credit market, and/or
- Paying into to the Biodiversity Conservation Fund (BCF).

Eight potential offset sites have been identified within parcels of land adjacent to the Project. These sites have had varying degrees of ecological surveys completed on them to consider their offset suitability for the Project. Through consideration of their size and potential credit generation, there are five potential offset sites likely to be further investigated for offset purposes. These are currently the priority sites of consideration for land-based offsets for the Project. In addition to these, RPRE have engaged Umwelt to complete a strategic investigation of potentially suitable land-based offset sites at a regional scale that may be suitable for this Project as well as another one of their proposed wind farm projects.

The five potential offset sites (**Figure 8.1**) have, based on a range of preliminary surveys, the potential to generate ecosystem and species credits consistent with those impacted by the Project. This includes PCTs 298, 335, 350 and 351 ecosystem credits. Species credits species likely to generate credits on the five potential offset sites are golden sun moth (*Synemon plana*), superb parrot (*Polytelis swainsonii*) and squirrel glider (*Petaurus norfolcensis*).



Legend

- Development Corridor - Wind Farm
- Development Corridor - Permanent Met Masts
- Indicative Development Footprint - Wind Farm
- Indicative Development Footprint - Permanent Met Masts
- Indicative Development Footprint - External Roads
- Preliminary Offset Investigation Sites
- Nature Reserves
- Watercourses

FIGURE 8.1

Preliminary Offset Investigation Sites

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia; Australian Government Department of the Environment (2012); OEH (2008); Umwelt (2020); Rye Park Renewable Energy Pty Ltd (2020)

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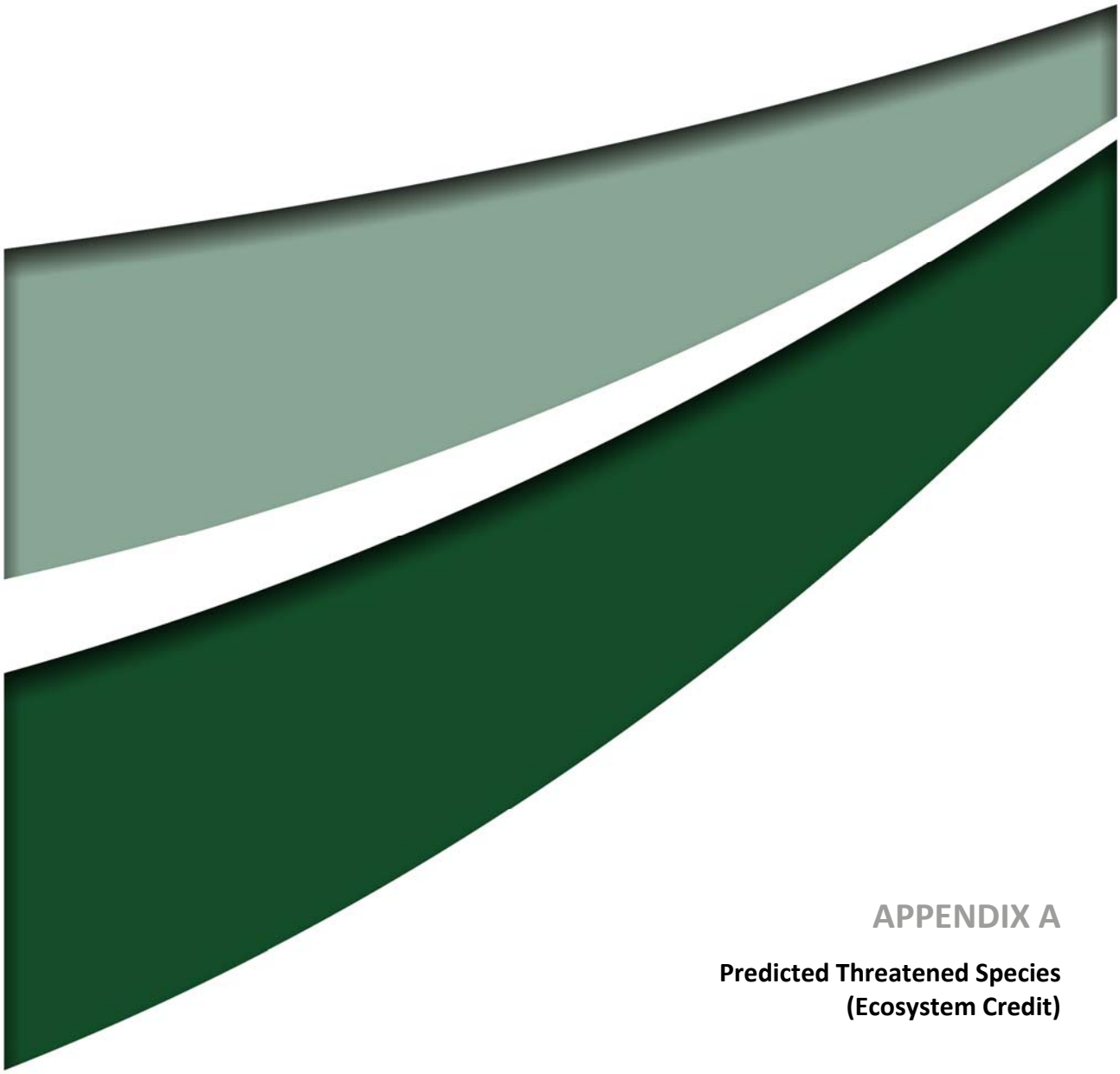


APPENDIX A

Predicted Threatened Species (Ecosystem Credit)

Predicted Threatened Species (Ecosystem Credit)

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Regent Honeyeater (foraging) ***Anthochaera phrygia***	CE	CE	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Dusky Woodswallow ***Artamus cyanopterus***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Gang-gang Cockatoo (foraging) ***Callocephalon fimbriatum***	V	V	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Speckled Warbler *Chthonicola sagittata*	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Spotted Harrier *Circus assimilis*	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Varied Sittella *Daphoenositta chrysoptera*	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Spotted-tailed Quoll *Dasyurus maculatus*	V	E	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Moderate	-	NSW South Western Slopes/Inland Slopes	335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	High	-	NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Little Lorikeet *Glossopsitta pusilla*	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Painted Honeyeater *Grantiella picta*	V	V	Moderate	Other; Mistletoes present at a density of greater than five mistletoes per hectare	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
White-bellied Sea-Eagle (foraging) *Haliaeetus leucogaster*	V	-	High	Waterbodies; Within 1 km of a river, lake, large dam or creek, wetland and coastline.	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Little Eagle (foraging) *Hieraaetus morphnoides*	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
					Slopes/Inland Slopes	335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Swift Parrot (foraging) ***Lathamus discolor***	E	CE	Moderate	-	NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Square-tailed Kite (foraging) ***Lophoictinia isura***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Hooded Robin (south-eastern form) ***Melanodryas cucullata***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Black-chinned Honeyeater (eastern subspecies) ***Melithreptus gularis***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Large Bent-winged Bat (foraging) ***Miniopterus orianae oceanensis***	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Turquoise Parrot ***Neophema pulchella***	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Barking Owl (foraging) ***Ninox connivens***	V	-	High	-	NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern

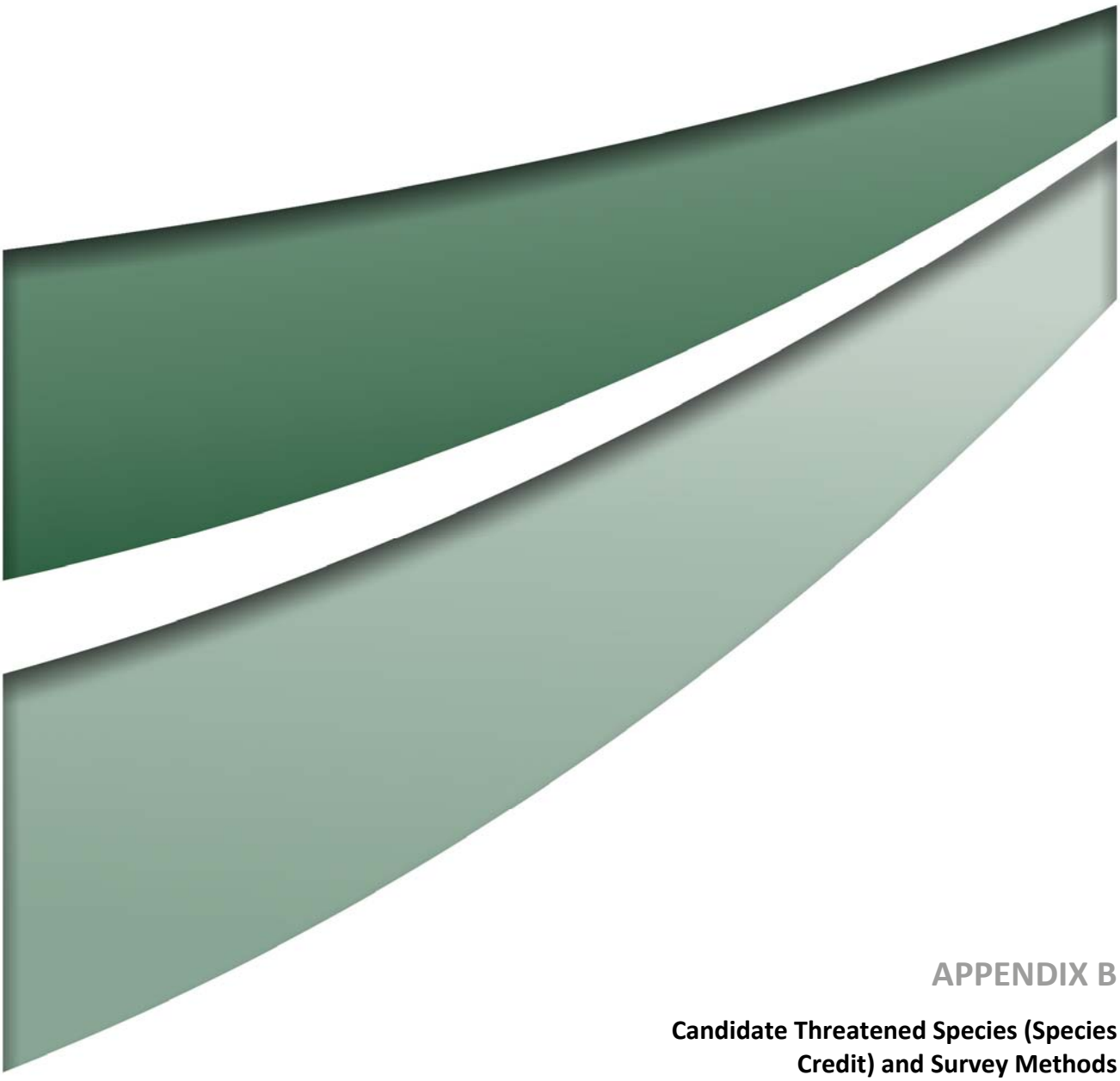
Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
						Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Powerful Owl (foraging) ***Ninox strenua***	V	-	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Blue-billed Duck ***Oxyura australis***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Yellow-bellied Glider ***Petaurus australis***	V	-	High	Hollow bearing trees; Hollows > 25 cm diameter	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Scarlet Robin ***Petroica boodang***	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Flame Robin *Petroica phoenicea*	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Koala (foraging) *Phascolarctos cinereus*	V	V	High	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Superb Parrot (foraging) *Polytelis swainsonii*	V	V	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis*	V	-	Moderate	-	NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
Grey-headed Flying-fox (foraging) *Pteropus poliocephalus*	V	V	High	-	NSW South Western Slopes/Inland Slopes	351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	High	-	NSW South Western Slopes/Inland Slopes	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	High	-	South Eastern Highlands/Murrumbateman	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
Diamond Firetail *Stagonopleura guttata*	V	-	Moderate	-	South Eastern Highlands/Murrumbateman NSW South Western Slopes/Inland Slopes	289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion
						350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion
						351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Masked Owl (foraging) *Tyto novaehollandiae*	V	-	High	-	NSW South Western Slopes/Inland Slopes	351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
Rosenberg's Goanna *Varanus rosenbergi*	V	-	High	East of Holbrook area; eastern third of	South Eastern Highlands/Murrumbateman	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	IBRA Region/Subregion	Vegetation Zone Prediction
				subregion, south-east of a line that runs between Tarcutta and Galong	NSW South Western Slopes/Inland Slopes	Highland Bioregion
Australasian Bittern^ ***Botaurus poiciloptilus***	E	E	Moderate	-	-	Nil
Eastern Curlew^ ***Numenius madagascariensis***	-	CE	High	-	-	Nil
Australian Painted Snipe^ ***Rostratula australis***	E	E	Moderate	-	-	Nil
Corben's Long-eared Bat^ ***Nyctophilus corbeni***	V	V	High	-	-	Nil

^Predicted by literature review and therefore do not have an IBRA Region/Subregion or Vegetation Zone Prediction applicable to the BAM Calculator.



APPENDIX B

Candidate Threatened Species (Species Credit) and Survey Methods

Predicted Threatened Species (Species Credit) and Survey Methods

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Flora Species							
Acacia meiantha ***Acacia meiantha***	E	E	Jul-Oct	NSW South Western Slopes - Inland Slopes		Yes	**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering Transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in September 2017, October 2017, July 2019, August 2019 and September 2019 (Umwelt) and a combination of meandering and targeted parallel searches were undertaken in October 2011, October 2014 (NGH Environmental 2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Yass Daisy ***Ammobium craspedioides***	V	V	Sep-Nov	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	West of Federal Highway; South of Cowra		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering and targeted parallel transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in September 2017, October 2017, December 2017, September 2019 and November 2019 (Umwelt); and a combination of meandering and targeted parallel searches were undertaken in October 2011, November 2011 and November 2013 (NGH Environmental 2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Crimson Spider Orchid ***Caladenia concolor***	E	V	Sep	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	West of Jingellic	Yes	**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Parallel transects were walked between 10 m apart across suitable habitat during survey periods across September and October 2017 (Umwelt); and October 2014, November 2013 and November 2011 (NGH Environmental 2014 and 2016a). Meandering transects were also undertaken within potential habitat for the species across the Development Corridor and Indicative Development Footprint – External Roads in September 2017, November 2017 and September 2019, providing opportunistic observations. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Black Gum ***Eucalyptus aggregata***	V	V	All year	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	The far eastern sub-region (in ranges)		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering transects were undertaken in September, October and December 2017, January and March 2018, April, September, November and December 2019, January and February 2020 (Umwelt). Surveys completed by NGH Environmental included meandering transects in October and November 2011, November 2013 and June 2015 (2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Robertson's Peppermint ***Eucalyptus robertsonii* subsp. *hemisphaerica***	V	V	All year	NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering transects were undertaken in September, October and December 2017, January and March 2018, April, September, November and December 2019, January and February 2020 (Umwelt). Surveys completed by NGH Environmental included meandering transects in October and November 2011, November 2013 and June 2015 (2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Tarengo Leek Orchid ***Prasophyllum petilum***	E	E	Sep-Dec	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	East of Binalong, south and east of Boorowa		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Parallel and meandering transects were undertaken in September, October and December 2017, while meandering transects were undertaken in September, November and December 2019, and January 2020 (Umwelt). Surveys completed by NGH Environmental included targeted and meandering transects in October and November 2011 and November 2013 (2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Small Purple-pea ***Swainsona recta***	E	E	Sep-Nov	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering Transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in September 2017, October 2017 and September, November and December 2019 (Umwelt). Meandering searches were undertaken in October and November 2011, and November 2013 (NGH). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Silky Swainson-pea ***Swainsona sericea***	V	-	Sep-Nov	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	The southern half of subregion		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering Transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in September 2017, October 2017 and September, November and December 2019 (Umwelt). Meandering searches were undertaken in October and November 2011, and November 2013 (NGH Environmental 2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Floating Swamp Wallaby-grass^ ***Amphibromus fluitans***	V	V	Dec-March	-	Semi-permanent/ephemeral wet areas		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Closest record is in Crookwell, NSW, approximately 50km north east of the Project. Meandering Transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in December 2017, January 2018, February 2018, November 2019, December 2019, January 2020 and February 2020 (Umwelt). Meandering searches were undertaken in November 2011, and November 2013 (NGH). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Button Wrinklewort^ ***Rutidosis leptorrhyncoides***	E	E	All year	-			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Closest record is Goulburn, NSW, approximately 70km east of the Project. Meandering transects were undertaken in September, October and December 2017, January and March 2018, April, September, November and December 2019, and January 2020 (Umwelt). Surveys completed by NGH included meandering transects in October and November 2011, November 2013 and June 2015. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Austral Toadflax^ ***Thesium australe***	V	V	Nov-Feb	-			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Closest record is south of Canberra, NSW, approximately 80km south of the Project. Meandering Transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in December 2017, January 2018, February 2018, November 2019, December 2019, January 2020 and February 2020 (Umwelt). Meandering searches were undertaken in November 2011, and November 2013 (NGH). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Fauna Species							
Regent Honeyeater (Breeding) ***Anthochaera phrygia***	CE	CE	None provided	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes		Yes	**Not present (surveyed). No species records occur within 10 km of the Indicative Development Footprints. The BAM Support Team confirmed on 20 February 2020 that the Indicative Development Footprints are not within an important area for this species.** Meandering transects were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in September, October and December 2017; January, February and March 2018; April, September, November and December 2019; and January 2020 (Umwelt). Bird surveys were undertaken in October 2017, January 2018, February 2018 and March 2018 (Umwelt). Bird surveys involved undertaking a short meandering transect over a period of 30 minutes while recording any bird species observed or heard during this period. Call playback for the regent honeyeater was undertaken in October 2017 (Umwelt). This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Bird Utilisation surveys were undertaken in February, March, October and November 2018, as well as in January and February 2019 (Umwelt). Bird Utilisation surveys were also undertaken in November 2013 (NGH Environmental 2014 and 2016a). Bird utilisation and raptor vantage surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. This also involved recording the height that each bird was observed at. Opportunistic observations were made over all Umwelt survey periods. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Pink-tailed Legless Lizard ***Aprasia parapulchella***	V	V	Sep-Nov	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	West of Dalton; Rocky areas or within 50 metres of rocky areas		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Diurnal reptile searches were undertaken in September and October 2017 (Umwelt). These searches involved turning logs and rocks in suitable habitat for a period of 30 minutes. Meandering transects were undertaken in November 2019 and logs and rocks were opportunistically turned to search for reptiles (Umwelt). Active reptile searches, including rolling of logs, rocks and branches was undertaken across 11 searches in November 2011 by NGH (NGH Environmental 2014 and 2016a). Tile grid arrays were also completed by NGH Environmental (2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).

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Bush Stone-curlew ***Burhinus grallarius***	E	-	All year	NSW South Western Slopes - Inland Slopes	Fallen/standing dead timber including logs		**Not present (surveyed). No species records occur within 10 km of the Indicative Development Footprints.** Meandering transects were undertaken across numerous survey periods in September, October and December 2017; January, February, and March 2018; April, September, November and December 2019; and January 2020 (Umwelt). Spotlighting transects and nocturnal surveys were undertaken in October 2017, January 2018, February and March 2018 (Umwelt). Suitable fallen logs were inspected. Bird utilisation surveys were undertaken in October and November 2018; and January and February 2019 (Umwelt). Spotlighting and nocturnal surveys were also undertaken in November 2013 (NGH Environmental 2014). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Gang-gang Cockatoo (Breeding) ***Callocephalon fimbriatum***	V	V	Oct-Jan	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** Records occur within 10 km of the Indicative Development Footprints, however no individuals were observed across extensive survey periods. Meandering transects for opportunistic sightings were undertaken in October and December 2017; January 2018; November and December 2019; and January 2020 (Umwelt). General bird surveys were undertaken in October 2017 and January 2018 (Umwelt). Bird surveys involved a undertaking a short meandering transect over a period of 30 minutes while recording any bird species observed or heard during this period. Bird utilisation surveys were undertaken in October 2018, November 2018, January 2019 and February 2019 (Umwelt). Bird utilisation surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. General bird surveys and bird utilisation surveys were also undertaken in November 2013 (NGH Environmental 2014). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Eastern Pygmy-possum ***Cercartetus nanus***	V	-	Oct-Mar	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Spotlighting and nocturnal surveys were undertaken in October 2017, January 2018, February 2018 and March 2018. Spotlighting involved walking meandering transects in suitable habitat between sunset and midnight with a high powered headtorch to search for nocturnal animals. Spotlighting transects were surveyed over a period of 30 minutes or more per site. Remote cameras were installed across the Development Corridor and Indicative Development Footprint – External Roads in February and March 2018, April and November 2019. Bushnell Trophy Cam HD cameras were installed 1 metre above the ground pointing at a bait station containing honey, peanut butter and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed across all Umwelt survey periods. Cage-trapping surveys were also completed in April 2012 as well as spotlighting surveys in November 2011, April 2012 and November 2013 by NGH Environmental (NGH Environmental 2014 and 2016a). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Large-eared Pied Bat ***Chalinolobus dwyeri***	V	V	Nov-Jan	NSW South Western Slopes - Inland Slopes		Yes	**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Echolocation surveys were conducted over 52 nights across the Development Corridor and Indicative Development Footprint – External Roads using a number of Titley Scientific Anabat Express detectors. Survey periods included November 2018; January and February 2019; March and April 2019; and January 2020. At each site, the Anabat was positioned one metre above the ground and positioned towards potential micro-bat flyaways along areas of

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							suitable habitat. The Anabat detector was programmed to start recording from one hour before sunset to one hour after sunrise. Opportunistic observations were made during all nocturnal and spotlighting surveys (Umwelt). Spotlighting and nocturnal surveys conducted in November 2013 also targeted this species (NGH). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Striped Legless Lizard ***Delma impar***	V	V	Sep-Dec	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Present (previously recorded).** This species was previously recorded by NGH Environmental. A single record was made at one location to the north of the Development Site. Derived Native Grassland is considered to be suitable habitat for the species only in close proximity to the record. Diurnal reptile searches were undertaken in September and October 2017 (Umwelt). These searches involved turning logs and rocks in suitable habitats or a period of 30 minutes. Meandering transects were undertaken in November and December 2019 and logs and rocks were opportunistically turned to search for reptiles (Umwelt). Active reptile searches, including rolling of logs, rocks and branches was undertaken across 11 searches in November 2011 by NGH (NGH Environmental 2014). Tile grids were installed by NGH in July 2013 and monitored in November and December 2013 for presence of striped legless lizard, and 24 targeted funnel trap surveys were monitored over four nights in November 2013. Habitat assessments were undertaken for this species in March 2014 (NGH Environmental 2014 and 2016a).
White-bellied Sea-Eagle (Breeding) ***Haliaeetus leucogaster***	V	-	Jul-Dec	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. A combination of meandering transects and opportunistic observations were made in September, October and December 2017, September, October and December 2019 and January 2010 to determine the presence of large stick nests (Umwelt). Bird Utilisation and Raptor Vantage surveys were undertaken in October and November 2018 and July 2019 (Umwelt). Bird surveys and Bird Utilisation surveys were also undertaken in November 2013 (NGH). Bird utilisation and raptor vantage surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. This also involved recording the height at which each bird was observed. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Little Eagle (Breeding) ***Hieraaetus morphnoides***	V	-	Aug-Oct	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Habitat assessments were undertaken to determine whether suitable habitat for this species was present in September and October 2017. Opportunistic observations were undertaken across all Umwelt survey periods. Bird Utilisation and Raptor Vantage surveys were undertaken in October and November 2018 and July 2019 (Umwelt). Bird surveys and Bird Utilisation surveys were also undertaken in November 2013 (NGH). Bird utilisation and raptor vantage surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. This also involved recording the height that each bird was observed at. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Swift Parrot (Breeding) ***Lathamus discolor***	E	CE	None provided	NSW South Western Slopes - Inland Slopes		Yes	**Not present (surveyed). The BAM Support Team confirmed on 20 February 2020 that the Indicative Development Footprints are not within an important area for this species.** No species records occur within 10km of the Indicative Development Footprints. Meandering transects for opportunistic sightings were undertaken in September,

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							October and December 2017; January, February and March 2018; April, September, November and December 2019; and January 2020 (Umwelt). Bird utilisation surveys were undertaken in October 2018, November 2018, January 2019 and February 2019 (Umwelt). Bird utilisation surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. Call playback and bird surveys were undertaken in October 2017 (Umwelt). Bird surveys involved a undertaking a short meandering transect over a period of 30 minutes while recording any bird species observed or heard during this period. Call playback involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Point count (bird census) surveys were also undertaken by NGH in July 2013, targeting this species. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Green and Golden Bell Frog ***Litoria aurea***	E	V	Nov-Mar	South Eastern Highlands - Murrumbateman	Semi-permanent/ephemeral wet areas; within 1 kilometre of wet areas, swamps or waterbody		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Diurnal amphibian searches were undertaken in January, February and March 2018. This involved active searches within suitable habitats. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in January, February and March 2018; December 2019; and January 2020. Call playback for this species was undertaken in February and March 2018; December 2019; and January 2020. This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Booroolong Frog ***Litoria booroolongensis***	E	E	Nov-Dec	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 1 0km of the Indicative Development Footprints. Diurnal amphibian searches were undertaken in October 2017; and January, February and March 2018. This involved active searches within suitable habitats. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in October 2017; January, February and March 2018; December 2019; and January 2020. Call playback for this species was undertaken in October 2017; January February and March 2018; December 2019; and January 2020. This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Yellow-spotted Tree Frog ***Litoria castanea***	CE	E	Nov-Dec	South Eastern Highlands - Murrumbateman		Yes	**Not present (surveyed).** Records occur within 10 km of the Indicative Development Footprints, however no individuals were observed across any Umwelt survey periods. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in December 2019 and January 2020. Call playback for this species was undertaken in December 2019 and January 2020. This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).

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Southern Bell Frog ***Litoria raniformis***	E	V	Oct-Jan	NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Diurnal amphibian searches were undertaken in October 2017; and January, February and March 2018. This involved active searches within suitable habitats. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in October 2017; January, February and March 2018; December 2019; and January 2020. Call playback for this species was undertaken in October 2017; February and March 2018; December 2019; and January 2020. This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Square-tailed Kite (Breeding) ***Lophoictinia isura***	V	-	Sep-Jan	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. A combination of meandering transects and opportunistic observations were made in September, October and December 2017; January 2018; September, October and December 2019; and January 2010 to determine the presence of large stick nests (Umwelt). Bird Utilisation and Raptor Vantage surveys were undertaken in October and November 2018; and January, February and July 2019 (Umwelt). Bird surveys and Bird Utilisation surveys were also undertaken in November 2013 (NGH). Bird utilisation and raptor vantage surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. This also involved recording the height that each bird was observed at. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Large Bent-winged Bat (Breeding) ***Miniopterus orianae oceanensis***	V	-	Dec-Feb	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes		Yes	**Species recorded within the Indicative Development Footprints, but no breeding habitat is present (surveyed).** Echolocation surveys were conducted over 52 nights across the Indicative Development Footprints using a number of Titley Scientific Anabat Express detectors. Survey periods included November 2018; January and February 2019; March and April 2019; and January 2020. At each site, the Anabat was positioned one metre above the and positioned towards potential micro-bat flyaways along areas of suitable habitat. The Anabat detector was programmed to start recording from one hour before sunset to one hour after sunrise. Opportunistic observations were made during all nocturnal and spotlighting surveys (Umwelt). Spotlighting and nocturnal surveys conducted in November 2013 also targeted this species (NGH).
Southern Myotis ***Myotis macropus***	CE	E	Oct-Mar	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Assumed present (surveyed).** Breeding habitat for this species was calculated within the Indicative Development Footprints. All woodland and forest habitat in the Indicative Development Footprints within 200m of a suitably sized waterway is considered to be suitable habitat for the species. In relation to the Indicative Development Footprints, only patches of remnant vegetation within 200 metres of Pudman Creek at Grassy Creek Road supports habitat for this species. Echolocation surveys were conducted over 52 nights across the Indicative Development Footprints using a number of Titley Scientific Anabat Express detectors. Survey periods included November 2018; January and February 2019; March and April 2019; and January 2020. At each site, the Anabat was positioned one metre above the and positioned towards potential micro-bat flyaways along areas of suitable habitat. The Anabat detector was programmed to start recording from one hour before sunset to one hour after sunrise. Opportunistic observations were made during all nocturnal and spotlighting surveys (Umwelt). Spotlighting and nocturnal surveys conducted in November 2013 also targeted this species

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							(NGH). Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Barking Owl (Breeding) ***Ninox connivens***	V	-	May-Dec	NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Hollow bearing tree assessments were undertaken in September 2017 (Umwelt); October and November 2011 (NGH); April 2012 (NGH); November 2013 (NGH); and June 2015 (NGH) (NGH Environmental 2014). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in September 2017; November 2018; February, April, July and August 2019 (Umwelt). Spotlighting searches were also undertaken in October and November 2011; April 2012; and November 2013 (NGH). Call playback for this species was undertaken in November 2018; and February, April, July and August 2019 (Umwelt). Call playback was also undertaken in October and November 2011; April 2012; and November 2013 (NGH Environmental). This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Stag watches, which involved watching hollow-bearing trees following the period immediately after sunset for forest owl activity, was undertaken in October and November 2011; and in April 2012. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Powerful Owl (Breeding) ***Ninox strenua***	V	-	May-Aug	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Hollow bearing tree assessments were undertaken in October and November 2011; April 2012; November 2013; and June 2015 (NGH). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in November 2018; February, April, July and August 2019 (Umwelt). Spotlighting searches were also undertaken in October and November 2011; April 2012; and November 2013 (NGH). Call playback for this species was undertaken in November 2018; and February, April, July and August 2019 (Umwelt). Call playback was also undertaken in October and November 2011; April 2012; and November 2013 (NGH). This involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Stag watches, which involved watching hollow-bearing trees following the period immediately after sunset for forest owl activity, was undertaken in October and November 2011; and in April 2012. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Squirrel Glider ***Petaurus norfolcensis***	V	-	All year	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Present (surveyed). This species was recorded at multiple locations within and adjacent to the Indicative Development Footprints. Suitable woodland and forest in the Indicative Development Footprints in proximity to the species records is considered suitable habitat for this species.** Cage-trapping surveys were also completed in April 2012 as well as spotlighting surveys in November 2011, April 2012 and November 2013 by NGH Environmental (NGH Environmental 2014 and 2016a). These surveys did not record the species.
Brush-tailed Rock-wallaby ***Petrogale pencillata***	E	V	All year	NSW South Western Slopes - Inland Slopes	Rocky outcrops/cliffs	Yes	**Not present (surveyed).** No records occur within 10 km of the Indicative Development Footprints and no suitable habitat occurs within the Indicative Development Footprints. Meandering transects were undertaken in September, October and December 2017; and January, February and March 2018 (Umwelt).

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							Fauna habitat assessments were taken across the Indicative Development Footprints in February and March 2018 to catalogue any suitable habitat for this species (Umwelt). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. Spotlighting was undertaken across three survey periods in October 2017; January 2018; and February and March 2018. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Brush-tailed Phascogale ***Phascogale tapoatafa***	V	-	All year	NSW South Western Slopes - Inland Slopes	Hollow bearing trees		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Fauna habitat assessments were taken across the Development Corridor and Indicative Development Footprint – External Roads in February and March 2018 to catalogue any suitable habitat for this species (Umwelt). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. Spotlighting was undertaken across three survey periods in October 2017; January 2018; and February and March 2018 (Umwelt). Remote cameras were installed within the Development Corridor and Indicative Development Footprint – External Roads to target brush-tailed phascogales in April 2019 (Umwelt). Bushnell Trophy Cam HD cameras were installed 1 metre above the ground pointing at a bait station containing honey, peanut butter and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed across all Umwelt survey periods. NGH Environmental completed cage-trapping and nocturnal surveys, comprising 8 traps over four nights and 8 traps over three nights at two sites in April 2012. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Koala (Breeding) ***Phascolarctos cinereus***	V	V	All year	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** Historical records occur within 10 km (1970, 1980 and 1997) of the Indicative Development Footprints however no individuals were identified across extensive survey periods. Meandering transects searching for suitable habitat or opportunistic sightings were undertaken in September, October and December 2017; January, February and March 2018; and April 2019 (Umwelt). Spotlighting and call playback were undertaken in October 2017; January 2018; and February and March 2018 (Umwelt). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. Call playback involved a period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Remote cameras were installed within the Development Corridor and Indicative Development Footprint – External Roads to target the koala in February and March 2018 (Umwelt). Bushnell Trophy Cam HD cameras were installed 1 metre above the ground pointing at a bait station containing honey, peanut butter and tuna. Cameras were set to take three photos in quick succession when movement was detected. Targeted scat searches were undertaken across the Development Corridor and Indicative Development Footprint – External Roads in accordance with the Spot Assessment Technique (SAT). Koala SAT searches had a focus on feed tree species (where applicable) and were undertaken in October 2017 (Umwelt) and November 2013 (NGH). Opportunistic observations were made across all Umwelt survey periods. Umwelt have considered the Draft Koala Habitat Protection Guideline (DPIE 2020). In the absence of current records of the species within the Development Corridor, but as PCTs 289, 350 and 351 generally support 15 per cent of regionally relevant eucalypt species for the koala, much of the habitat in the Development Corridor is

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							likely to be deemed 'Highly Suitable Koala Habitat' (DPIE 2020). Further commentary and consideration of these guidelines and the SEPP is required within the Modification Document. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Superb Parrot (Breeding) ***Polytelis swainsonii***	V	V	Sep-Nov	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes			**Present (surveyed).** This species was recorded at several locations within the Indicative Development Footprints by both Umwelt and NGH Environmental (2014 and 2016). All PCT350 woodland and Derived Native Grasslands that support mature trees with hollows within the Development Corridor and Indicative Development Footprint – External Roads is considered suitable habitat. Bird surveys involved a undertaking a short meandering transect over a period of 30 minutes while recording any bird species observed or heard during this period. Hollow-bearing tree surveys and habitat mapping for this species occurred in September and December 2017 (Umwelt); October and November 2011 (NGH); April and November 2012 (NGH), November 2013 (NGH) and June 2015 (NGH). Bird utilisation surveys and Targeted Superb Parrot surveys were completed in October and November 2018 (Umwelt); January, February, April and July 2019 (Umwelt); and November 2013 (NGH). Bird utilisation surveys involved a visual assessment of the species and habit (e.g. feeding, perching, flying) of all observed bird species from a high vantage point in the landscape. Targeted surveys for superb parrot assessed flight paths and local use of the site during the breeding season. This involved walking transects in superb parrot habitat and mapping flight paths taken by sighted individuals.
Grey-headed Flying-fox (Breeding) ***Pteropus poliocephalus***	V	V	Oct-Dec	NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Meandering transects to search for potential roosts or habitat were undertaken for the species during October and December 2017 (Umwelt). Spotlighting for this species was completed in December 2017. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. Opportunistic observations were made during all Umwelt survey periods. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Golden Sun Moth ***Synemon plana***	E	CE	Oct-Dec	South Eastern Highlands - Murrumbateman NSW South Western Slopes - Inland Slopes	 A radius of 15 km west of Binalong and eastwards to the subregion's eastern-most boundary; and in a radius of 15 km from Tumut	Yes	**Present (surveyed).** This species was recorded at several locations within the Indicative Development Footprints by both Umwelt and NGH Environmental (2014 and 2016). All Derived Native Grasslands in PCT350 and PCT351 in proximity to the records are considered suitable habitat for the species. Meandering transects to search for potential individuals or habitat were undertaken for the species during October and December 2017; and November and December 2019 (Umwelt). Targeted Golden sun moth transects, walked approximately 10 metres apart in suitable habitat, were undertaken in December 2017 (Umwelt); October and November 2011 (NGH); November 2012 (NGH); and November and December 2013 (NGH). Golden sun moth meandering transects (i.e. not strict parallel transects) were completed in November 2018 (Umwelt) and golden sun moth habitat mapping completed in March 2014 (NGH). Opportunistic observations were made throughout all Umwelt survey periods.
Masked Owl (Breeding) ***Tyto novaehollandiae***	V	-	May-Aug	NSW South Western Slopes - Inland Slopes			**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. These surveys occurred in February, April, July and August 2019 (Umwelt). Call playback for this species was concurrently undertaken in February, April, July and August 2019 (Umwelt). This involved a

Species	BC Act	EPBC Act	Survey Period	IBRA Region/Subregion	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
							period of quiet listening for five minutes, followed by playing the animal's calls over a 15 watt directional loud hailer for five minutes, followed by a ten-minute quiet listening period. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).
Greater Glider^ *Petauroides volans*	-	V	All year	-	Hollow bearing trees		**Not present (surveyed).** No species records occur within 10 km of the Indicative Development Footprints. Closest record is Binda, NSW, approximately 50km north east of the Project. Fauna habitat assessments were taken across the Development Corridor and Indicative Development Footprint – External Roads in February and March 2018 to catalogue any suitable habitat for this species (Umwelt). Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. Spotlighting was undertaken across three survey periods in October 2017; January 2018; and February and March 2018 (Umwelt). Remote cameras were installed within the Development Corridor and Indicative Development Footprint – External Roads to target brush-tailed phascogales in April 2019 (Umwelt). Bushnell Trophy Cam HD cameras were installed 1 metre above the ground pointing at a bait station containing honey, peanut butter and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed across all Umwelt survey periods. NGH Environmental completed spotlighting transects. Impacts were not calculated for this species as part of the original approval for the Project (NGH Environmental 2016a).

APPENDIX C

Flora and Fauna Species Lists

Flora Species List

The following list was developed from the floristic plot rapid transect surveys of the Development Corridor. It includes all species of vascular plants observed during these surveys.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

AA	denotes abundance rating according to BAM
PC	cover measure according to BAM
asterisk (*)	denotes species non-native species
double asterisk (**)	denotes High Threat Weed species under the BAM
subsp.	subspecies and
var.	variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2020), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Table C1 Vegetation Zones 1 to 5

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG												VZ4 – PCT350 – DNG										VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Filicopsida																																																
Adiantaceae	*Cheilanthes sieberi*	rock fern																											100	1																	300	0.5
Magnoliopsida – Liliidae (Monocots)																																															
Anthericaceae	*Thysanotus patersonii*	twining fringe-lily									4																																			
Cyperaceae	*Carex appressa*	tall sedge			100	30	500	50	50	3							20	4			30	0.5																										
Cyperaceae	*Carex* sp.						3	0.4																																								
Cyperaceae	**Cyperus eragrostis*	umbrella sedge																			20	0.1																										
Cyperaceae	*Lepidosperma laterale*	variable sword-sedge																																												200	2
Cyperaceae	*Schoenoplectus validus*								20	0.1																																					
Cyperaceae	*Schoenus apogon*	fluke bogrush																			100	0.4							100	0.1																		
Iridaceae	*Patersonia sericea*	silky purple-flag																																												100	1				
Iridaceae	***Romulea rosea* var. *australis*																												1000	3																		
Juncaceae	*Juncus australis*	rush																			5	0.1																										
Juncaceae	*Juncus filicaulis*										10	4			2	0.1																														
Juncaceae	*Juncus* sp.	a rush			20	10	100	25	30	0.1											40	0.3			20	1			20	0.2					2	0.4										
Juncaceae	*Juncus usitatus*																10	2	50	2							5	0.7																		
Juncaceae	*Luzula densiflora*	woodrush									50	10																																		
Liliaceae	*Liliaceae indeterminate*	lilies																			10	0.1																								
Lomandraceae	*Lomandra filiformis*	wattle matt-rush																					50	1					20	0.7											200	0.1				
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	wattle matt-rush	50	10	10	0.4					20	10	50	4			100	15	10	0.7									50	0.1					100	5	100	3					20	1	100	5	120	2	2000	10
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*																																		20	0.8	2	0.4	50	5								
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush																			50	1.5																										
Lomandraceae	*Lomandra*	many-																									2	0.4			10	1														

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG												VZ4 – PCT350 – DNG										VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
	multiflora subsp. *multiflora*	flowered mat-rush																																													
Orchidaceae	*Eriochilus cucullatus*	parson's bands																									15	0.1																			5	0.1
Orchidaceae	*Microtis* sp.										5	0.1																																		
Orchidaceae	*Pterostylis sp.*	Greenhood																																												20	0.1
Orchidaceae	*Thelymitra* sp.																																												5	0.1
Phormiaceae	*Dianella revoluta*	blueberry lily																															50	4			20	3	100	1								
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily																																											15	0.3orchid
Poaceae	**Aira caryophyllea*	silvery hairgrass																					5	0.4																						
Poaceae	**Aira cupaniana*	silvery hairgrass									10	0.1																	20	0.01																
Poaceae	*Aristida ramosa*	purple wiregrass	50	10							10	5			1	0.1	50	5	50	0.1							50	1	20	1			20	3	20	3							50	10	50	1		
Poaceae	*Aristida vagans*	threeawn speargrass											10	2																															500	1
Poaceae	**Arrhenatherum elatius*	oatgrass							1000	50																																				
Poaceae	*Austrodanthonia caespitosa*	ringed wallaby grass	30	2																																									
Poaceae	*Austrodanthonia carphoides*	short wallaby grass											50	2											1000	15							20	1	20	1							5	0.4				
Poaceae	*Austrodanthonia eriantha*	wallaby grass																					20	1																								
Poaceae	*Austrodanthonia fulva*	wallaby grass			10	0.4																																								
Poaceae	*Austrodanthonia monticola*	mountain wallaby grass															100	10							50	3																			500	2				
Poaceae	*Austrodanthonia racemosa*	wallaby grass																													50	0.1											500	10				
Poaceae	*Austrodanthonia setacea*	small-flowered wallaby-grass																							10	0.5																						
Poaceae	*Austrostipa densiflora*	speargrass																																												50	0.5
Poaceae	*Austrostipa scabra*	speargrass																											6	0.1	5	0.1											100	10				
Poaceae	*Austrostipa scabra* subsp. *falcata*	rough speargrass			10	0.4							4	0.5			50	10							500	15	100	3					20	1					300	1								
Poaceae	**Avena fatua*	wild oats			20	0.8																					20	1			30	1														
Poaceae	*Bothriochloa macra*	red grass							5	0.1							5	0.4							50	2			100	0.5																

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG								VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Poaceae	*Briza maxima*	quaking grass	5	0.01																			50	1							5	0.01																		
Poaceae	*Briza minor*	shivery grass							50	0.1																					5	0.01																		
Poaceae	*Bromus catharticus*	prairie grass			100	30																																										
Poaceae	**Bromus diandrus*	great brome													500	5							20	1																								
Poaceae	*Bromus hordeaceus*	soft brome							200	0.5					100	2									20	1							100	0.1														
Poaceae	*Bromus molliformis*	soft brome																							100	2															100	5						
Poaceae	*Bromus rubens*	red brome																													10	0.01									1000	25						
Poaceae	*Chloris truncata*	windmill grass															20	5																														
Poaceae	*Cynodon dactylon*	common couch			100	5	100	15									50	5			20	0.2			20	2																	10	1				
Poaceae	**Cynosurus echinatus*	rough dog's tail							50	0.5																																						
Poaceae	**Dactylis glomerata*	cocksfoot							100	1																	10	0.8			8	0.01																
Poaceae	*Deyeuxia* sp.																																													20	0.1
Poaceae	*Dichanthium sericeum*	Queensland bluegrass																							100	5																						
Poaceae	*Elymus scaber*	common wheatgrass							20	0.1							10	0.4							50	2	10	0.4					1000	5														
Poaceae	*Echinopogon caespitosus*	Hedgehog-grass																																											5	0.1
Poaceae	*Enneapogon nigricans*	Black-head nineawn																															20	0.1														
Poaceae	**Holcus lanatus*	Yorkshire fog																					5	1																								
Poaceae	**Hordeum leporinum*	barley grass													1	0.1																														
Poaceae	**Hordeum marinum*	sea barley grass															100	3									500	5																		
Poaceae	**Hordeum* sp.	a barley grass									2	0.1																																		
Poaceae	*Joycea pallida*	silvertop wallaby grass	50	10							3	3					3	0.4															100	20	20	3	100	30	3000	25	1	0.1	20	10				
Poaceae	**Lolium perenne*	perennial ryegrass	3	0.01											100	2																									100	5						
Poaceae	**Lolium rigidum*	Wimmera ryegrass																					500	5																						
Poaceae	*Microlaena stipoides*	weeping grass													20	0.5					1000	2					50	0.5													100	5				200	0.5
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass									500	15							1000	6					100	3																	50	1		

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG								VZ5 – PCT351 – MG															
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Poaceae	**Nassella trichotoma*	serrated tussock					5	0.4																																									
Poaceae	*Panicum effusum*	hairy panic	20	1													50	20	20	0.5					20	1	20	1																	2	0.1		
Poaceae	*Panicum* sp.	panicum																													10	0.1																
Poaceae	**Paspalum dilatatum*	paspalum																							5	0.4	50	5																				
Poaceae	**Pennisetum setaceum*	fountain grass							50	1																																						
Poaceae	**Phalaris aquatica*	phalaris			50	5	50	1	50	0.5																	50	5			50	2																
Poaceae	*Poa labillardierei* var. *labillardierei*	tussock grass			10	2			1000	8							20	5																												
Poaceae	*Poa sieberiana*	snowgrass											2	0.5							40	0.2															50	10					100	5			10	0.1
Poaceae	*Poa sieberiana* var. *cyanophylla*																																						300	1								
Poaceae	*Rytidosperma pallidum*																																												200	3
Poaceae	*Rytidosperma* sp.										500	30			500	10			100	3	500	0.5					400	5	50	2	100	0.2									10	0.2			50	1	500	4
Poaceae	*Themeda australis*	kangaroo grass			2	0.4					20	2							5	0.2							1000	65	8000	65	1000	40													20	0.2
Poaceae	**Vulpia bromoides*	squirrel tail fesque					100	0.4							100	5	1000	3							500	1	500	3																		
Poaceae	**Vulpia myuros*	rat's tail fescue							1000	2			100	2									1000	1							1000	5														
Poaceae	**Vulpia* sp.	rat's-tail fescue									5	0.1																																		
Typhaceae	*Typha domingensis*	narrow-leaved cumbungi							100	5																																		
Magnoliopsida – Magnoliidae (Dicots)																																															
Acanthaceae	*Brunoniella australis*	blue trumpet																																	3	0.4										
Amaranthaceae	*Gomphrena* sp.																								20	1																				
Apiaceae	*Eryngium ovinum*	blue devil																											8	0.1																
Apiaceae	*Hydrocotyle laxiflora*	stinking pennywort									100	4									100	0.1																							250	0.1
Apiaceae	*Platysace ericoides*																																												5	0.1
Asteraceae	**Arctotheca calendula*	capeweed																							50	1																				

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG								VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Asteraceae	***Carthamus lanatus*	saffron thistle															10	0.4													10	0.01																		
Asteraceae	*Cassinia aculeata*	dolly bush	1	0.01																																										1000	35
Asteraceae	*Cassinia arcuata*	sifton bush	100	15																																			80	1							100	2
Asteraceae	*Cassinia quinquefaria*	Bill's beard																																					1	5								
Asteraceae	*Chrysocephalum apiculatum*	common everlasting																											4	0.5																		
Asteraceae	**Cirsium vulgare*	spear thistle			20	1	20	1									50	5																														
Asteraceae	**Conyza bonariensis*	flaxleaf fleabane																											7	0.1																		
Asteraceae	*Euchiton* sp.	a cudweed									2	0.1									50	0.1					20	0.1																				
Asteraceae	**Gamochaeta americana*	Cudweed																																												30	0.1
Asteraceae	**Hypochaeris glabra*	smooth catsear																			50	0.1	1	1					100	0.1	3	0.01																		
Asteraceae	**Hypochaeris radicata*	catsear			20	0.8			200	0.5	100	7			1	0.1			100	1					50	5	10	0.6			4	0.01	20	0.1									10	0.2					50	0.1
Asteraceae	*Senecio tenuiflorus*	a fireweed																																										1	0.4				
Asteraceae	*Solenogyne dominii*																		3	0.1									300	0.2																		
Asteraceae	**Sonchus oleraceus*	common sowthistle			10	0.8																																									
Asteraceae	*Triptilodiscus pygmaeus*	common sunray									5	0.5																																				
Boraginaceae	**Echium plantagineum*	Paterson's curse																											20	0.1																		
Campanulaceae	*Wahlenbergia* sp.	bluebell									1	0.1																																				
Campanulaceae	*Wahlenbergia stricta*	tall bluebell											3	0.4																															5	0.4				
Caryophyllaceae	**Petrorhagia nanteuilii*	proliferous pink																									10	0.4																				
Caryophyllaceae	**Petrorhagia* sp.										2	0.1																																				
Chenopodiaceae	*Einadia hastata*	berry saltbush																							10	0.4																						
Clusiaceae	*Hypericum gramineum*	small st john's wort									5	0.5																	100	0.1															20	0.5				
Clusiaceae	*Hypericum japonicum*																				20	0.1																										
Convolvulaceae	*Convolvulus angustissimus*																												1	0.01																		

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG								VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Convolvulaceae	*Convolvulus erubescens*	pink bindweed																											20	0.1																		
Convolvulaceae	*Dichondra repens*	kidney weed																			20	0.1							20	0.1																		
Dilleniaceae	*Hibbertia obtusifolia*	hoary guinea flower									50	10																	8	0.2					10	0.4	20	5	20	2					20	2	3	0.1	20	0.2
Dilleniaceae	*Hibbertia* sp.																																												10	1				
Ericaceae	*Brachyloma daphnoides*	daphne heath																																	100	4	50	15									5	0.2
Ericaceae	*Leucopogon fletcheri*																																						50	2								
Ericaceae	*Leucopogon virgatus*																																		10	0.5											
Ericaceae	*Melichrus urceolatus*	urn heath									30	7																							100	5					50	2			20	5	7	0.6	30	0.5
Ericaceae	*Monotoca scoparia*																																		5	0.5			20	3								
Fabaceae (Faboideae)	*Daviesia genistifolia*	broom bitter pea	2	0.02																																											
Fabaceae (Faboideae)	*Daviesia leptophylla*																																		5	0.4	1	0.4			5	0.1						
Fabaceae (Faboideae)	*Daviesia ulicifolia*	gorse bitter pea											3	1																																	
Fabaceae (Faboideae)	*Desmodium varians*	slender tick-trefoil																											40	0.1	7	0.01															
Fabaceae (Faboideae)	*Dillwynia phylicoides*	parrot-pea																																										20	4				
Fabaceae (Faboideae)	*Dillwynia sericea*	egg and bacon peas; parrot peas									15	5																																			
Fabaceae (Faboideae)	*Glycine tabacina*	variable glycine																					20	1							1	0.01																
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	7	0.5																																	20	2	1	0.4					10	5			
Fabaceae (Faboideae)	*Hovea heterophylla*		1	0.01																															20	0.8	20	1	5	0.4					20	1			
Fabaceae (Faboideae)	*Indigofera australis*	Australian indigo									6	3																																			
Fabaceae (Faboideae)	*Platylobium formosum* subsp. *formosum*																																						20	1								
Fabaceae (Faboideae)	*Pultenaea* sp.		10	1																																										
Fabaceae (Faboideae)	*Pultenaea villosa*	hairy bush-pea																																							100	0.1							
Fabaceae (Faboideae)	**Trifolium arvense*	harefoot clover																							5	0.4					80	0.1															

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG								VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Fabaceae (Faboideae)	*Trifolium subterraneum*	subterranean clover																	7	0.1					20	1																							
Fabaceae (Mimosoideae)	*Acacia dealbata*	silver wattle									6	5			1	0.1													2	0.1					2	0.5	1	0.4	2	0.4								
Fabaceae (Mimosoideae)	*Acacia deanei*	green wattle																																					5	1								
Fabaceae (Mimosoideae)	*Acacia genistifolia*	early wattle	20	5																																											
Fabaceae (Mimosoideae)	*Acacia gunnii*	ploughshare wattle																											15	0.2					1	0.4												
Fabaceae (Mimosoideae)	*Acacia mearnsii*	black wattle																			4	0.8																										
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta wattle	1	0.5																																							4	2				
Fabaceae (Mimosoideae)	*Acacia* sp. 1																																												50	2
Gentianaceae	*Centaurium erythraea*	common centaury																											10	0.1																		
Gentianaceae	*Centaurium* sp.										3	0.5																																				
Geraniaceae	*Geranium solanderi*	native geranium									2	0.1																																				
Goodeniaceae	*Goodenia hederacea*	ivy goodenia									50	2																													80	1					7	0.1	50	0.3
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	ivy goodenia											1	0.4																					20	0.8	50	2					100	4				
Goodeniaceae	*Goodenia pinnatifida*	scrambles eggs																																			2	0.4										
Haloragaceae	*Gonocarpus tetragynus*	poverty raspwort									10	3	5	0.4															200	0.1							5	0.4			25	0.1			100	2	1	0.1	30	0.1
Haloragaceae	*Haloragis brownii*	swamp raspwort																			80	0.1																										
Lamiaceae	*Mentha satureioides*	native pennyroyal																							100	4																						
Lauraceae	*Cassytha glabella*																																				50	1									20	0.1
Lobeliaceae	*Pratia pedunculata*	matted pratia																			200	1																										
Loranthaceae	*Amyema miquelii*	box mistletoe	6	1									10	5					1	1															2	2												
Myrtaceae	*Eucalyptus blakelyi*	Blakely's red gum											2	5	2	10	3	20	20	30	100	65								1	1																	
Myrtaceae	*Eucalyptus bridgesiana*	apple box																					3	10																					10	15				
Myrtaceae	*Eucalyptus camaldulensis*	river red gum																					12	10																								

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG										VZ5 – PCT351 – MG													
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Myrtaceae	*Eucalyptus dives*	broad-leaved peppermint																																	2	2			7	10										
Myrtaceae	*Eucalyptus goniocalyx*	bundy	7	20																																	8	25					1	5	20	20				
Myrtaceae	*Eucalyptus macrorhyncha*	red stringybark	10	15													1	2	4	5															1	2	3	15	2	5	17	25	5	10	3	5	50	20		
Myrtaceae	*Eucalyptus mannifera*	brittle gum																																	10	10			10	15										
Myrtaceae	*Eucalyptus melliodora*	yellow box									5	10	10	25	3	20	1	10	5	10			6	10																									
Myrtaceae	*Eucalyptus polyanthemos*	red box																																							2	5								
Myrtaceae	*Eucalyptus rossii*	inland scribbly gum																																	20	20	2	15	10	20	25	35	4	10			50	20	4	35
Myrtaceae	*Eucalyptus sideroxylon*	mugga ironbark	3	10																																													
Myrtaceae	*Leptospermum multicaule*	silver tea-tree									10	10																									50	15										
Oxalidaceae	*Oxalis perennans*				10	0.4					2	0.1							10	0.1	40	0.1			10	0.4			10	0.1											2	0.1	50	1			50	0.1
Oxalidaceae	**Oxalis pes-caprae*	soursob					10	0.4																																								
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge																																												35	0.5
Phyllanthaceae	*Poranthera microphylla*	small poranthera									10	2																									5	0.4							100	1		
Plantaginaceae	*Plantago debilis*	shade plantain																									50	1																			
Plantaginaceae	**Plantago lanceolata*	lamb's tongues																									50	0.1			20	0.5															
Plantaginaceae	*Veronica plebeia*	trailing speedwell									5	0.5																																			
Polygonaceae	***Acetosella vulgaris*	sheep sorrel			20	0.7					20	2							100	1	500	0.2			50	4	10	0.4	500	0.2			10	0.1							50	0.5						
Polygonaceae	*Rumex brownii*	swamp dock			10	0.6									3	0.2									500	0.4																				
Polygonaceae	*Rumex* sp.	dock																	2	0.1																											
Rosaceae	*Acaena echinata*	sheep's burr																													60	2															
Rosaceae	*Acaena ovina*	acaena																											5	0.1	15	0.8															
Rosaceae	***Rosa rubiginosa*	sweet briar							2	0.2													1	1																									
Rubiaceae	*Pomax umbellata*	pomax							10	0.1																											3	0.4			15	0.1								
Rutaceae	*Boronia* sp.																																						50	0.1								
Solanaceae	**Solanum nigrum*	black-berry nightshade			3	0.4											2	0.4																													

Family Name	Scientific Name	Common Name	VZ1 – PCT289 – MG		VZ2 – PCT335 – MG						VZ3 – PCT350 – MG														VZ4 – PCT350 – DNG										VZ5 – PCT351 – MG															
			4107Jan03		Q33		Q35		4107Feb02		Q1		Q15		Q6		Q31		Q43		DMRP1		P03		Q11		Q32		DMRP3		4107Jan02		4107Feb03		Q16		Q20		Q23		Q26		Q8		Q13		Q42		J3	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Thymelaeaceae	*Pimelea curviflora*	rice flower																																			2	0.4														
Thymelaeaceae	*Pimelea curviflora* var. *curviflora*																																													10	0.4				
Violaceae	*Viola betonicifolia* subsp. *betonicifolia*	native violet																			200	0.1																														

Table C2 Vegetation Zones 6 to 9

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Filicopsida																																														
Adiantaceae	*Cheilanthes sieberi*	rock fern													20	0.1	1000	1							15	0.4	6	0.4	100	0.2							100	3							
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	rock fern																					10	0.3																	1	0.1		
Magnoliopsida – Liliidae (Monocots)																																													
Cyperaceae	*Carex appressa*	tall sedge																																									5	0.1
Iridaceae	**Romulea rosea* var. *australis*																																						5	0.1				
Juncaceae	*Juncus planifolius*																																				5	0.4						
Juncaceae	*Juncus* sp.	a rush			3	1	20	1					50	0.1	20	0.5																										10	0.1
Lomandraceae	*Lomandra filiformis*	wattle matt-rush											1000	5							5	0.1											300	2	1000	5			200	0.5			100	8
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	wattle matt-rush	20	2	50	5	10	0.6	500	15	1000	15			30	1	200	2	100	0.7			20	0.3	10	2			10	0.2	20	1					50	5			100	1		
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*								5	2																																		
Lomandraceae	*Lomandra glauca*	pale mat-rush																																									20	0.5
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush																					2	0.2																				5	0.6
Orchidaceae	*Microtis* sp.																																				20	0.4						
Poaceae	**Aira caryophyllea*	silvery hairgrass																					50	0.5																				
Poaceae	**Aira cupaniana*	silvery hairgrass	500	5	10	0.4			1000	10																	3	0.4			5	0.4			1000	3							
Poaceae	**Aira* sp.	a hairgrass											50	0.1																														
Poaceae	*Aristida ramosa*	purple wiregrass					500	10	100	10	400	5					15	0.2	200	0.5	1	0.01					50	3	5	0.1			250	1	1000	5	500	10	5	0.1			20	1
Poaceae	*Aristida* sp.	a wiregrass																							30	1																		
Poaceae	*Aristida vagans*	threeawn speargrass	20	4																																								
Poaceae	*Austrodanthonia*	short wallaby					1000	10	100	15															2000	10			100	1														

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
	carphoides	grass																																											
Poaceae	*Austrodanthonia caespitosa*	ringed wallaby grass															2000	25	2000	60																										
Poaceae	*Austrodanthonia duttoniana*	brown-back wallaby grass																					100	10																						
Poaceae	*Austrodanthonia eriantha*	wallaby grass																																					1	0.1						
Poaceae	*Austrodanthonia fulva*	wallaby grass															1000	3					100	10											200	1										
Poaceae	*Austrodanthonia monticola*	mountain wallaby grass	500	25	1000	20	1000	15																			500	10			500	15					1000	20					40	3
Poaceae	*Austrodanthonia racemosa*	wallaby grass											1000	15																														
Poaceae	*Austrodanthonia setacea*	small-flowered wallaby-grass																																			50	3					20	1
Poaceae	*Austrodanthonia sp.*	A wallaby-grass																			2000	45							1000	10														
Poaceae	*Austrostipa densiflora*	foxtail speargrass									20	0.1					2000	25																										
Poaceae	*Austrostipa scabra*	speargrass			20	0.3			50	3	200	0.5	100	0.5	100	1	1000	5	2000	20	1000	5	1000	30	2000	10					100	5					5	0.1				
Poaceae	*Austrostipa scabra* subsp. *falcata*	rough speargrass					500	15																			20	2																
Poaceae	*Austrostipa scabra* subsp. *scabra*	rough speargrass																															250	1	500	2								
Poaceae	**Avena fatua*	wild oats									200	0.1																																
Poaceae	*Bothriochloa macra*	red grass											5	0.1																														
Poaceae	**Briza maxima*	quaking grass																																									1000	10
Poaceae	**Briza minor*	shivery grass											25	0.1																									25	0.1				
Poaceae	**Bromus molliformis*	soft brome	100	5																																								
Poaceae	*Chloris truncata*	windmill grass			100	10	20	0.8			20	0.1							30	0.2																								
Poaceae	*Cynodon dactylon*	common couch											5	0.1											7	0.4							80	0.1	200	0.5						
Poaceae	*Elymus scaber*	common			10	0.5	50	0.4	50	5			200	0.5																									20	0.1				

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
		wheatgrass																																									
Poaceae	*Eragrostis cilianensis*	grey lovegrass																	30	0.1																								
Poaceae	*Eragrostis* sp.	a lovegrass																															100	0.1										
Poaceae	**Hordeum* sp.	a barley grass	50	5																																								
Poaceae	*Joycea pallida*	silvertop wallaby grass									200	10									1	0.1	4	0.3	3	1			2	0.2	2	0.4					4	0.4	1	0.1	100	30		
Poaceae	**Lolium perenne*	perennial ryegrass																	10	0.1																								
Poaceae	*Microlaena stipoides*	weeping grass									2000	15			2000	30	500	2	1000	8	1000	5	1000	30					2000	65											10	0.5		
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass																									1000	20																
Poaceae	*Panicum effusum*	hairy panic					50	2			10	0.1	20	0.1					20	0.1													50	0.1					10	0.1				
Poaceae	***Paspalum dilatatum*	paspalum							50	10									5	0.1																								
Poaceae	*Poa afinis*														20	0.1																												
Poaceae	*Poa sieberiana*	snowgrass	3	0.4							20	0.2													1000	15			10	0.3									5	0.1	50	10		
Poaceae	*Poa* sp.														1000	5	200	0.2																										
Poaceae	*Rytidosperma* sp.										1000	15	2000	25	3000	40			100	0.5	1200	6			17	1							100	0.1	1000	5								
Poaceae	*Themeda australis*	kangaroo grass											500	2					20	0.1	10	0.1																						
Poaceae	**Vulpia bromoides*	squirrel tail fesque							1000	15																																		
Poaceae	**Vulpia myuros*	rat's tail fescue											50	0.1																									100	0.5				
Magnoliopsida – Magnoliidae (Dicots)																																											
Apiaceae	*Hydrocotyle laxiflora*	stinking pennywort																					20	0.2													5	0.4						
Asteraceae	**Arctotheca calendula*	capeweed													1000	5	1000	3	1000	3	50	0.5																						
Asteraceae	***Carthamus lanatus*	saffron thistle							5	0.4																																		
Asteraceae	*Cassinia aculeata*	dolly bush																							1	0.4											500	40						
Asteraceae	*Cassinia arcuata*	sifton bush															1	0.3			1	0.01	1	0.5					5	0.1			1000	65	1000	65	20	1	200	80				
Asteraceae	*Cassinia laevis*	cough bush																					50	10							500	30												

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Asteraceae	*Chrysocephalum apiculatum*	common everlasting							5	0.4																																		
Asteraceae	**Cirsium vulgare*	spear thistle							5	0.4																					2	0.4												
Asteraceae	**Gamochaeta americana*	Cudweed													5	0.1																												
Asteraceae	**Hypochaeris glabra*	smooth catsear	50	10			50	5	20	2					50	0.5					5	0.1																						
Asteraceae	**Hypochaeris radicata*	catsear	10	2	20	1	100	10							50	0.5	1000	1	300	0.8	100	0.1	2	0.1	1	0.4			100	0.1	20	2			50	0.1								
Asteraceae	*Ozothamnus diosmifolius*	white dogwood																																			100	25						
Asteraceae	*Solenogyne dominii*																				50	0.1	100	0.2																				
Asteraceae	*Triptilodiscus pygmaeus*	common sunray																					20	0.2																				
Asteraceae	*Vittadinia gracilis*	Woolly New Holland Daisy															10	0.1																										
Asteraceae	*Vittadinia* sp.																				500	0.2																						
Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell																																							1	0.1		
Campanulaceae	*Wahlenbergia* sp.	bluebell																					2	0.1																				
Campanulaceae	*Wahlenbergia stricta*	tall bluebell					50	0.6																																				
Caryophyllaceae	**Petrorhagia nanteuilii*	proliferous pink					20	0.6	20	1																											3	0.4						
Chenopodiaceae	*Chenopodium pumilio*	small crumbweed									200	0.3																																
Chenopodiaceae	*Einadia nutans* subsp. *nutans*	climbing saltbush			2	0.4																																						
Clusiaceae	*Hypericum gramineum*	small St John's wort																											5	0.1									5	0.1				
Clusiaceae	***Hypericum perforatum*	St. Johns wort																													5	0.4					7	0.4						
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop													2000	0.5	500	0.1	300	0.1	2000	0.2																						
Dilleniaceae	*Hibbertia obtusifolia*	hoary guinea flower			4	1	10	0.8													1	0.01	1	0.1	6	0.4	50	10	20	0.2					20	3			10	0.2	4	0.01
Dilleniaceae	*Hibbertia* sp.																																40	1	50	0.1					1	0.1		
Ericaceae	*Brachyloma*	daphne																					2	0.2	7	1			5	0.2														

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
	daphnoides	heath																																										
Ericaceae	*Leucopogon ericoides*	pink beard-heath																																			1	0.4							
Ericaceae	*Melichrus urceolatus*	urn heath																					5	0.3	3	1	5	0.4					50	2	10	0.5	20	3			5	0.5		
Euphorbiaceae	*Chamaesyce drummondii*								5	0.4																																			
Fabaceae (Faboideae)	*Daviesia genistifolia*	broom bitter pea																																									10	1
Fabaceae (Faboideae)	*Daviesia leptophylla*																																									50	4
Fabaceae (Faboideae)	*Dillwynia retorta*																																		10	0.1							
Fabaceae (Faboideae)	*Dillwynia sericea*	egg and bacon peas; parrot peas																																							20	0.5		
Fabaceae (Faboideae)	*Dillwynia* sp.																								2	0.5																	
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla																																	10	0.1							3	0.8
Fabaceae (Faboideae)	*Hovea heterophylla*																								6	0.4																	3	0.01
Fabaceae (Faboideae)	**Medicago minima*	woolly burr medic											50	0.1																														
Fabaceae (Faboideae)	*Pultenaea microphylla*	a bush pea																																	5	0.1								
Fabaceae (Faboideae)	*Pultenaea* sp.																																				1	0.4					3	0.01
Fabaceae (Faboideae)	**Trifolium arvense*	haresfoot clover					50	0.4																																				
Fabaceae (Faboideae)	**Trifolium subterraneum*	subterranean clover									4000	15			2000	40	1000	2	2000	8	1000	2																						
Fabaceae (Mimosoideae)	*Acacia dealbata*	silver wattle	5	0.5																			20	20									15	10							1	0.1	100	15
Fabaceae (Mimosoideae)	*Acacia genistifolia*	early wattle									6	0.6																					1	1										
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta wattle																							12	25	500	45	30	6			2	1										
Fabaceae	*Fabaceae* indeterminate														0.1	30																												
Gentianaceae	**Centaurium erythraea*	common centaury																															60	0.1	10	0.1	100	3						

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Geraniaceae	*Erodium cicutarium*	common storksbill													10	0.1																														
Geraniaceae	*Erodium botrys*	long storksbill															1000	3																												
Goodeniaceae	*Goodenia hederacea*	ivy goodenia																					2	0.1											50	0.1	10	0.6						
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	ivy goodenia					10	0.5																																	5	0.2		
Haloragaceae	*Gonocarpus tetragynus*	poverty raspwort	50	1																			20	0.2	30	1			250	0.3			25	0.1								4	0.01
Lamiaceae	*Mentha satureioides*	native pennyroyal					100	3	10	0.4																																		
Loranthaceae	*Amyema miquelii*	box mistletoe																							1	0.5																		
Loranthaceae	*Amyema pendulum*																						1	0.1																				
Loranthaceae	*Amyema* sp.	mistletoe																			2	0.3																			20	0.5		
Myrtaceae	*Eucalyptus blakelyi*	Blakely's red gum																																									2	5
Myrtaceae	*Eucalyptus cinerea*	argyle apple																																							7	20	4	5
Myrtaceae	*Eucalyptus dives*	broad-leaved peppermint																																									2	5
Myrtaceae	*Eucalyptus goniocalyx*	bundy																													1	1									1	5		
Myrtaceae	*Eucalyptus mannifera*	brittle gum																																									1	5
Myrtaceae	*Eucalyptus melliodora*	yellow box																																									2	2
Myrtaceae	*Leptospermum continentale*																		5	0.2									100	7														
Myrtaceae	*Leptospermum multicaule*	silver tea-tree																					5	5	40	15																		
Oxalidaceae	*Oxalis exilis*																						10	0.2																				
Oxalidaceae	*Oxalis perennans*				5	0.4	100	6	20	0.4			5	0.1																														
Oxalidaceae	*Oxalis* sp.																				1000	0.2			15	0.4			50	0.1														
Plantaginaceae	*Plantago lanceolata*	lamb's tongues					50	2																																				

Family Name	Scientific Name	Common Name	VZ6 – PCT351 – DNG																				VZ7 – PCT351 – Acacia								VZ8 – PCT351 – Sifton										VZ9 – PCT351 – Apple			
			Q21		Q30		Q12		Q14		DMRP2		4107Feb04		J1		J2		J7		J8		Q10		Q24		Q36		J4		Q18		Q28		Q29		Q34		4107Feb01		Q9		4107Jan01	
			A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
Plantaginaceae	*Plantago* sp.	plantain																															5	0.1										
Plantaginaceae	*Veronica plebeia*	trailing speedwell																											10	0.1														
Polygonaceae	***Acetosella vulgaris*	sheep sorrel	1000	10			50	1	100	15	200	0.2			50	0.2	200	1	200	0.4	500	0.2							100	0.2	20	2					5	0.4	1	0.1				
Polygonaceae	*Rumex brownii*	swamp dock											10	0.1																			10	0.1										
Rosaceae	**Rubus anglocandicans*	blackberry																																							1	1
Rosaceae	**Rubus fruticosus* sp. agg.	blackberry																	1	0.1																								
Rubiaceae	*Galium gaudichaudii*	rough bedstraw																																							3	0.1		
Rubiaceae	*Pomax umbellata*	pomax											10	0.1											1	0.4																		
Violaceae	*Viola betonicifolia* subsp. *betonicifolia*	native violet																					1	0.1																				

Fauna Species List

The following list was developed from surveys undertaken across the Development Corridor. Details of the survey methodologies undertaken are provided in **Section 2** of the main report.

The following abbreviations or symbols are used in the list:

BC Act	*Biodiversity Conservation Act 2016*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
V	Vulnerable
E	Endangered
CE	Critically Endangered
MIG	Migratory
asterisk (*)	denotes species not indigenous to the Development Corridor.

Birds recorded use the scientific and common name nomenclature of BirdLife Australia. Reptiles recorded use the scientific and common name nomenclature of Cogger (2014). Amphibians recorded use the scientific and common name nomenclature of Cogger (2014), and mammals recorded use the scientific and common name nomenclature of Van Dyke and Strahan (2008).

Table C3 Fauna Species Identified in the Development Corridor

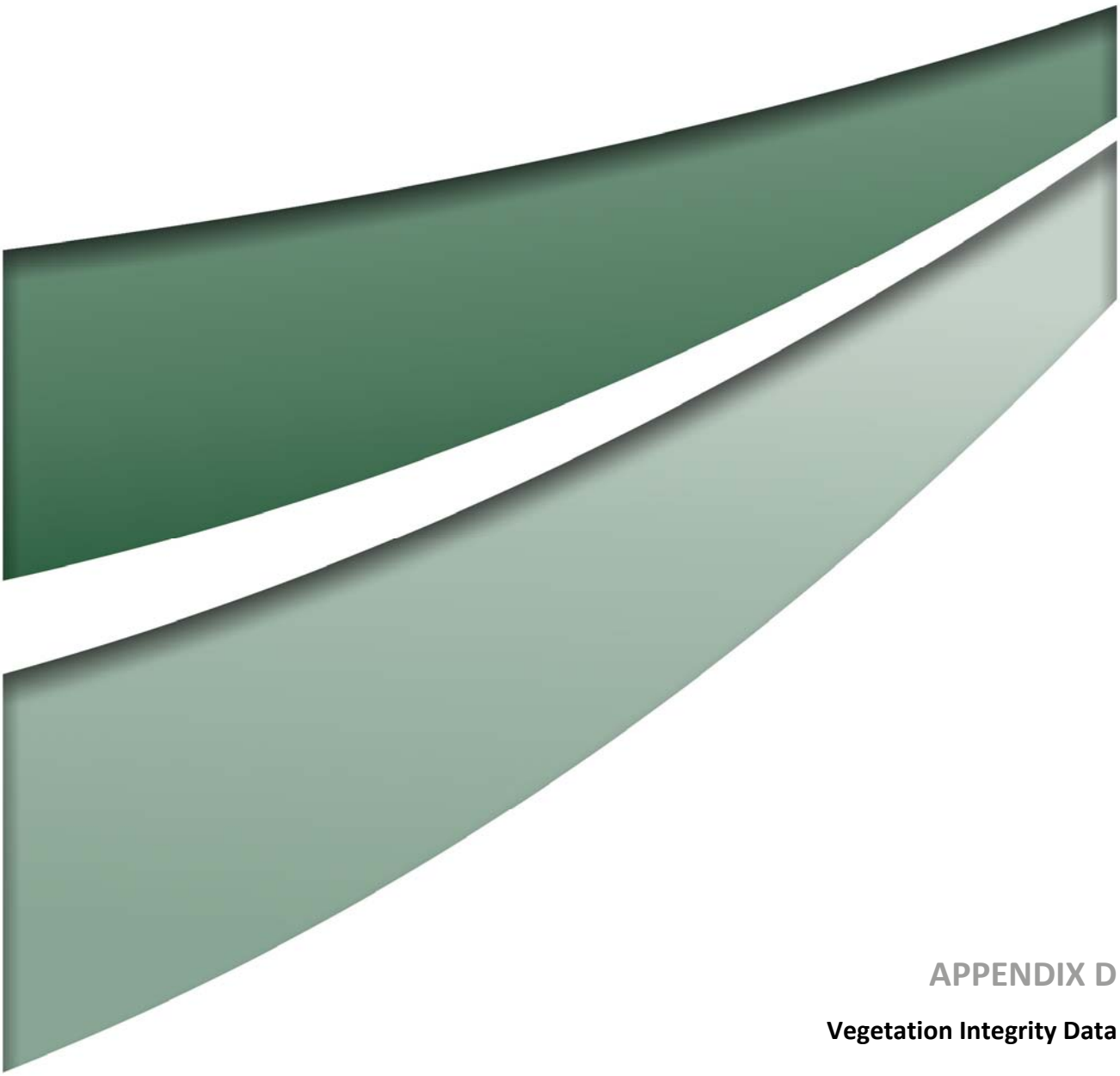
Family	Scientific Name	Common Name	BC Act	EPBC Act
AMPHIBIA				
HYLIDAE	*Litoria fallax*	eastern dwarf tree frog		
HYLIDAE	*Litoria* sp.	a tree frog		
MYOBATRACHIDAE	*Crinia parinsignifera*	eastern sign-bearing froglet		
MYOBATRACHIDAE	*Crinia signifera*	common froglet		
MYOBATRACHIDAE	*Limnodynastes peronii*	brown-striped frog		
MYOBATRACHIDAE	*Limnodynastes tasmaniensis*	spotted grass frog		
MYOBATRACHIDAE	*Uperoleia laevigata*	smooth toadlet		
AVES				
ACANTHIZIDAE	*Acanthiza chrysorrhoa*	yellow-rumped thornbill		
ACANTHIZIDAE	*Acanthiza lineata*	striated thornbill		
ACANTHIZIDAE	*Acanthiza nana*	yellow thornbill		
ACANTHIZIDAE	*Acanthiza pusilla*	brown thornbill		
ACANTHIZIDAE	*Acanthiza reguloides*	buff-rumped thornbill		
ACANTHIZIDAE	*Chthonicola sagittata*	speckled warbler	V	

Family	Scientific Name	Common Name	BC Act	EPBC Act
ACANTHIZIDAE	*Gerygone fusca*	western gerygone		
ACANTHIZIDAE	*Gerygone oliveacea*	white-throated gerygone		
ACANTHIZIDAE	*Hylacola pyrrhopygia*	chestnut-rumped heathwren		
ACANTHIZIDAE	*Sericornis frontalis*	white-browed scrubwren		
ACANTHIZIDAE	*Smicrornis brevirostris*	weebill		
ACCIPITRIDAE	*Aquila audax*	wedge-tailed eagle		
ACCIPITRIDAE	*Elanus axillaris*	black-shouldered kite		
ACROCEPHALIDAE	*Acrocephalus australis*	Australian reed-warbler		MIG
ALCEDINIDAE	*Dacelo novaeguineae*	laughing kookaburra		
ALCEDINIDAE	*Todiramphus macleayii*	forest kingfisher		
ALCEDINIDAE	*Todiramphus sanctus*	sacred kingfisher		
ANATIDAE	*Chenonetta jubata*	wood duck		
APODIDAE	*Hirundapus caudacutus*	white-throated needletail		V, MIG
ARDEIDAE	*Egretta novaehollandiae*	white-faced heron		
ARTAMIDAE	*Artamus cyanopterus*	dusky woodswallow	V	
ARTAMIDAE	*Artamus* sp.	a woodswallow		
ARTAMIDAE	*Cracticus nigrogularis*	pied butcherbird		
ARTAMIDAE	*Cracticus tibicen*	Australian magpie		
ARTAMIDAE	*Cracticus torquatus*	grey butcherbird		
ARTAMIDAE	*Strepera graculina*	pied currawong		
CACATUIDAE	*Cacatua galerita*	sulphur-crested cockatoo		
CACATUIDAE	*Eolophus roseicapillus*	galah		
CACATUIDAE	*Eolophus roseicapillus albiceps*	galah		
CAMPEPHAGIDAE	*Coracina novaehollandiae*	black-faced cuckoo-shrike		
CAMPEPHAGIDAE	*Lalage sueurii*	white-winged triller		
CHARADRIIDAE	*Vanellus miles*	masked lapwing		
CLIMACTERIDAE	*Cormobates leucophaea*	white-throated treecreeper		
COLUMBIDAE	*Ocyphaps lophotes*	crested pigeon		
COLUMBIDAE	*Phaps chalcoptera*	common bronzewing		
CORACIIDAE	*Eurystomus orientalis*	dollarbird		
CORCORACIDAE	*Corcorax melanorhamphos*	white-winged chough		
CORVIDAE	*Corvus coronoides*	Australian raven		

Family	Scientific Name	Common Name	BC Act	EPBC Act
CUCULIDAE	*Cacomantis pallidus*	pallid cuckoo		
ESTRILDIDAE	*Neochmia temporalis*	red-browed Finch		
ESTRILDIDAE	*Stagonopleura guttata*	diamond firetail	V	
FALCONIDAE	*Falco berigora*	brown falcon		
FALCONIDAE	*Falco cenchroides*	nankeen kestrel		
HIRUNDINIDAE	*Hirundo neoxena*	welcome swallow		
MALURIDAE	*Malurus cyaneus*	superb fairy-wren		
MALURIDAE	*Malurus cyaneus*	superb fairy-wren		
MELIPHAGIDAE	*Acanthorhynchus tenuirostris*	eastern spinebill		
MELIPHAGIDAE	*Anthochaera carunculata*	red wattlebird		
MELIPHAGIDAE	*Epthianura albifrons*	white-fronted chat	V	
MELIPHAGIDAE	*Lichenostomus chrysops*	yellow-faced honeyeater		
MELIPHAGIDAE	*Lichenostomus leucotis*	white-eared honeyeater		
MELIPHAGIDAE	*Lichenostomus penicillatus*	white-plumed honeyeater		
MELIPHAGIDAE	*Manorina melanocephala*	noisy miner		
MELIPHAGIDAE	*Meliphaga lewinii*	Lewin's honeyeater		
MELIPHAGIDAE	*Philemon corniculatus*	noisy friarbird		
MEROPIDAE	*Merops ornatus*	rainbow bee-eater		MAR
MONARCHIDAE	*Grallina cyanoleuca*	magpie-lark		
MONARCHIDAE	*Myiagra inquieta*	restless flycatcher		
MONARCHIDAE	*Myiagra rubecula*	leaden flycatcher		
MONARCHIDAE	*Myiagra rubecula concinna*	leaden flycatcher		
MOTACILLIDAE	*Anthus novaeseelandiae*	Australian pipit		
NECTARINIIDAE	*Dicaeum hirundinaceum*	mistletoebird		
NEOSITTIDAE	*Daphoenositta chrysoptera*	varied sittella	V	
ORIOLIDAE	*Oriolus sagittatus*	olive-backed oriole		
PACHYCEPHALIDAE	*Colluricincla harmonica*	grey shrike-thrush		
PACHYCEPHALIDAE	*Pachycephala pectoralis*	golden whistler		
PACHYCEPHALIDAE	*Pachycephala rufiventris*	rufous whistler		
PARDALOTIDAE	*Pardalotus punctatus*	spotted pardalote		
PARDALOTIDAE	*Pardalotus striatus*	striated pardalote		
PETROICIDAE	*Eopsaltria australis*	eastern yellow robin		
PETROICIDAE	*Petroica boodang*	scarlet robin	V	
PETROICIDAE	*Petroica goodenovii*	red-capped robin		

Family	Scientific Name	Common Name	BC Act	EPBC Act
PHALACROCORACIDAE	*Microcarbo melanoleucos*	little pied cormorant		
POMATOSTOMIDAE	*Pomatostomus superciliosus*	white-browed babbler		
PSITTACIDAE	*Alisterus scapularis*	Australian king-parrot		
PSITTACIDAE	*Platycercus elegans*	crimson rosella		
PSITTACIDAE	*Platycercus eximius*	eastern rosella		
PSITTACIDAE	*Polytelis swainsonii*	superb parrot	V	V
PSITTACIDAE	*Psephotus haematonotus*	red-rumped parrot		
RHIPIDURIDAE	*Rhipidura albiscapa*	grey fantail		
RHIPIDURIDAE	*Rhipidura leucophrys*	willie wagtail		
STURNIDAE	**Sturnus vulgaris*	common starling		
MAMMALIA				
BOVIDAE	**Capra hircus*	goat		
BOVIDAE	**Ovis aries*	sheep		
CANIDAE	**Vulpes*	red fox		
CERVIDAE	**Dama*	fallow deer		
DASYURIDAE	*Antechinus flavipes*	yellow-footed antechinus		
DASYURIDAE	*Antechinus* sp.	an antechinus		
EMBALLONURIDAE	*Saccolaimus flaviventris*	yellow-bellied sheathtail-bat	V	
LEPORIDAE	**Oryctolagus cuniculus*	rabbit		
MACROPODIDAE	*Macropus giganteus*	eastern grey kangaroo		
MACROPODIDAE	*Macropus robustus*	wallaroo		
MACROPODIDAE	*Macropus rufogriseus*	red-necked wallaby		
MACROPODIDAE	*Wallabia bicolor*	swamp wallaby		
MOLOSSIDAE	*Austronomus australis*	white-striped freetail-bat		
MOLOSSIDAE	*Mormopterus petersi*	inland free-tailed bat		
MOLOSSIDAE	*Mormopterus planiceps*	south-eastern freetail bat		
PETAURIDAE	*Petaurus norfolcensis*	squirrel glider	V	
PETAURIDAE	*Petaurus* sp.	a glider		
PHALANGERIDAE	*Trichosurus vulpecula*	common brushtail possum		
PSEUDOCHEIRIDAE	*Pseudocheirus peregrinus*	common ringtail possum		
TACHYGLOSSIDAE	*Tachyglossus aculeatus*	short-beaked echidna		
VESPERTILIONIDAE	*Chalinolobus gouldii*	Gould's wattled bat		

Family	Scientific Name	Common Name	BC Act	EPBC Act
VESPERTILIONIDAE	*Chalinolobus morio*	chocolate wattled bat		
VESPERTILIONIDAE	*Falsistrellus tasmaniensis*	eastern false pipistrelle	V	
VESPERTILIONIDAE	*Miniopterus orianae oceanensis*	large bent-winged bat	V	
VESPERTILIONIDAE	*Myotis macropus*	southern myotis	V	
VESPERTILIONIDAE	*Scotorepens balstoni*	inland Broad-nosed Bat		
VESPERTILIONIDAE	*Vespadelus vulturnus*	little forest bat		
REPTILIA				
AGAMIDAE	*Pogona barbata*	bearded dragon		
CHELIDAE	*Chelodina longicollis*	snake-necked turtle		
DIPLODACTYLIDAE	*Diplodactylus vittatus*	eastern stone gecko		
ELAPIDAE	*Pseudechis porphyriacus*	red-bellied black snake		
SCINCIDAE	*Ctenotus sp.*	a skink		
SCINCIDAE	*Egernia cunninghami*	Cunningham's skink		
SCINCIDAE	*Egernia striolata*	tree skink		
SCINCIDAE	*Lampropholis guichenoti*	pale-flecked garden sunskink		
SCINCIDAE	*Morethia boulengeri*	south-eastern morethia skink		
SCINCIDAE	*Saiphos equalis*	three-toed skink		
SCINCIDAE	*Tiliqua rugosa*	shingle-back		
VARANIDAE	*Varanus varius*	lace monitor		
LEPIDOPTERA				
CASTNIIDAE	*Synemon plana*	golden sun moth	E	CE



APPENDIX D

Vegetation Integrity Data

Vegetation Integrity Data

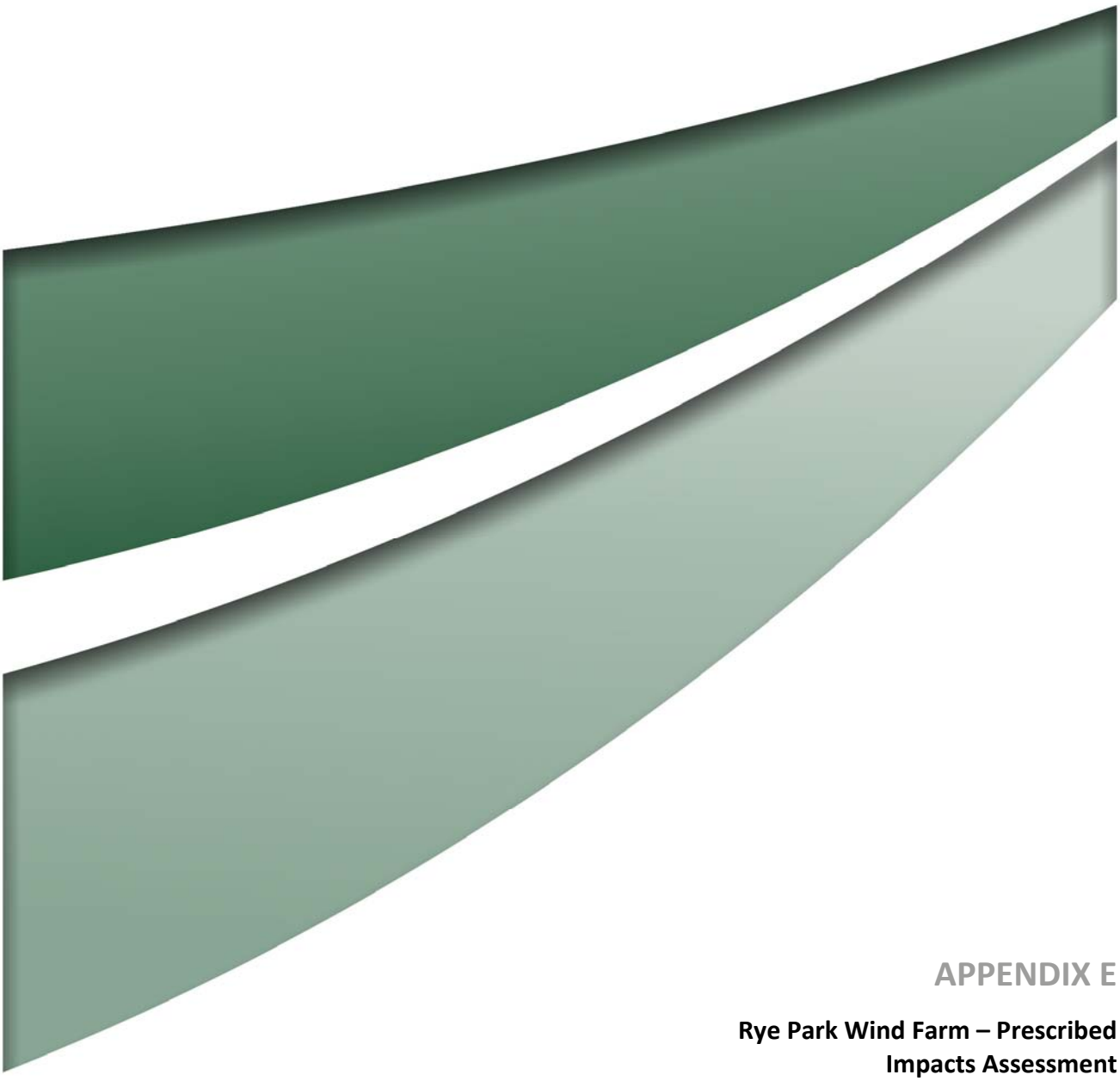
The following vegetation integrity data was collected from surveys of the Development Corridor. It includes the composition, structure and function attributes that are recorded in each BAM Vegetation Integrity Plot. This data is assessed against benchmark data for PCTs and entered into the BAM Calculator to assess the condition of each PCT in the Indicative Development Footprints.

The following abbreviations are used in the table below:

Tr	Tree (growth form)
Sh	Shrub (growth form)
Gr	Grass (growth form)
Fb	Forb (growth form)
Fn	Fern (growth form)
Ot	Other (growth form)

	COMPOSITION						STRUCTURE						FUNCTION										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs (m)	High Threat Weeds
													>5	5-10	10-20	20-30	30-50	50-80					
VZ 1 – PCT289 Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion – *Moderate to Good*																							
4107Jan03	4	5	5	1	0	2	45.5	21	33	0	0	1.5	1	1	1	1	1	1	6	1	80.6	59	0
VZ 2 – PCT 335 Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion – *Moderate to Good*																							
33	0	0	8	2	0	0	0	0	48.6	1	0	0	0	0	0	0	0	0	0	0	78	8	5.7
35	0	0	4	0	0	0	0	0	90.4	0	0	0	0	0	0	0	0	0	0	0	40	0	1.4
4107Feb02	0	0	8	0	0	0	0	0	16.5	0	0	0	0	0	0	0	0	0	0	0	97	1	1.7
VZ 3 – PCT 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion – *Moderate to Good*																							
1	2	5	8	12	0	0	15	35	79	13	0	0	1	1	1	0	1	1	1	1	9	26	2
15	2	1	5	3	0	1	30	1	9	1.2	0	5	1	1	1	1	1	1	1	1	82	144	0
6	3	0	4	1	0	0	30.1	0	10.7	0.2	0	0	1	0	1	1	1	1	1	0	48	10	5
31	3	0	13	0	0	0	32	0	88.2	0	0	0	1	0	0	0	1	1	3	4	42	48	0.4
43	3	0	7	3	0	1	45.0	0.0	12.5	0.3	0.0	1.0	1	1	1	1	0	1	2	3	74.0	70.0	1.0
DMRP1	1	1	9	9	0	0	65	0.8	5.7	1.8	0	0	1	1	1	1	1	1	4	4	88	33	0.3
P03	3	0	2	0	0	1	30	0	2	0	0	1	1	1	1	1	1	1	2	0	70.8	6	3
VZ 4 – PCT 350 Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion – *Derived Native Grassland*																							
11	0	0	10	4	0	0	0	0	49	5.2	0	0	1	0	0	0	0	0	0	0	23	0	4.4
32	0	0	7	1	0	0	0	0	71	1	0	0	1	0	0	0	0	0	0	0	93.8	0	10.4
DMRP3	1	2	8	9	0	2	0.1	0.4	72.4	1	0	0.2	1	0	0	0	0	0	0	0	2.6	0	0.2
4107Jan02	1	0	7	3	1	3	1	0	44.9	3.3	1	0.0	1	0	0	1	0	0	0	0	3.4	1	5.0
4107Feb03	0	0	5	0	0	0	0	0	5.5	0	0	0	1	0	0	0	0	0	0	0	73.6	0	0.1
VZ 5 – PCT 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion – *Moderate to Good*																							
16	5	7	7	3	0	1	34.5	11.2	31.2	5.6	0	2	1	1	1	1	1	0	0	0	58	119	0
20	4	5	5	7	0	2	55.4	35.8	10.4	5	0	3	1	1	1	1	1	0	0	3	25	246	0
23	5	3	3	2	0	1	50.4	6	45	3.4	0	0.4	1	1	1	1	1	0	0	10	80.4	207	0
26	2	8	5	5	0	0	60	11.3	27.6	3.2	0	0	1	1	1	1	1	0	0	3	78	29.5	0
8	4	0	6	1	0	0	30	0	26.3	0.1	0	0	1	0	0	1	1	1	4	8	41	154	0.5
13	4	5	7	8	0	1	42	12.4	33.4	10.3	0	5	1	1	1	1	1	1	8	2	24	49	0
42	2	2	5	2	0	0	40.0	0.7	5.1	0.2	0.0	0.0	1	1	1	1	1	0	2	2	87.0	54.0	0.0
J3	1	7	12	8	1	1	35	38.5	23.5	1.2	0.5	0.1	0	0	1	0	1	1	1	1	39	147	0
VZ 6 – PCT 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion – *Derived Native Grassland*																							
21	1	0	4	1	0	0	0.5	0	31.4	1	0	0	1	0	0	0	0	0	0	0	84	92	10
30	0	1	6	2	0	0	0	1	36.8	0.8	0	0	1	0	0	0	0	0	0	0	2	0	0
12	0	1	9	4	0	0	0	0.8	54.8	10.1	0	0	1	0	0	0	0	0	0	0	14.6	0	1
14	0	0	6	4	0	0	0	0	50	1.6	0	0	1	0	0	0	0	0	0	1	29	73	25.4
DMRP2	0	1	10	1	0	0	0	0.6	61	0.3	0	0	1	0	0	0	0	0	0	0	6	0	0.2
4107Feb04	0	0	11	2	0	0	0	0	48.5	0.2	0	0	1	0	0	0	0	0	0	0	85	2	0

	COMPOSITION						STRUCTURE						FUNCTION										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs (m)	High Threat Weeds
													>5	5-10	10-20	20-30	30-50	50-80					
J1	0	0	8	1	1	1	0	0	77.6	0.5	0.1	0.1	0	0	0	0	0	0	0	0	1	0	0.2
J2	0	1	8	2	1	0	0	0.3	62.4	0.2	1	0	0	0	0	0	0	0	0	0	0	0	1
J7	0	1	9	1	0	0	0	0.2	90.1	0.1	0	0	0	0	0	0	0	0	0	0	0	2.4	0.6
J8	0	2	8	4	0	0	0	0.02	56.31	0.7	0	0	0	0	0	0	0	0	0	0	2	0	0.2
VZ 7 – PCT 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion – *Acacia Shrubland*																							
10	1	6	7	8	1	1	20	16.1	80.8	1.3	0.3	0.1	1	0	0	0	0	0	0	0	14.4	21	0
24	1	6	8	4	1	1	25	18.3	40.4	2.2	0.4	0.5	1	1	1	1	1	1	1	3	35	45	0
36	1	2	4	0	1	0	45	10.4	35	0	0.4	0	1	1	1	1	0	0	0	0	48.2	8	0
J4	1	4	7	4	1	1	6	7.5	76.8	0.6	0.2	0.3	1	1	1	1	0	0	0	0	25	0	0.2
VZ 8 – PCT 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion – *Sifton Bush Shrubland*																							
18	1	1	4	0	0	0	1	30	21.4	0	0	0	0	0	0	0	0	0	0	0	15.8	37	2.4
28	2	4	6	3	0	0	11	69	4.3	0.3	0	0	0	0	0	0	0	0	0	0	41	0.5	0
29	0	5	7	1	0	1	0	65.8	18.6	0.1	0	0.1	0	0	0	0	0	0	0	0	41	9	0
34	0	7	6	3	1	0	0	72.8	38.8	1.4	3	0	0	0	0	0	0	0	0	0	60	10	0
4107Feb 01	0	1	8	1	0	0	0	80	1.2	0.1	0	0	0	0	0	0	0	0	0	0	82.4	32	0.2
VZ 9 – PCT 351 Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion – *Argyle Apple Forest*																							
9	3	4	4	3	1	1	25.1	1.3	41.5	0.4	0.1	0.5	1	1	1	1	0	1	2	0	41	25	0
4107Jan 01	6	4	8	2	0	1	37	5.02	14.3	0.02	0	0.8	1	0	1	1	1	1	11	6	69	131	0
VZ 10 – Non-native Vegetation																							
7	0	0	1	1	0	0	0	0	0.3	0.2	0	0	1	0	0	0	0	0	0	0	0.6	0	5.2
5	0	0	1	2	0	0	0	0	0.2	0.3	0	0	1	0	0	0	0	0	0	0	2.4	0	0
P01	1	0	4	2	0	0	3	0	11	2	0	0	1	0	1	1	1	0	0	0	12	0	5
P02	0	0	3	5	0	0	0	0	3	5	0	0	1	0	0	0	0	0	0	0	10	0	12
P04	1	1	3	0	0	0	25	3	4	0	0	0	1	1	1	0	1	1	7	0	60	7	14
J5	0	0	7	0	0	0	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J6	0	1	6	0	0	0	0	0.1	28.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6



APPENDIX E

Rye Park Wind Farm – Prescribed Impacts Assessment

umwelt
Environmental & Social Consultants

renewables

RYE PARK WIND FARM

BDAR – Prescribed Impacts
Section 9.2.1.8

FINAL

August 2020

RYE PARK WIND FARM

BDAR – Prescribed Impacts
Section 9.2.1.8

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tilt Renewables

Project Director:	Travis Peake
Project Manager:	Bill Wallach
Report No.	4107/R05/Appendix E
Date:	August 2020

Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	David Moore	16/07/2020	Travis Peake	13 August 2020

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1.0 Introduction

This document has been prepared to address criterion 9.2.1.8 a- k within the 'assessing prescribed biodiversity impacts' section of the Biodiversity Assessment Method as required under the NSW *Biodiversity Conservation Act 2016* (BC Act) for the proposed Rye Park Wind Farm modification. These criterion request further analysis of project related impacts on aerial species, particularly threatened species. Aerial species considered as part of this analysis were selected based on recorded flight data collected during bird and bat utilisation surveys during 2011-2013 (NGH 2014) and during 2018/19 by Umwelt in the Project Area. At the request of the Biodiversity and Conservation Division 14 species were considered in this assessment comprising 13 threatened species (nine bird and four bat species) and one non-threatened bird species (wedge-tailed eagle).

This assessment considers the utilisation of the 14 fauna species across a broad Project Area, which includes the extent of landholdings involved with the Project. This is necessary to capture given the mobility of the species being assessment and the criterion being considered.

In **Figures 4.1**, **4.2** and **4.3**, we present the Indicative Development Footprints which comprises the entirety of the Indicative Development Footprint for the Rye Park Wind Farm. The Indicative Development Footprints includes a combination of the Indicative Development Footprint – Wind Farm, the Indicative Development Footprint – External Roads and the Indicative Development Footprint – Permanent Met Masts.

2.0 Predict the likelihood of impact on aerial species resident in, or likely to fly over, the project area including but not limited to bat/bird strike and barotrauma

To ascertain the likelihood and consequence of impacts on aerial species, a risk-based assessment approach has been applied. This assessment has been developed based on a recent report completed by the Arthur Riley Institute (Lumsden *et al.* 2019). The assessment considers the likelihood of blade strike based on recorded flight behaviours and assesses consequence using a range of measures associated with population ecology, abundance and conservation status.

The results of the risk assessment are summarised in **Table 2.1** below, with five species considered a high risk, six considered a moderate risk and three considered a minor risk of being impacted by the Project. The resultant risk rating for these species is primarily due to their relative abundance in the Project Area, their predicted or observed flight behaviour in the Project Area and/or their known susceptibility to blade strike at wind farms in south-east Australia.

The interpretation and justification for these results is provided in **Section 4.0** with reference to data collected during bird utilisation surveys conducted in the Project Area and in consideration of the scant relevant and publicly available data from Australian wind farms.

Table 2.1 Risk Assessment Summary

Common Name	Latin Name	Likelihood	Consequence	Risk Rating
Little eagle	*Hieraaetus morphnoides*	High	Moderate	High
Black falcon	*Falco subniger*	High	Moderate	High
Wedge-tailed eagle	*Aquila audax*	High	Low	Moderate
Superb parrot	*Polytelis swainsonii*	High	Moderate	High
White-throated needletail	*Hirundapus caudacutus*	High	Moderate	High
White-fronted chat	*Epthianura albifrons*	High	Low	Moderate
Brown treecreeper	*Climacteris picumnus victoriae*	Low	Moderate	Minor
Varied sittella	*Daphoenositta chrysoptera*	Moderate	Low	Minor
Painted honeyeater	*Grantiella picta*	Moderate	Moderate	Moderate
Dusky woodswallow	*Artamus cyanopterus*	High	Low	Moderate
Large bent-winged bat	*Miniopterus schreibersii oceanensis*	High	Moderate	High
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	Moderate	Moderate	Moderate
Southern myotis	*Myotis macropus*	Low	Moderate	Minor
Eastern false pipistrelle	*Falsistrellus tasmaniensis*	Moderate	Moderate	Moderate

3.0 Predict the rate of impact per turbine per year for species likely to be affected

The rate of impact per turbine per year is not quantitatively estimated here given the lack of information on key relevant factors such as turbine avoidance. Rather, a risk-based assessment, similar to that developed by the Arthur Riley Institute (Lumsden *et al.* 2019) has been completed. The details of this assessment are included within the response to **Section 4.0**.

Where available, mortality estimates from other Australian wind farms has been considered for each aerial species within the responses below. Mortality estimates include data from two of 15 Victorian wind farms at which mortality monitoring has been undertaken and mortality rates for particular species determined (Moloney *et al.* 2019). However, it is emphasised that mortality rates are likely to vary considerably between wind farms, depending on a range of variables such as their proximity to key habitat features (e.g. important cave roosts), turbine size, landscape position and the inherent spatial variability in species abundance and utilisation of airspace (Richardson 2000, Drewitt and Langston 2006, Krijgsveld *et al.* 2009). For this reason, it is not advisable to extrapolate or predict mortality estimates provided in Moloney *et al.* (2019) for other wind farms such as the Project. However, the consideration of available mortality data is important when considering estimating relative risk for a species, such as in **Section 4.3**.

4.0 Justify predictions of likelihood of impact and rates of impact, with reference to relevant literature and other published sources of information

4.1 Risk Assessment Method

The relative risk of blade strike for the eleven species assessed here was estimated using two criteria to ascribe likelihood of risk and four criteria to ascribe consequence of risk (**Table 4.1, Table 4.2**). These six criteria were employed in a recent study conducted with the aim of developing a science-based approach to aid decision-making regarding turbine collision risk for birds and bats in Victoria (Lumsden *et al.* 2019). Each criterion was either adopted unchanged or was adjusted for the purposes of this current assessment as appropriate to ensure the particulars of each criterion was relevant to specific aspects of the Project such as geographic location. For the purposes of this assessment, Criterion A, C and F were slightly altered, Criterion B was substantially altered and the thresholds and spatial scale for Criterion E were adjusted.

Table 4.1 Criteria used to ascribe likelihood of risk

A	B
Known or likely frequency of flights within RSA height	Status or frequency of occurrence in the Project Area

Table 4.2 Criteria used to ascribe consequence of risk

C	D	E	F
Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to regional, national or international population	Impact on population relative to demographic capacity to replace fatalities (i.e. generalised combination of dispersal capacity of potential replacements, fecundity and generation time)	Known or estimated size of national or global population	Listed conservation status under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the BC Act

Each species was ranked either low, moderate or high for each criterion depending on which is most appropriate in consideration of the assessed species' ecology and observed or predicted utilisation of the Study Area. Descriptions for each ranking are outlined in (**Table 4.3**).

Criterion A (flight height) was assessed by identifying the frequency of flights observed between 30 m and 200 m in the Study Area, and assessing this with consideration of observed and reported flight behaviour from elsewhere in Australia. Given that flight height data for bird and bat species in Australia is scant and observation data from pre-construction surveys at wind farms sites is largely unavailable, estimates of flight height require an adequate number of observations from the assessed site coupled with consideration of expert opinion on known flight behaviour for each species assessed. This Criterion is important as flight height is the primary variable through which a relative estimate of collision risk can be reached.

Criterion B (status in Project Area) was assessed by determining the status or estimating the frequency of occurrence in the Project Area. This Criterion is included as it is an essential component for estimating overall blade strike risk.

Criterion C (geographic population concentration) was assessed by estimating the degree to which a species' population may be concentrated due to site related factors such as geographic location, habitat type, proximity to important habitat or roost locations (i.e. significant wetlands, roost caves) and how this relates to the specific landscape in which the Project Area is located. Lumsden *et al*. (2019) noted that this criterion is intended to account for situations where the degree to which a taxon is geographically concentrated may influence the risk posed by the particular location of a wind farm. Where large flocks or aggregations are involved the concentration of individuals may be for short seasonal periods, but may nonetheless substantially heighten risk to a large portion of a species' total population. This is particularly important if a large proportion of a species' population passes through a localised area, such as a migratory corridor, over the course of each seasonal passage.

Criterion D (demographic resilience) was assessed through consideration of known aspects of each assessed species breeding biology and, most specifically, the nature of species' life-history traits. This criterion is included in the risk assessment as it is necessary to estimate the capacity to which a species' may replace individuals lost to mortality resulting from blade strike.

Criterion E (population size) is included to account for the variation in the significance of mortality of a given number of individuals between species as a result of the large variation in assessed species' national or global populations. This, when assessed in combination with Criterion D provides a measure through which the relative vulnerability of a species to loss of individuals can be estimated.

Criterion F (listed conservation status) refers to the status of bird and bat species listed under the EPBC Act or the BC Act. In instances where a species listing differs between Acts, for example one that is listed vulnerable under the EPBC Act and endangered under the BC Act the most threatened listing category is selected for the purposes of this assessment. Species listed as migratory and/or marine under the EPBC Act are not assigned a rank for this criterion.

Table 4.3 Descriptions of each ranking for Criterion A-F

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	Species that do not or rarely fly at RSA height	Species that rarely occur in the Project Area.	Species that are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed	Species that form breeding territories and that have a reasonable proportion of the population as nonbreeding 'floaters' that can rapidly replace breeding territorial adults if lost; species that may or may not form breeding territories and that are short-lived and have high fecundity; species that have capacity for long range or widespread juvenile or sub-adult dispersal	Total population (i.e. whether that corresponds to the national population of Australian endemics or a migrant's global population) is estimated to number more than 20,000 individuals	Species not listed or listed as near threatened or data deficient under the EPBC Act or the BC Act
Moderate	Species which regularly fly below RSA height and occasionally fly at RSA height	Species that occasionally occur in, or occasionally move through the Project Area	Species that may be more widespread or have greater flexibility in the range of suitable habitat availability, but where a high proportion of their population is likely to be concentrated at sites where they do occur	Species with life-history characteristics that sit between the low and high descriptions here	Total population is estimated to number between 5,000 and 20,000 individuals	Species listed as vulnerable under the EPBC Act or the BC Act
High	Species in which a high proportion of flight activity is at RSA height	Species that regularly occur in, or regularly move through the Project Area	Bat species that have major aggregations at a few caves, or bird or bat species that have either very restricted distributions or those where a substantial proportion of a population may move through certain areas (i.e. migratory pathways)	Species that form breeding territories but where there is limited capacity for a lost breeding adult to be readily replaced; species that do not form breeding territories and that are long-lived and/or have low fecundity; species that may have short-distance juvenile or sub-adult dispersal capacity only	Total population is estimated to number less than 5,000 individuals	Species listed as endangered or critically endangered under the EPBC Act or the BC Act

4.2 Estimating overall risk

Estimates of overall risk for each assessed species were determined by following an approach similar to that employed by Lumsden *et al*. (2019) with the most notable exception being the difference in spatial scale for which resulting estimates of risk are intended to be relevant to (i.e. state-wide vs site-specific). Elements of the likelihood and consequence of collision were combined to form an overall qualitative risk category ('low'/'moderate'/'high') specific to the Project for the likelihood of collision and the consequence of collision. Likelihood of collision questions (Criterion A and B) and consequence of collision questions (Criterion C to F) were combined in a generally additive process to determine whether the overall likelihood and consequence of collisions was 'low', 'moderate' or 'high'.

For the overall estimate of **likelihood of collision** to be considered 'high', then at least Criterion A or Criterion B must be considered 'high' and neither could be considered 'low'. To be considered 'low', the rank for both these criteria must be 'low'. All other combinations are considered 'moderate'.

For the overall estimate of **consequence of collision**, the modal response of Criterion C, Criterion D, Criterion E and Criterion F was used as the estimate. In cases where responses are evenly spread between two risk ratings, the higher risk rating was designated. In cases where the risks were spread across all three levels, 'low'; ''moderate' and 'high', a 'moderate' risk was selected. The exception was in cases where the risk associated with criterion C for localised concentration was 'high'. It was considered that the consequences of high mortality due to wind turbine collisions for species that have a limited distribution and/or are highly concentrated is sufficiently large such that, if a species risk associated with this element was 'high', the consequences of collision should also be set to 'high', irrespective of the risks of the other criteria.

Once the overall risk levels for the likelihood and consequence of collision specific to the Project had been assigned for a species, the results were then placed into a risk matrix to determine the level of concern (**Table 4.4**). Five categories of risk were used, namely 'negligible', 'low', 'moderate', 'high' and 'severe', based on the combination of the scores for likelihood and consequence.

Table 4.4 Risk matrix

		Consequence of collisions		
		Low	Moderate	High
Likelihood of collisions	Low	Negligible	Minor	Moderate
	Moderate	Minor	Moderate	High
	High	Moderate	High	Severe

4.3 Assessment of likelihood and consequence of impact

4.3.1 Black falcon

4.3.1.1 Information on black falcon from Australian wind farms

There is one published record of blade strike of black falcon in the available literature (Wood 2015, Moloney *et al.* 2019). Over a two-year monitoring period from March 2013 to February 2015 one deceased black falcon was detected at Macarthur Wind Farm in south-western Victoria (Wood 2015). It was noted that the black falcon had a relatively low occurrence on the wind farm site having not been recorded during pre or post construction surveys, and was therefore unlikely to be significantly impacted by collision with wind turbines (at that wind farm) (Wood 2015). This case highlights that though a lack of records from pre-construction surveys at a wind farm may be interpreted as indicating a lower likelihood of blade strike, the risk of blade strike for highly mobile species considered to be 'unlikely to occur' or 'rare' in the region should not be discounted.

4.3.1.2 Status and flight behaviour in the Project Area

Black falcon were recorded on three occasions during bird utilisation surveys conducted in 2018/19 (**Figure 4.1**). All three observations were from February 2019 in open woodland on lower slopes of the landscape:

- 5 February 2019: one black falcon was observed foraging at RSA height at an average of 80 m AGL, 4 kms north-east of the Project Area at a control vantage point.
- 6 February 2019: a pair were observed circling at RSA height (at an average of 50 m AGL) on the western slopes of the Project Area, 800 m west of proposed turbine #84 before departing to the south.
- 8 February 2019: one bird was incidentally observed flying rapidly at 10 m AGL, 2 km west of the Project Area near the southern portions of the Project.

Black falcons were not recorded in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014).

Based on the broad habitat requirements, high mobility and wide-ranging distribution of this species, there is potential for this species to occur at any location within the Project Area. As with other raptors, the black falcon is likely to spend a high proportion of time at RSA height whilst flying within the Project Area.

4.3.1.3 Likelihood and Consequence of Impacts

The overall risk rating for black falcon is high, based on a high likelihood and moderate consequence of collisions (**Table 4.5**). The high likelihood of collisions is based on this species' flight behaviour though it is noted that given black falcon only occasionally occur in the Project Area the rate of collisions is likely to be relatively low. Rationale for responses to each criterion is as follows:

a) A high proportion of the black falcon's flight activity is at RSA height

b) The black falcon occasionally occurs in the Project Area.

c) The black falcon is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the black falcon overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Marchant and Higgins 1993).

e) In 2009, the national population of black falcon was estimated between 1,000 to 10,000 individuals, roughly equating to 670 – 6,700 mature individuals, although the data quality is reported as being poor (Birdlife International 2020). Hence, Criterion E is conservatively assigned 'high'.

f) The black falcon is listed as vulnerable in NSW under the BC Act.

The black falcon's risk rating of high largely reflects the potentially high consequence of low frequencies of blade strike in the Project Area.

Table 4.5 Black falcon risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X			
Moderate		X		X		X
High	X				X	
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

4.3.2 Little eagle

4.3.2.1 Information on little eagle from Australian wind farms

Moloney *et al.* (2019) reported one record of blade strike of little eagle from post-construction mortality monitoring of 15 wind farms in Victoria from 2003 to 2018. Smales (2014), reported two records of blade strike of little eagle from eight wind farms in south-eastern Australia (i.e. Victoria and South Australia). It is likely that these reports are referring to the same record of blade strike in Victoria.

4.3.2.2 Status and flight behaviour in the Project Area

Little eagle were recorded twice in the Project Area during surveys conducted in 2018/19 (**Figure 4.1**):

- 9 November 2018: one bird was observed foraging approximately 750 m north-east of proposed turbine #18 at 150 m AGL.
- 1 February 2019: one bird was observed flying east to west over the main ridge, at approximately 60 m AGL at proposed turbine #80.

Little eagles were not recorded in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014).

Based on the broad habitat requirements, high mobility and wide-ranging distribution of this species, there is potential for this species to occur at any location within the Project Area. As with other raptors, the little eagle is likely to spend a high proportion of time at RSA height whilst flying within the Project Area.

4.3.2.3 Likelihood and Consequence of Impacts

The overall risk rating for little eagle is high, based on a high likelihood and moderate consequence of collisions (**Table 4.6**). The high likelihood of collisions is based on this species' flight behaviour though it is

noted that given little eagle only occasionally occur in the Project Area the rate of collisions is likely to be relatively low. Rationale for responses to each criterion is as follows:

a) A high proportion of the little eagle's flight activity is at RSA height

b) The little eagle occasionally occurs in the Project Area.

c) The little eagle is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the little eagle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Marchant and Higgins 1993).

e) In 2009, the population of little eagle was estimated to number 10,000 to 100,000 individuals, based upon an estimate made by Ferguson and Christie (2001), although the data quality is listed as poor (Birdlife International 2020). Given the uncertainty of this estimate and the decline of little eagle in NSW (Barrett et al. 2007) and the ACT (Olsen and Fuentes 2005) Criterion E was assigned 'moderate' (based on the lower population estimate).

f) The little eagle is listed as vulnerable in NSW under the BC Act.

The little eagle's risk rating of high largely reflects the potentially high consequence of low frequencies of blade strike in the Project Area.

Table 4.6 Little eagle risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X			
Moderate		X		X	X	X
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

4.3.3 Wedge-tailed eagle

4.3.3.1 Information on wedge-tailed eagle from Australian wind farms

The wedge-tailed eagle is commonly reported during mortality monitoring events at wind farms in Australia. Moloney *et al.* (2019) report wedge-tailed eagle as the second most frequently recorded bird species found dead during monitoring from 2003 to 2018 across 15 wind farms in Victoria, with 58 carcasses detected and equating to 10% of all birds found. Using this data, Moloney *et al.* (2019) calculated mortality estimates of 0.06 (95% CI: 0.02 – 0.41) and 0.1 (95% CI: 0 - 0.2) individuals per turbine per year at two Victorian wind farms.

At two wind farms in north-western Tasmania, 18 wedge-tailed eagle carcasses were recorded during monitoring conducted for three and six years at Bluff Point Wind Farm and Studland Bay Wind Farm respectively (Hull *et al.* 2013). This particular monitoring program modelled a mortality estimate of 1.5 and 1.1 collisions per annum at Bluff Point (37 turbines) and Studland Bay (25 turbines). A 95% turbine avoidance rate closely approximated the observed mean annual mortality rate of 1.6 and 1.1 individuals per annum at each wind farm respectively (Smales *et al.* 2013).

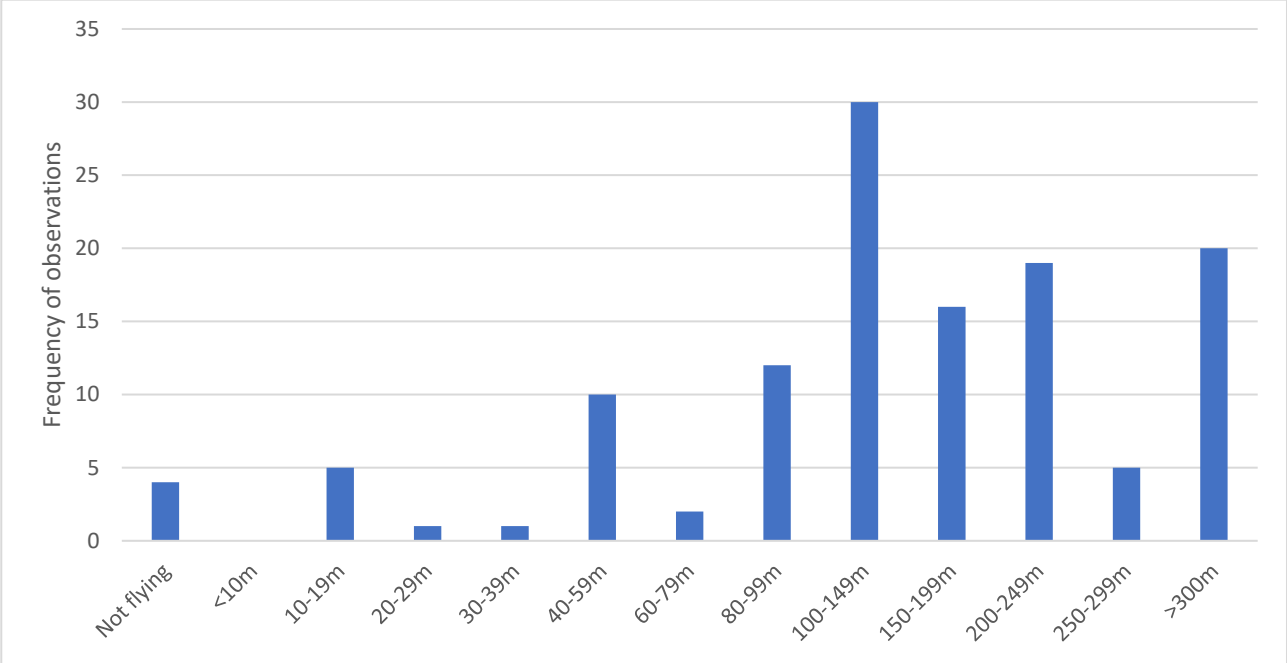
Wedge-tailed eagles are known to have collided with wind turbines in south-east NSW however the total number of fatalities detected in this region is not publicly available (BCD unpublished data). Six wedge-tailed eagle carcasses were recorded under turbines at Gullen Range Wind Farm during monthly monitoring of 30-32 (of 73 turbines) conducted from January – June 2015 (BLA, 2016).

4.3.3.2 Status and flight behaviour in the Project Area

Wedge-tailed eagle were observed throughout the Project Area and recorded on 125 occasions during the 2018/19 bird utilisation surveys (**Figure 4.2**). No nests were recorded in the Project Area during these surveys, though one active nest was recorded on the boundary of the Project Area 1.5 km south-east of proposed turbine #87. NGH (2014) recorded wedge-tailed eagle on 14 occasions in the Project Area during bird utilisation surveys conducted during 2011 - 2013. One inactive wedge-tailed eagle nest was recorded in the central section of the Project Area, resulting in proposed turbine #91 being removed from the layout and proposed turbine #92 being shifted south (NGH 2014).

A summary of wedge-tailed eagle observations made during the 2018/19 survey is presented below:

- 64% (80/125) of observations were of individuals, 29% (36/125) were of pairs, 6% (7/125) were of three birds and less than 2% (2/125) were of four birds.
- Wedge-tailed eagles were recorded in flight on 121 occasions:
    - Observed flights were almost exclusively of individuals or pairs soaring, displaying or circling above 40 m AGL (92% of observations) (Error! Reference source not found.).
    - 74% of flights (90/121) were recorded between 30 – 200 m.
- Of the vantage point sites surveyed during each season (five sites), wedge-tailed eagles were recorded during 60% (24/40) of surveys (Umwelt 2018 /19).



Graph 4.1 Frequency of wedge-tailed eagle observations in each height class.

Wedge-tailed eagle observations were distributed fairly consistently between the three 'impact' vantage points, lower at one 'control' site VPC03 and higher 'control' site VPC04 (**Table 4.7**). The higher number of observed wedge-tailed eagle at VPC04, may be attributed to landscape factors and the layout of elevated ridges surrounding the observer location. VPC03's position differed markedly in that it was positioned on a prominent high point along the dominant ridgeline of the Project Area and there were no other elevated areas (e.g. hills or ridges) within detection distance to the east or west.

Wedge-tailed eagle were regularly recorded regardless of wind speed at the three 'impact' vantage points although it is noted that no surveys were conducted in the early morning prior to thermals becoming active, meaning that very few surveys were conducted in still conditions (**Table 4.8**).

Table 4.7 Summary of wedge-tailed eagle observations at 'impact' and 'control' vantage survey points

	VPI01	VPI03	VPI04	VPC03	VPC04
Proportion of surveys detected	50% (4/8)	88% (7/8)	50% (4/8)	25% (2/8)	75%(6/8)
Number of individuals observed	13	14	12	6	24

Table 4.8 Summary of wedge-tailed eagle observations at vantage point surveys by recorded wind speed

	<11km/h	11-28km/h	29-38km/h	39-61km/h
Proportion of surveys detected	64% (7/11)	43% (6/14)	75% (9/12)	66% (2/3)
Number of individuals observed	20	14	24	11
Number of records / survey	1.8	1.0	2	3.7

4.3.3.3 Likelihood and Consequence of Impacts

The overall risk rating for wedge-tailed eagle is moderate, based on a high likelihood and low consequence of collisions (**Table 4.9**). The rationale for responses to each criterion is as follows:

a) A high proportion of the wedge-tailed eagle's flight activity is at RSA height.

b) The wedge-tailed eagle is a common resident in the Project Area.

c) The wedge-tailed eagle is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the wedge-tailed eagle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D however overall they average out between the two and hence Criterion D is assigned 'moderate' (Marchant and Higgins 1993).

e) The total population of wedge-tailed eagle is described as very large by Birdlife International (2020) and given this species very large distribution (c. 10.6 million km^2) the total population is likely to exceed 20,000 individuals.

f) The subspecies of wedge-tailed eagle that occurs in the Project Area is not listed as threatened under the EPBC Act or the BC Act.

The wedge-tailed eagle's risk rating of moderate reflects the moderate level of impact that a potentially high frequency of blade strike in the Project Area is likely to have on this species' total population.

Table 4.9 Wedge-tailed eagle risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

4.3.4 Superb parrot

4.3.4.1 Information on superb parrot from Australian wind farms

There are no records of blade strike of superb parrot in the available literature from Victoria (Moloney *et al.* 2019) which is unsurprising given the lack of wind farms in the superb parrot's range in north-eastern Victoria. There are no records of blade strike of superb parrot in the available data collected in south-eastern NSW to date (BCD unpublished data). In south-eastern NSW, there are three operational wind farms which may present a risk to superb parrot, namely Cullerin Range, Gunning and Gullen Range. These three wind farms are located at the current eastern edge of the superb parrot's range in the Southern Tablelands region.

Given the location of the Project and considering the construction of the Bango Wind Farm an increase in the risk of blade strike to superb parrot in south-eastern NSW is likely to result. Research to be conducted on the movement of superb parrots in the Yass region including at the under construction Bango Wind Farm is likely to improve understanding of the susceptibility of this species to blade strike and indirect

impacts resulting from the operation of turbines (Rayner 2019). Potential cumulative impacts on superb parrot from wind farms in this region are discussed in **Section 6.0**.

4.3.4.2 Status and flight behaviour in the Project Area

Superb parrots were frequently recorded in box-gum woodland in the lower-lying parts of the landscape immediately west of the Project Area during the 2011-13 surveys (NGH 2014) and the 2018/19 surveys. The species was observed in various locations in the Project Area during both the 2011/2013 and 2018/2019 survey periods. The majority of records during both surveys were concentrated in an area in the southern portion of the Project Area.

During 2011-2013, NGH (2014) documented regular superb parrot flights near proposed turbines #106, 107, 109 and 110 where an observer watched activity from a dedicated vantage point. In response to this finding, proposed turbines #106, 107, 109 and 110 were removed from the proposed layout. Additional records, including breeding pairs were detected to the north of proposed turbines #119, 120, 122, 124, 125 and 142. The majority of superb parrot records during 2018/2019 were also recorded within this area.

Superb parrots were recorded on 30 occasions during 2018/2019 bird surveys (**Figure 4.1**), with survey effort focussed immediately north (in the range of approximately 200 to 1000 m north) of proposed turbines #119, 120, 122, 124, 125 and 142. These six proposed turbines are likely to pose the highest risk to superb parrots in the Project Area. Active breeding was not detected during 2018/19, however, given surveys were generally restricted to a specific area in which transects designed to monitor movements were walked, breeding in nearby suitable habitat may have gone undetected.

Other notable records made during the 2018/2019 survey, include two records from the northern portion of the Project Area (all other records for the species in the Project Area during 2018/19 were from the southern areas) and one from control site VPC04 to the north-east of the Project Area. These records are detailed below:

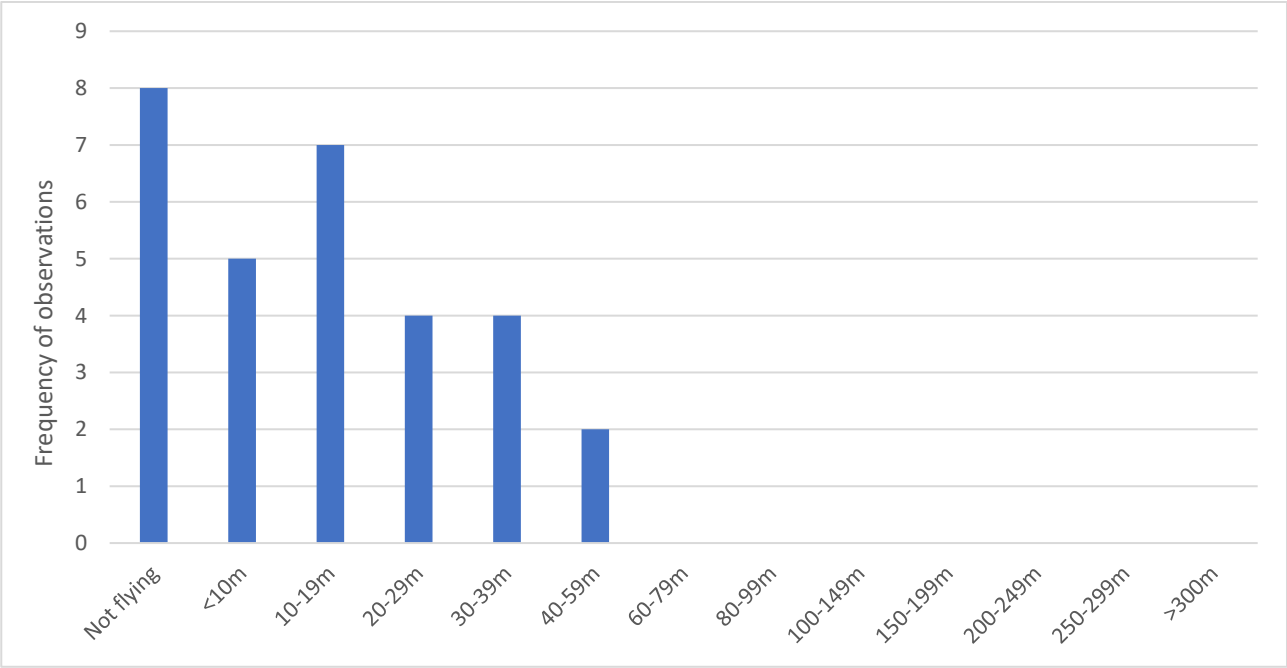
- 30 January 2019: three superb parrots were observed flying in a northerly direction at 15 m AGL in the north-eastern section of the Project Area 500 m east of proposed turbine #22 and 700 m west of proposed turbine #136.
- 30 January 2019: a group of five superb parrots were observed perched in the far northern section of the Project area, 600 metres west of proposed turbine #4.
- 30 January 2019: one individual was recorded at a ‘control’ vantage point north-east of the Project Area (VPC04) flying north-east at 40 m AGL.

Further to the above, ten incidental superb parrot observations (2018/19 surveys) were made in the vicinity of Dalton Road and Little Plains Road approximately 1-2.5 km west of the Project Area. These observations confirm similar records made NGH (2014) during 2011-2013 in this area.

Of the records made the 2018/19 surveys, superb parrots were observed in flight on 22 occasions (**Graph** 4.2). A summary of these observations is provided below:

- 18% (4/22) of flights were of individuals or flocks flying between 20-29m AGL, 18% (4/22) at 30-39m AGL and 9% (2/22) at 40-49m AGL whilst the remaining 55% (12/22) of flights were below 20 m AGL.
- In the southern section of the Project Area superb parrot were observed in flight on 14 occasions. 43% (6/14) of flights were below 20 m AGL, 29% (4/14) were at 20-29 m AGL, 21% (3/14) were at 30-39 m and one was at 40 m AGL.

Based on observations from elsewhere in their range it is expected that the observed maximum flight of 40 m AGL does not correspond with the maximum flight height of this species. Further, the true frequency of flights above 20 m AGL relative to the number of flights below 20 m AGL is likely to be higher than depicted in **Graph 4.2**.



Graph 4.2 Frequency of superb parrot observations in each height class

4.3.4.3 Likelihood and Consequence of Impacts

The overall risk rating for superb parrot is high, based on a high likelihood and moderate consequence of collisions (**Table 4.10**). Rationale for responses to each criterion is as follows:

a) The superb parrot regularly flies below RSA height and occasionally flies at RSA height

b) The superb parrot regularly occurs in the Project Area.

c) The superb parrot's range is relatively restricted and the extent of its habitat has been reduced substantially since European settlement. Superb parrot are known to congregate in areas of remaining habitat particularly in the south-eastern portion of their range during spring and summer. Furthermore, a large proportion of their total population occurs and moves through the region in which the Project Area is located.

d) The life-history characteristics of the superb parrot overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins 1999)

e) There are several estimates of total superb parrot population size. Higgins (1999) estimated that there were less than 5,000 breeding pairs, Garnett and Crowley (2000) estimated a total of 5000 adult birds, Baker-Gabb (2011) estimated a total of 5,000 to 8,000 individuals and Garnett et al. 2011 estimated there to be well over 10,000 individuals. Based on these population estimates Criterion E was assigned 'moderate'.

f) The superb parrot is listed as vulnerable under the EPBC Act and the BC Act.

Table 4.10 Superb parrot risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low						
Moderate	X		X	X	X	X
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

4.3.5 White-throated needletail

4.3.5.1 Information on white-throated needletail from Australian wind farms

The white-throated needletail is particularly vulnerable to blade strike (Hull *et al.* 2013). Five birds have been found during post-construction mortality monitoring conducted at 15 wind farms in Victoria from 2003 to 2018 (Moloney *et al.* 2019). There are 11 records of blade strike of white-throated needletail at both Bluff Point Wind Farm and at Studland Bay Wind Farm in north-west Tasmania (Hull *et al.* 2013). White-throated needletail are known to have collided with wind turbines in south-east NSW, with much of the data collected in this region being not publicly available (BCD unpublished data). Despite this, there are six records of deceased white-throated needletail at Capital Wind Farm from 2012/13 on the Atlas of Living Australia.

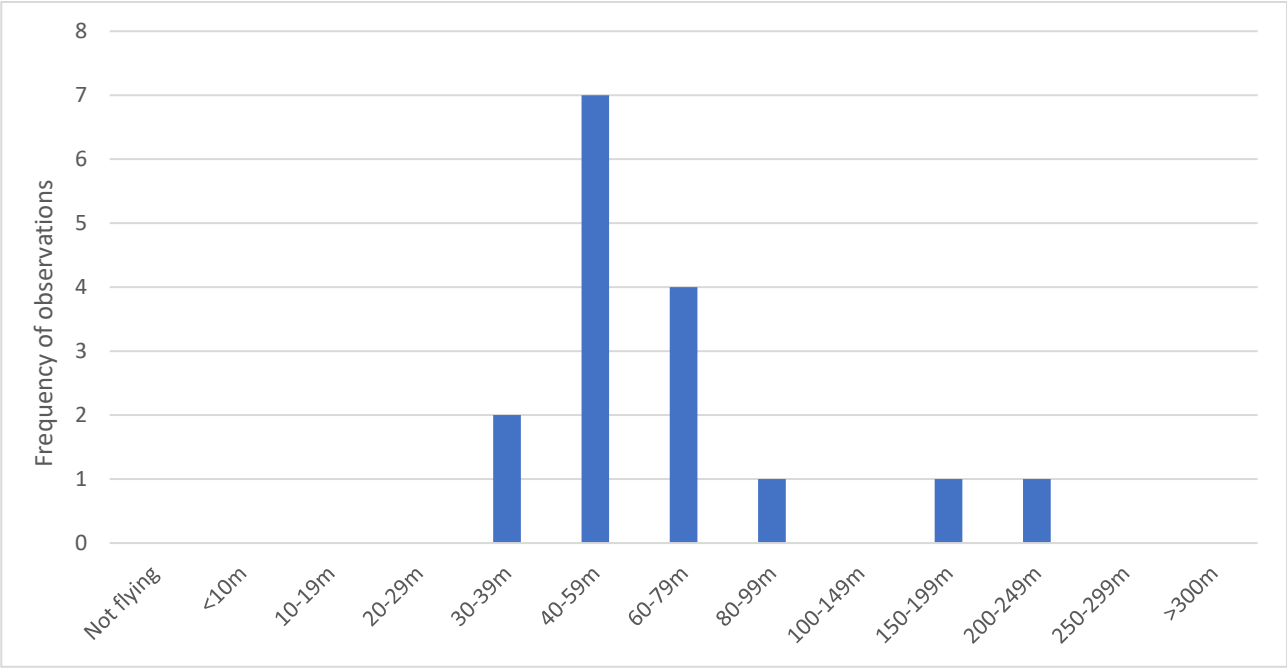
4.3.5.2 Status and flight behaviour in the Project Area

White-throated needletails were recorded on 16 occasions in the Project Area in February/March 2019 (**Figure 4.1**). These observations were not concentrated in any particular section of the Project Area, although the majority were instances of foraging above or moving through the higher sections of the Project Area (i.e. 700 m above sea level). White-throated needletail were not recorded in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014).

A summary of the white-throated needletail observations made within the Project Area is presented below:

- 4-6 February 2019: a flock of 24 individuals, 500 m west of proposed turbine #69 was observed circling at approximately 200 m AGL. There were a further seven observations during the next two days including an observation of 13 birds flying south at 60 m AGL near proposed turbine #120 in the southern section of the Project Area and 15 birds flying east at the same height above Grassy Creek Road in the northern section of the Project Area.
- 13 – 15 February 2019: six observations, including one of a flock of 55 individuals flying around proposed turbines #80 and #82 at RSA height.
- 14 February 2019: 41 individuals were observed flying directly along the ridge in a southerly direction at RSA height over a period of 15 minutes near three proposed turbines removed from the layout (#102, 103 and 104).
- 8 March 2019: Two observations comprising five and six individuals, observed at a control vantage point (VPC03) north of Blakney Creek South Road and between proposed turbines #83 and #143.

Each observation of white-throated needletails in the Project Area was of individuals or flocks flying at RSA height (**Graph 4.3**). The majority of observations were of birds flying between 40 - 80 m AGL with 83% (165/200) of observed individuals occurring within this height range. Although not recorded during the surveys, white-throated needletails would also forage below and above RSA in the Project Area.



Graph 4.3 Frequency of observations of white-throated needletail in each height class.

4.3.5.3 Likelihood and Consequence of Impacts

The overall risk rating for white-throated needletail is high, based on a high likelihood and moderate consequence of collisions (**Table 4.11**). The rationale for responses to each criterion is as follows:

a) A high proportion of the white-throated needletail's flight activity is at RSA height.

b) Based on the observations of this species in the Project Area, Criterion B could either be assigned 'moderate' or 'high' because this species could either be an occasional or a regular seasonal visitor in the Project Area each year. Regardless, because a rating of 'low' for Criterion B is not considered, the overall likelihood of collision is automatically deemed 'high' due to the 'high' rating assigned for Criterion A.

c) Although the white-throated needletail has a very large range it is noted that because a large proportion of this species' population may occur at specific preferred foraging areas or use particular migratory paths there is a high degree of variability in the likelihood of collisions between locations across its distribution in eastern Australia.

d) The location of the Project Area in the western section of its range in south-eastern NSW suggests that it is unlikely that a high proportion of this species' population occurs in the Project Area annually. However, observations from the Project Area indicate that the NNW-SSE aligned ridge running the length of the Project Area is potentially an important landscape feature in a regional context for white-throated needletail.

e) The life-history characteristics of the white-throated needletail overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins 1999).

f) The total population of white-throated needletail has not been estimated (Birdlife International 2020). The population size of the nominate subspecies that migrates to Australia is likely to comprise approximately 10,000 individuals (DoE 2015).

g) The white-throated needletail is listed as vulnerable and migratory under the EPBC Act.

Table 4.11 White-throated needletail risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low						
Moderate		X	X	X	X	X
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

4.3.6 White-fronted chat

4.3.6.1 Information on white-fronted chat from Australian wind farms

There are no published records of blade strike of white-fronted chats in the available literature in Victoria (Moloney *et al.* 2019), south-east New South Wales (BCD unpublished data) or in north-west Tasmania (Hull *et al.* 2013). This is despite having a wide distribution in southern Australia, a preference for open landscapes in which the majority of wind farms are situated and a tendency to occasionally fly above the typical minimum RSA height. Given the survey effort of post-construction monitoring to date, scavenger rates in open landscapes and the small size of this species amongst other factors it is plausible that instances of blade strike have gone undetected at Australian wind farms.

A review of literature identified that the species may actively avoid turbines, with an observation of turbine avoidance from Codrington Wind Farm in south-western Victoria. Meredith *et al.* (2002) reported a 100% turbine avoidance rate for the species at this location. However, given that the context of the situation in which this observation was made is unknown (i.e. the survey effort, number of observed flights, habitat type and all other relevant factors are unspecified) little can be drawn from this observation other than the conclusion that white-fronted chat do indeed avoid turbines (though the question of the rate at which they do remains unanswered).

4.3.6.2 Status and Flight Behaviour in the Project Area

White-fronted chats were regularly recorded in the northern half of the Project Area during bird utilisation surveys conducted in 2018/19, from four distinct areas of occupancy (**Figure 4.1**). These areas supported suitable habitat for the species, being open areas containing isolated patches of low bracken. Across all surveys conducted during 2018/2019, white-fronted chats were recorded on 86 occasions, occurring in flocks of up to 28 individuals. 90% of observations were recorded in the particular areas highlighted in **Figure 4.1**, including one record of an active nest.

White-fronted chats were recorded on four occasions in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014).

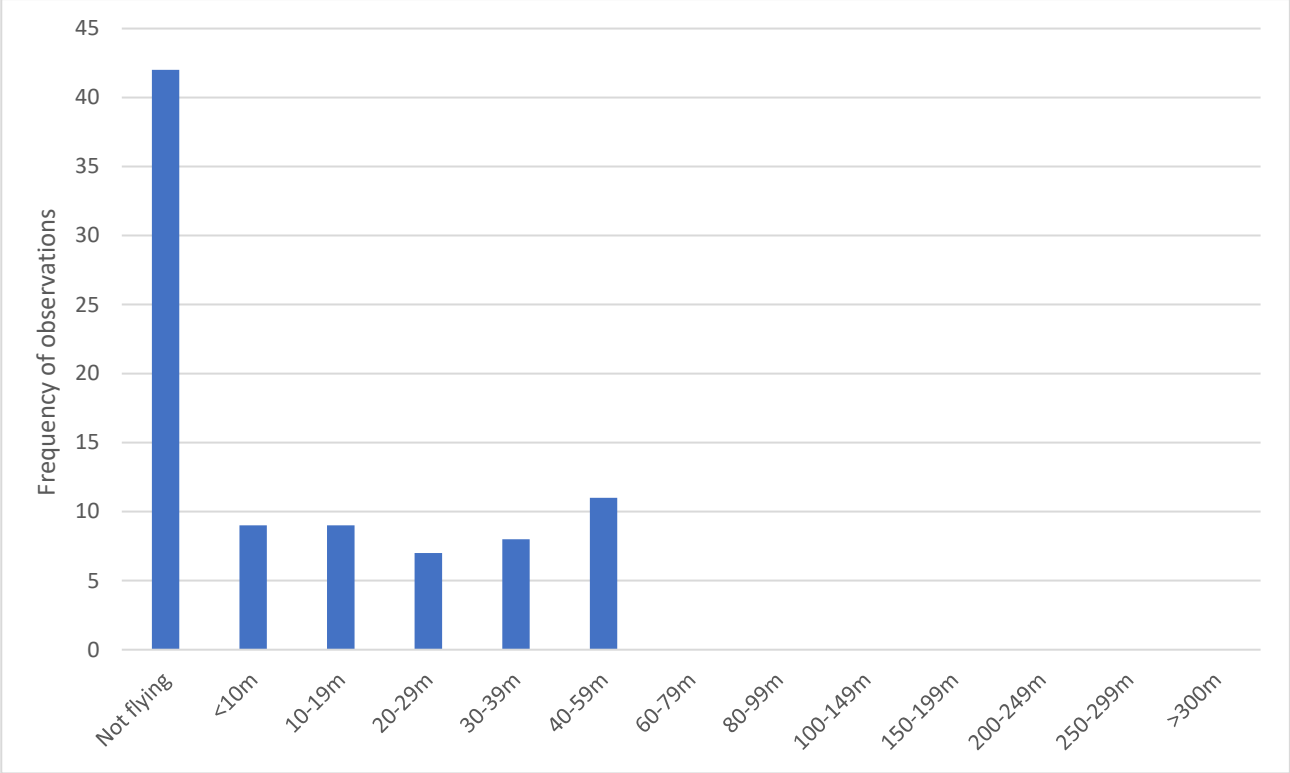
Based on the extent of occupied habitat and the proportion of potential habitat surveyed it is likely that white-fronted chats most frequently occur at 25 proposed turbine locations in the Project Area (**Figure 4.1, Table 4.12**). Movement between the four areas of occupancy is considered likely, given the relatively short

distances and absence of barriers. For this reason, the occurrence of white-fronted chat is unlikely to be restricted to these 25 identified proposed turbine locations alone, although abundance and flight records appear to be greatest in such areas throughout the 2018/19 surveys.

Table 4.12 Proposed turbines located within likely white-fronted chat area of occupancy

Area	Turbines
North-western area	1, 2, 3, 4, 5, 7, 9, 151
North-eastern area	18, 21, 22, 25, 26, 30, 31, 36, 39, 135, 136, 137, 138
High Rock Rd property	73, 74,
Flakney Creek Rd area	82, 83

Whilst white-fronted chats tended to spend a considerable amount of time foraging on the ground or perched on low shrubs or fences (49% of observations), the species was also regularly recorded flying at or above 30 m AGL in the Project Area (**Graph 4.4**). On eight occasions (18% of observed flights), individuals or flocks were recorded flying at between 30-39 m AGL and on 11 occasions (25% of observed flights), they were recorded between 40-59 m AGL. Observed flights at RSA height were typically undertaken by individuals, pairs or larger groups across a distance of several hundred metres at a time. Of the observed flights at and above 40 m AGL three were of a single bird, six were of pairs and the remaining two comprised flocks of 10 and 16 individuals.



Graph 4.4 Frequency of observations of white-fronted chat in each height class.

4.3.6.3 Likelihood and Consequence of Impacts

The overall risk rating for white-fronted chat is moderate, based on a high likelihood and low consequence of collisions (**Table 4.13**). The rationale for responses to each criterion is as follows:

a) The white-fronted chat regularly flies below RSA height and occasionally flies at RSA height.

b) The white-fronted chat is a resident in the Project Area and frequently occurs in areas where turbines are proposed.

c) The white-fronted chat is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The white-fronted chat is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins et al. 2001).

e) There are no estimates of the total population of white-fronted chat (Birdlife International 2020) however given their large area of occupancy its population is likely to exceed 20,000 individuals.

f) The white-fronted chat is listed as vulnerable in NSW under the BC Act.

Table 4.13 White-fronted chat risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X	X	X	
Moderate	X					X
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

4.3.7 Brown treecreeper

4.3.7.1 Information on brown treecreeper from Australian wind farms

There are no published records of blade strike of brown treecreepers in the available literature in Victoria (Moloney *et al.* 2019) or south-east New South Wales (BCD unpublished data), though it is noted that the majority of wind farms monitored in Victoria are on the south-western edge or outside of this species' distribution.

4.3.7.2 Status and flight behaviour in the Project Area

Brown treecreepers were not recorded in the Project Area in 2018/19 despite extensive surveys across suitable habitat. Brown treecreeper were recorded on six occasions in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014). All observations were of birds near proposed turbines #102, 103 and 104 (which have since been removed from the layout). Each observation was of birds below 20 m AGL (NGH 2014).

4.3.7.3 Likelihood and Consequence of Impacts

The overall risk rating for brown treecreepers is minor, based on a low likelihood and moderate consequence of collisions (Table 4.14). The rationale for responses to each criterion is as follows:

a) Based on observations from the Project Area and knowledge of this species' flight behaviour from elsewhere, the brown treecreeper is unlikely to fly at RSA height in the Project Area.

b) The surveys conducted in 2011-2013 and 2018/19 indicate that the brown treecreeper is currently an uncommon/rare visitor or resident in the Project Area. This species has declined considerably in the greater region during the past three decades (Reid 1999, Trail and Duncan 2000, COG 2020) to the point that certain sites that were formerly occupied are now irregularly visited or no longer support brown treecreeper (e.g. as documented in parts of the ACT) (COG 2020).

c) The brown treecreeper is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The brown treecreeper is not long-lived and has relatively high fecundity, though appears to have a limited capacity to replace individuals lost in certain fragmented landscapes such as the region in which the Project Area is located (Higgins et al. 2001).

e) The population size of the brown treecreeper is unknown (Birdlife International 2020), though it is likely to exceed 20,000 individuals based on the size of its distribution in eastern Australia (c. 3.3 million km^2). Due to the estimated extent of occurrence of the south-eastern subspecies (*C. p melanotus*) of approximately 600,000 km2 (Garnett et al. 2011) and its decline Criterion E is conservatively assigned 'moderate' because the population of this subspecies may number between 5,000 and 20,000 individuals.

f) The brown treecreeper is listed as vulnerable in NSW under the BC Act.

Table 4.14 Brown treecreeper risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X	X	X			
Moderate				X	X	X
High						
Risk Rating						
Likelihood	Low	**Consequence**	Moderate	**Risk Rating**	Minor	

4.3.8 Varied sittella

4.3.8.1 Information on varied sittella from Australian wind farms

There are no published records of blade strike of varied sittellas in the available literature in Victoria (Moloney *et al.* 2019) or south-east New South Wales (BCD unpublished data).

4.3.8.2 Status and flight behaviour in the Project Area

Varied sittellas were observed on eight occasions in the Project Area in 2018/19 (**Figure 4.1**) comprising three records in the far southern section of the Project Area, four records in the central section and one in the northern section. Of these eight observations, two were at proposed turbines #80 and 150 in the central section of the Project Area. Observations were not concentrated in any particular area of the Project Area. Varied sittella may occur in any area of woodland (including open woodland supporting scattered paddock trees) or dry forest in the Project Area.

All observations during 2018/19 were of groups foraging or moving between paddock trees at or below canopy height. A total of 1/6 (17%) flight observations were of birds flying at 10 m AGL, 2/6 (33%) at 15 m AGL and 3/6 (50%) at 20 m AGL. Varied sittellas were recorded on four occasions between 0 – 20 m AGL in the Project Area during bird utilisation surveys conducted during 2011-2013 (NGH 2014).

4.3.8.3 Likelihood and Consequence of Impacts

The overall risk rating for varied sittella is minor, based on a moderate likelihood and low consequence of collisions (Table 4.15). The rationale for responses to each criterion is as follows:

a) Based on observations from the Project Area and knowledge of this species' flight behaviour from elsewhere varied sittella are likely to rarely fly at RSA height in the Project Area.

b) The varied sittella is a resident in the Project Area.

c) The varied sittella is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The varied sittella is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins and Peter 2002).

e) The total population of varied sittella is unknown (Birdlife International 2020) though it is likely to exceed 20,000 individuals given its very large distribution across the Australian mainland (c. 9.2 million km2) (Birdlife International 2020).

f) The varied sittella is listed as vulnerable in NSW under the BC Act.

Table 4.15 Varied sittella risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X		X	X	X	
Moderate						X
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Low	**Risk Rating**	Minor	

4.3.9 Painted honeyeater

4.3.9.1 Information on painted honeyeater from Australian wind farms

There are no published records of blade strike of painted honeyeaters in the available literature in Victoria (Moloney *et al.* 2019) or south-east New South Wales (BCD unpublished data). The majority of wind farms monitored in Victoria are on the south-western edge or outside of this species' distribution.

4.3.9.2 Status and flight behaviour in the Project Area

Painted honeyeaters were not recorded in the Project Area in 2018/19 despite extensive surveys in suitable habitat. Painted honeyeaters were recorded on seven occasions in the Project Area during bird utilisation surveys conducted during November 2013 (NGH 2014). Six of these observations were of birds in flowering mistletoe in an area of box-gum woodland in the southern section of the Project Area, west of four proposed turbines (#106, 107, 109 and 110) that have since been removed from the layout. It was estimated that 10-12 individuals were present in this particular area during November 2013 (NGH 2014). The southernmost record is approximately 800 m north of proposed turbine #120. The other observation during November 2013 was from an area of box-gum woodland in the central section of the Project Area approximately 800 m north-west of proposed turbine #143. Flight data was only recorded for two observations. Both flight records were of individuals below 10 m AGL (NGH 2014).

4.3.9.3 Likelihood and Consequence of Impacts

The overall risk rating for painted honeyeater is moderate, based on a moderate likelihood and moderate consequence of collisions (Table 4.16).The rationale for responses to each criterion is as follows:

a) Based on observations from the Project Area and knowledge of this species' flight behaviour from elsewhere, painted honeyeaters are likely to regularly fly below and occasionally fly at RSA height in the Project Area.

b) The painted honeyeater is an uncommon/rare visitor, most likely to occur during spring and summer when mistletoe is flowering in the Project Area.

c) The painted honeyeater is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The painted honeyeater is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins et al. 2001).

e) Garnett et al. (2011) estimated a declining population of between 2,500 and 10,000 mature individuals, roughly equivalent to 3,750 - 15,000 individuals in total. Taking a precautionary approach, the lower estimate has been accepted and Criterion E is assigned 'high'.

f) The painted honeyeater is listed as vulnerable under the EPBC Act and the BC Act.

Table 4.16 Painted honeyeater risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low		X	X	X		
Moderate	X					X
High					X	
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

4.3.10 Dusky woodswallow

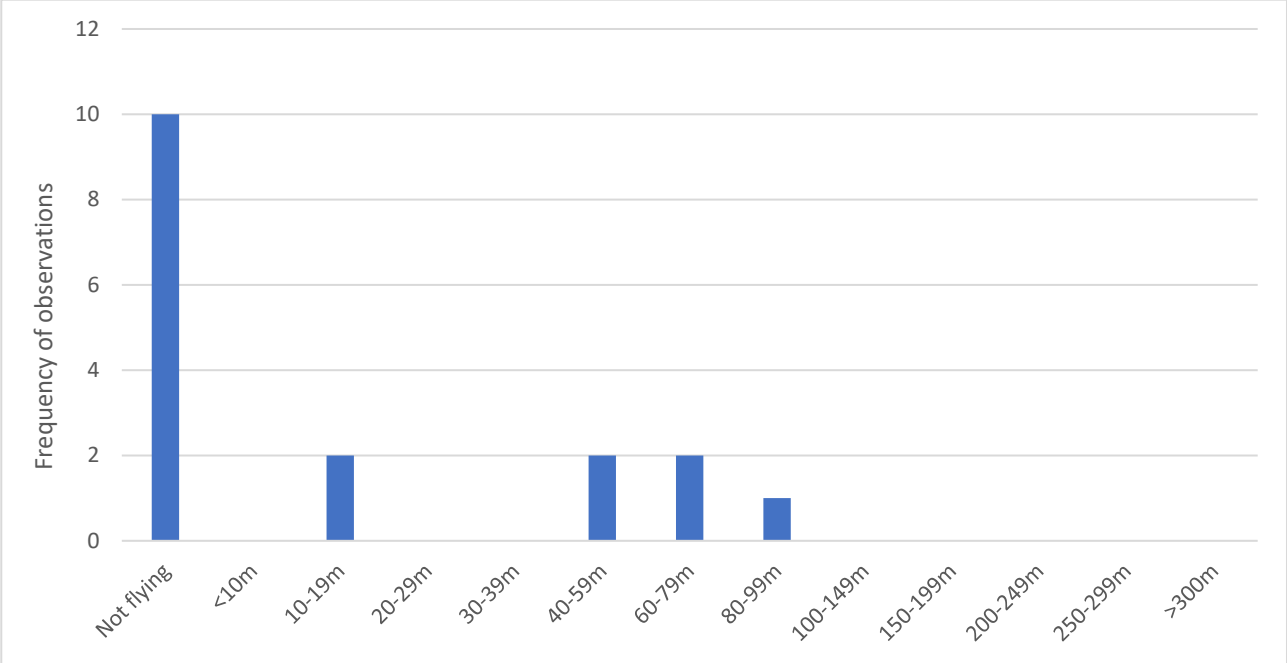
4.3.10.1 Information on dusky woodswallow from Australian wind farms

Moloney *et al.* (2019) reported one record of blade strike of dusky woodswallows at Victorian wind farms from post-construction mortality monitoring from 2003 to 2018. Smales (2014) also reported one record of blade strike from a total of eight wind farms in south-eastern Australia (i.e. Victoria and South Australia). It is likely that these reports are referring to the same record.

4.3.10.2 Status and flight behaviour in the Project Area

Dusky woodswallows were recorded on 17 occasions in the Project Area in 2018/19 (**Figure 4.1**). These observations were not concentrated in any particular section of the Project Area although dusky woodswallows were more frequently seen at a vantage survey point (VPI04) at proposed turbine #31 than at any other vantage point of transect. Dusky woodswallows were recorded on three occasions in the Project Area during bird utilisation surveys conducted during 2011 - 2013 (NGH 2014).

Of all observations in 2018/2019, 58% (10/17) were of dusky woodswallows perched, whilst 71% (5/7) of flight records comprised flocks or individuals foraging at RSA height between 40-100 m AGL (**Graph 4.5**).



Graph 4.5 Frequency of observations of dusky woodswallow in each height class.

4.3.10.3 Likelihood and Consequence of Impacts

The overall risk rating for dusky woodswallow is moderate, based on a high likelihood and low consequence of collisions (**Table 4.17**). The rationale for responses to each criterion is as follows:

a) A high proportion of the dusky woodswallow's flight activity is at RSA height.

b) The dusky woodswallow regularly occurs in the Project Area.

c) The dusky woodswallow is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The dusky woodswallow is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins et al. 2006).

e) The total population of the dusky woodswallow is unknown (Birdlife International 2020) though it is likely to exceed 20,000 individuals.

f) The dusky woodswallow is listed as vulnerable in NSW under the BC Act.

Table 4.17 Dusky woodswallow risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X	X	X	
Moderate						X
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

4.3.11 Large bent-winged bat

4.3.11.1 Information on large bent-winged bat from Australian wind farms

There are no published records of blade strike of large bent-winged bats in the available literature in Victoria (Moloney *et al.* 2019) or south-east New South Wales (BCD unpublished data). The majority of wind farms monitored to date in Victoria are located outside of this species' distribution. There are eight published records of blade strike of the closely related southern bent-winged bat in the available literature in Victoria (Moloney *et al.* 2019). A mortality model for southern bent-winged bat generated a mortality rate estimate of 0.1 individuals per turbine per year (95% CI 0-0.5) for one particular wind farm (Moloney *et al.* 2019).

Large bent-winged bats are known to have collided with wind turbines in south-east NSW however data collected in this region is not publicly available (BCD unpublished data).

4.3.11.2 Status and flight behaviour in the Project Area

Three confirmed large bent-winged bat calls were recorded during the 2018/19 survey. Each of these records were from ground level, 250 m south-west of proposed turbine #124 (**Figure 4.3**). During the November 2011 and April 2012, 41 large bent-winged bats were recorded in the Project Area (NGH 2014). The majority of these calls were from the central section of the Project Area between proposed turbines #80 and #143 (NGH 2014). The species was also recorded in the southern section of the Project Area near the removed turbines #104 and 105 and in the northern section of the Project Area near proposed turbines #9 and #25.

As very few confident large bent-winged bat identifications were made from the data collected in 2018/19, unresolved calls that may have been from large bent-winged bats were pooled to create a "possible large bent-winged bat" dataset (**Appendix E1**). This allowed for the comparison of data within and outside the bent-winged bat migration period.

A total of 1107 sample nights were included in the analyses from 30 different sites. Overall, there was no spike in activity during the autumn migration season. The data suggest that whilst the Project Area is located within an area that large bent-winged bats migrate through (Dwyer 1969) there is no evidence that a highly utilised autumn migratory path intersects the Project Area.

4.3.11.3 Likelihood and Consequence of Impacts

The overall risk rating for large bent-winged bat is high, based on a high likelihood and moderate consequence of collisions (**Table 4.18**). The rationale for responses to each criterion is as follows:

a) Based on available data large bent-winged bats are likely to occasionally fly at RSA height in the Project Area.

b) The number of large bent-winged bat records in 2011-2013 and in 2019, indicate that this species either occasionally or regularly occurs in the Project Area. Criterion B is conservatively assigned 'high' here.

c) Large bent-winged bats congregate in large numbers at a few caves in the region the nearest being a maternity cave located at Wee Jasper approximately 45 kilometres south-west of the Project Area. There was no spike in activity of confirmed or potential large bent-winged bat calls during the migration period in autumn 2019. Hence, Criterion C is assigned 'moderate'.

d) The life-history characteristics of the large bent-winged bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

e) It is likely that the total population of large bent-winged bats is over 20,000 individuals (Churchill 1998, Pennay *et al.* 2011).

f) The large bent-winged bat is listed as vulnerable in NSW under the BC Act.

Table 4.18 Large bent-winged bat risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low					X	
Moderate	X		X	X		X
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

4.3.12 Yellow-bellied sheathtail bat

4.3.12.1 Information on yellow-bellied sheathtail bat from Australian wind farms

There are no published records of blade strike of yellow-bellied sheathtail bats in the available literature from post-construction monitoring conducted in its range in south-eastern Australia (BCD unpublished data, Moloney *et al.* 2019).

4.3.12.2 Status and flight behaviour in the Project Area

The yellow-bellied sheathtail bat was recorded in the Project Area during both the 2011-2013 and 2018/2019 survey events.

Calls for yellow-bellied sheathtail bats were recorded during the 2018/19 surveys, with 14 calls recorded from five locations (**Figure 4.3**). Seven calls were detected from ground level in wooded habitat approximately 1.3 km north of proposed turbine #145. One call from ground level and two calls at 45 m AGL were also recorded at proposed turbine #31. Single calls were recorded from ground level and at 45 m AGL near proposed turbine #80. Single calls were also recorded from ground level near proposed turbine #69 and from ground level near proposed turbine #2.

During the 2011-2013 survey, four yellow-bellied sheathtail bat calls were recorded at one location near proposed turbine #80. NGH (2014) considered this species to be an occasional seasonal visitor in the Project Area.

4.3.12.3 Likelihood and Consequence of Impacts

The overall risk rating for yellow-bellied sheathtail bat is moderate, based on a moderate likelihood and moderate consequence of collisions (**Table 4.19**). The rationale for responses to each criterion is as follows:

a) The yellow-bellied sheathtail bat is likely to regularly fly below RSA height and occasionally fly at RSA height.

b) The yellow-bellied sheathtail bat is likely to occasionally occur in or move through the Project Area. NGH (2014) considered this species to be an occasional seasonal visitor in the Project Area. The data collected during the 2018/19 survey support this.

c) The yellow-bellied sheathtail bat is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the yellow-bellied sheathtail bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

e) Very little is known about the ecology of the yellow-bellied sheathtail bat though given its very large distribution (Churchill 2008) its population is likely to exceed 5,000 individuals and may possibly be over 20,000. Given the migratory nature of individuals that occur in south-eastern Australia coupled with the lack of any population estimates Criterion E is conservatively assigned 'moderate'.

f) The yellow-bellied sheathtail bat is listed as vulnerable in NSW under the BC Act.

Table 4.19 Yellow-bellied sheathtail bat risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X			
Moderate	X	X		X	X	X
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

4.3.13 Southern myotis

4.3.13.1 Information on southern myotis from Australian wind farms

There are no records of blade strike of southern myotis in the available literature from post-construction monitoring conducted in its range in south-eastern Australia (BCD unpublished data, Moloney *et al.* 2019).

4.3.13.2 Status and flight behaviour in the Project Area

One southern myotis call was recorded in the Project Area during the 2018/19 bat surveys from ground level near proposed turbine #18 on 12 November 2018. NGH (2014) considered the likelihood of occurrence of this species in the Project Area unlikely.

4.3.13.3 Likelihood and Consequence of Impacts

The overall risk rating for southern myotis is minor, based on a low likelihood and moderate consequence of collisions (**Table 4.20**). The rationale for responses to each criterion is as follows:

a) The southern myotis is likely to rarely fly at RSA height.

b) The southern myotis is likely to rarely occur in the Project Area due to the Project Area's location relative to this species' known range in the region coupled with the vegetation present and the number of records from bat surveys conducted in the Project Area to date.

c) The southern myotis is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the southern myotis overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

e) The southern myotis has a large distribution in northern and eastern Australia where it is generally uncommon (Churchill 2008). Given the lack of any population estimates Criterion E is conservatively assigned 'moderate'.

f) The southern myotis is listed as vulnerable in NSW under the BC Act.

Table 4.20 Southern myotis risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X	X	X			
Moderate				X	X	X
High						
Risk Rating						
Likelihood	Low	**Consequence**	Moderate	**Risk Rating**	Minor	

4.3.14 Eastern false pipistrelle

4.3.14.1 Information on eastern false pipistrelle from Australian wind farms

There are 28 records of dead eastern false pipistrelles found at Victorian wind farms during post-construction mortality monitoring from 2003 to 2018 (Moloney *et al.* 2019). Moloney *et al.* 2019 calculated mortality estimates of 1.6 (95% CI: 0.6 – 2.9) individuals per turbine per year at one wind farm.

4.3.14.2 Status and flight behaviour in the Project Area

The eastern false pipistrelle was recorded once in the Project Area during the 2018/19 bat surveys, from ground level near proposed turbine #69 (**Figure 4.3**). Four eastern false pipistrelle calls have previously been recorded at one location near proposed turbine #80 (NGH 2014). This relatively low number of detections is probably a result of the Project Area's location corresponding to the western edge of the eastern false pipistrelle's known range in the region.

4.3.14.3 Likelihood and Consequence of Impacts

The overall risk rating for eastern false pipistrelles is moderate, based on a moderate likelihood and moderate consequence of collisions (**Table 4.21**). The rationale for responses to each criterion is as follows:

a) The eastern false pipistrelle likely regularly flies below RSA height and occasionally flies at RSA height.

b) The eastern false pipistrelle is considered to rarely or occasionally occur in the Project Area due to the Project Area's location relative to this species' known range in the region coupled with the vegetation present in the Project Area and the low number of records from bat surveys conducted in the Project Area to date.

c) The eastern false pipistrelle is widely distributed within areas of suitable habitat across its range and the habitat itself is relatively widely dispersed.

d) The life-history characteristics of the eastern false pipistrelle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D

e) Given the lack of any population estimates for eastern false pipistrelles Criterion E is conservatively assigned 'moderate'.

f) The eastern false pipistrelle is listed as vulnerable in NSW under the BC Act.

Table 4.21 Eastern false pipistrelle risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X			
Moderate	X	X		X	X	X
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

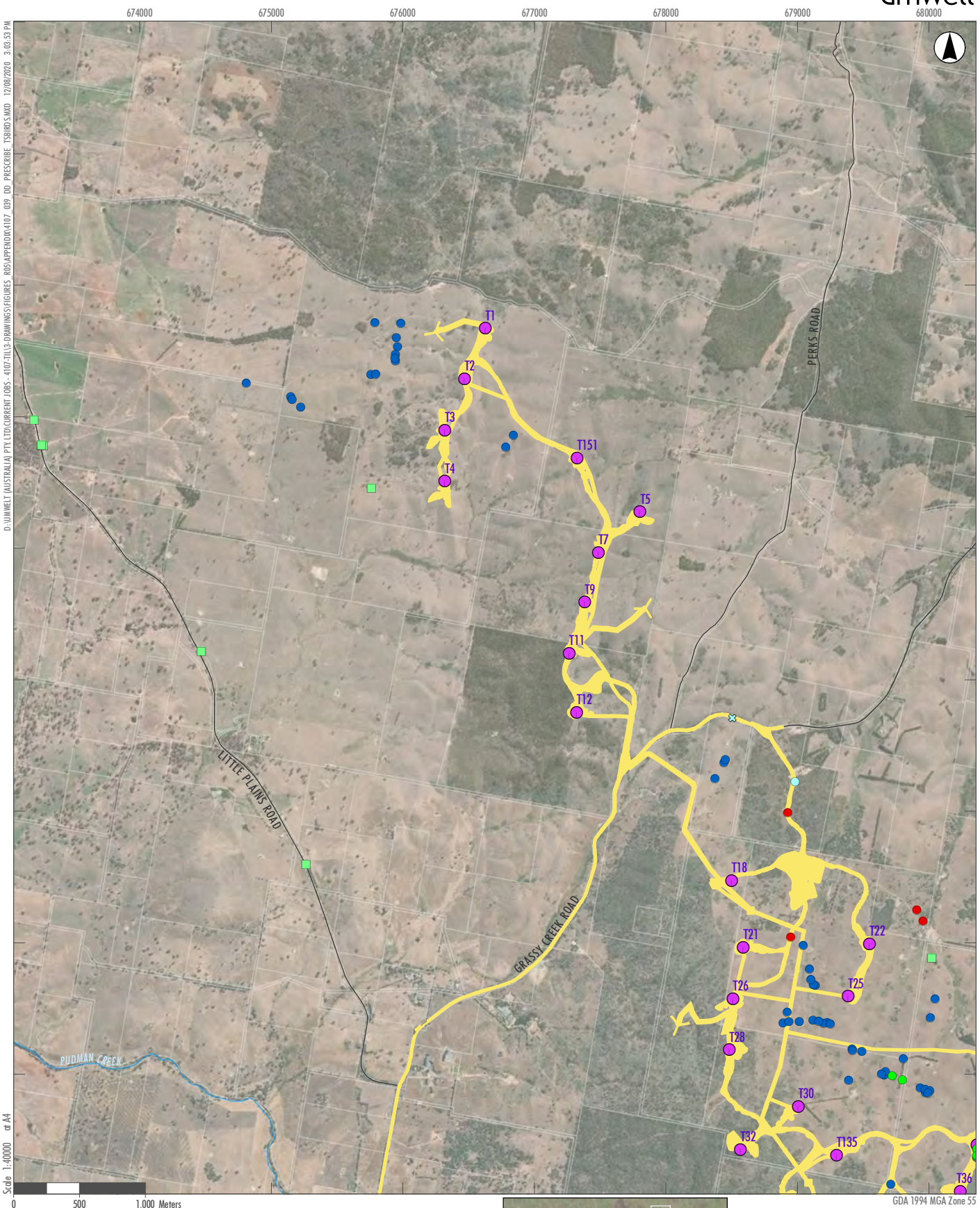


FIGURE 4.1.1

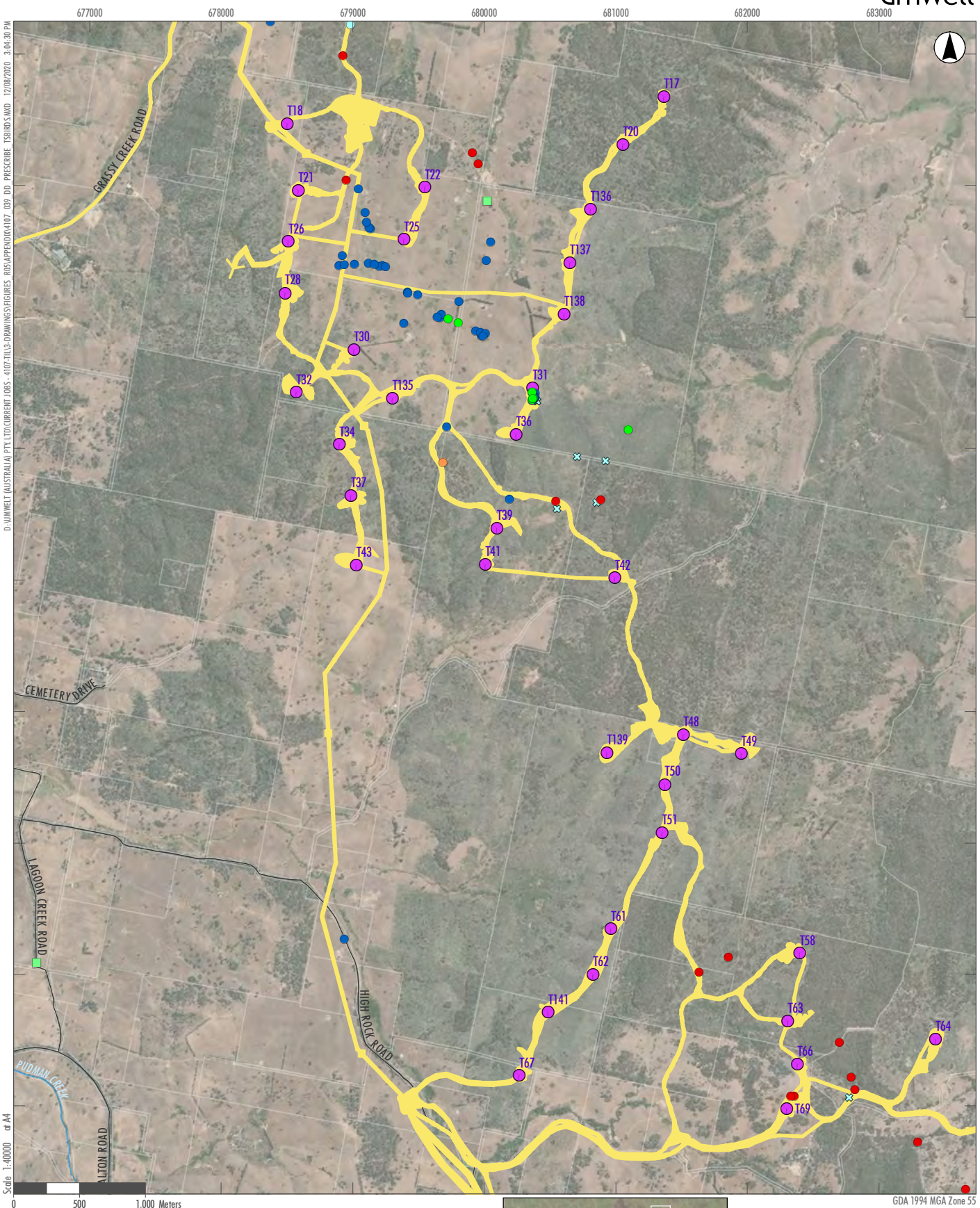
Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

FIGURE 4.1.2

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

EPBC Act Species

- White-throated Needletail

NSW BC Act and EPBC Act Species

- Superb Parrot

NSW BC Act Species

- Dusky Woodswallow
- Varied Sittella
- Black Falcon
- Little Eagle
- Hooded Robin
- Scarlet Robin
- Flame Robin
- Speckled Warbler
- White-fronted Chat

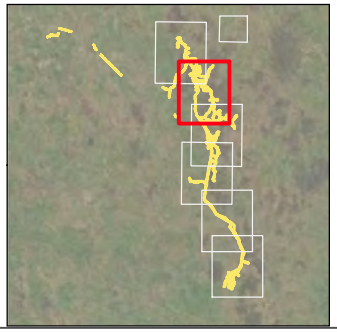


FIGURE 4.1.3

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

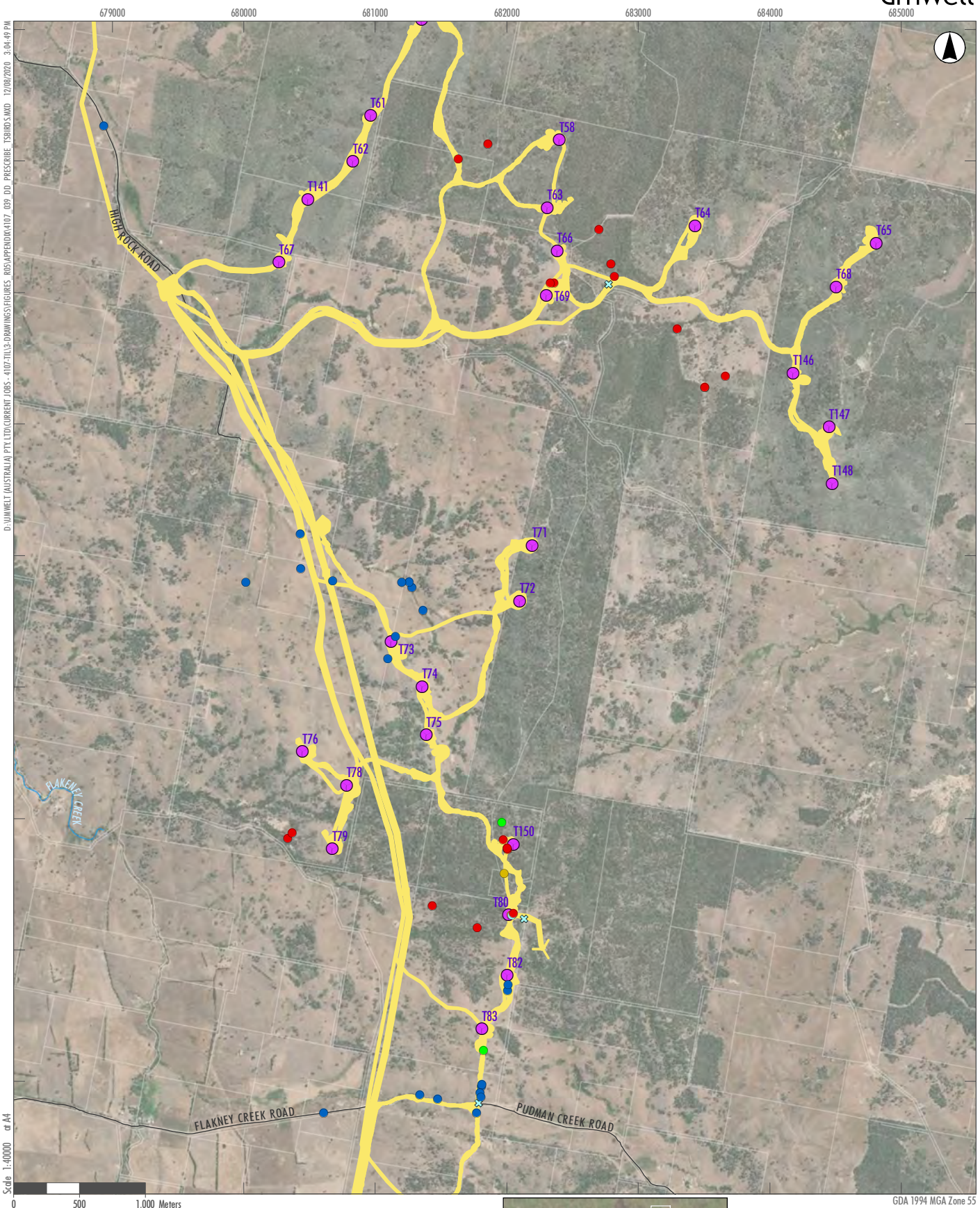


FIGURE 4.1.4

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

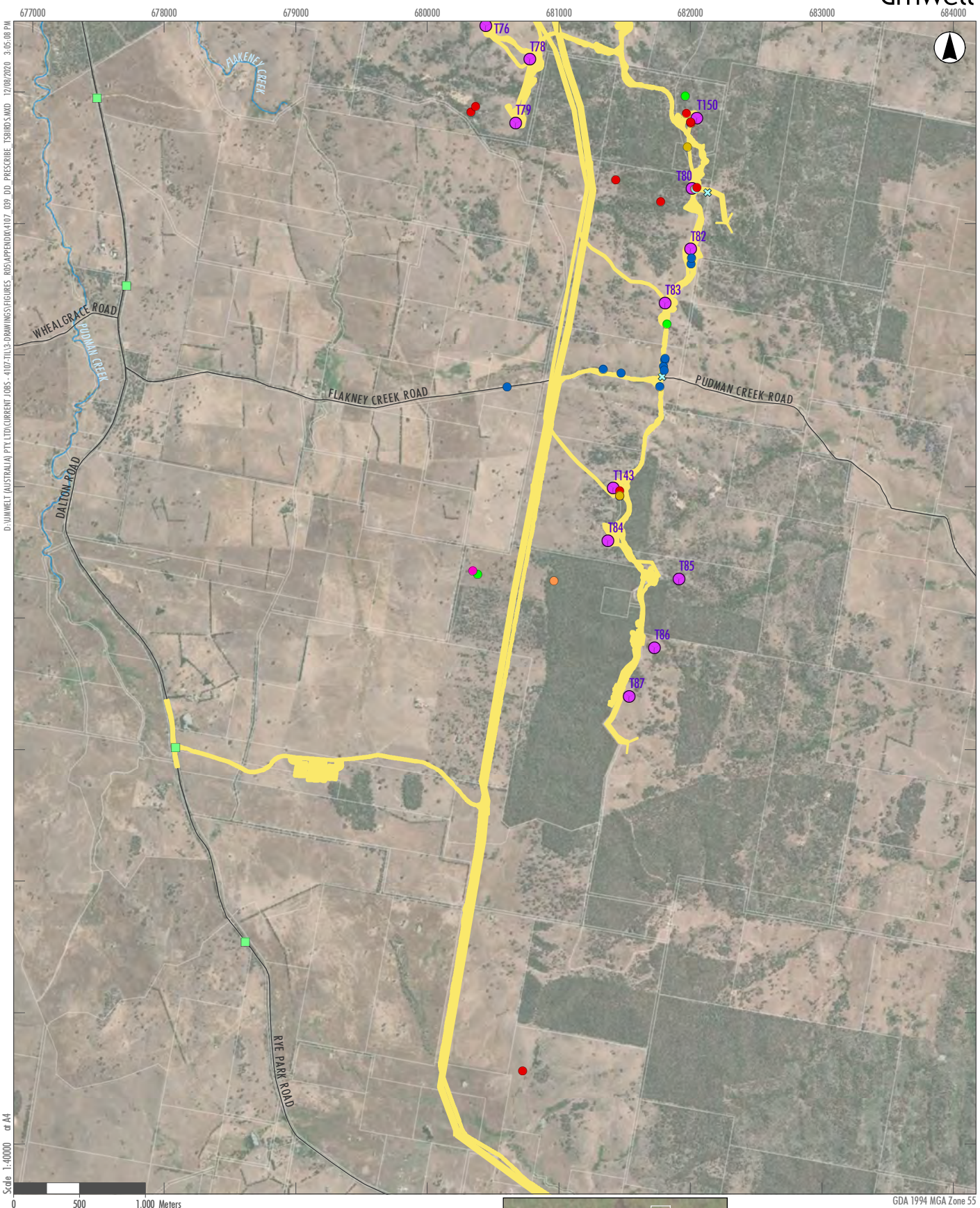
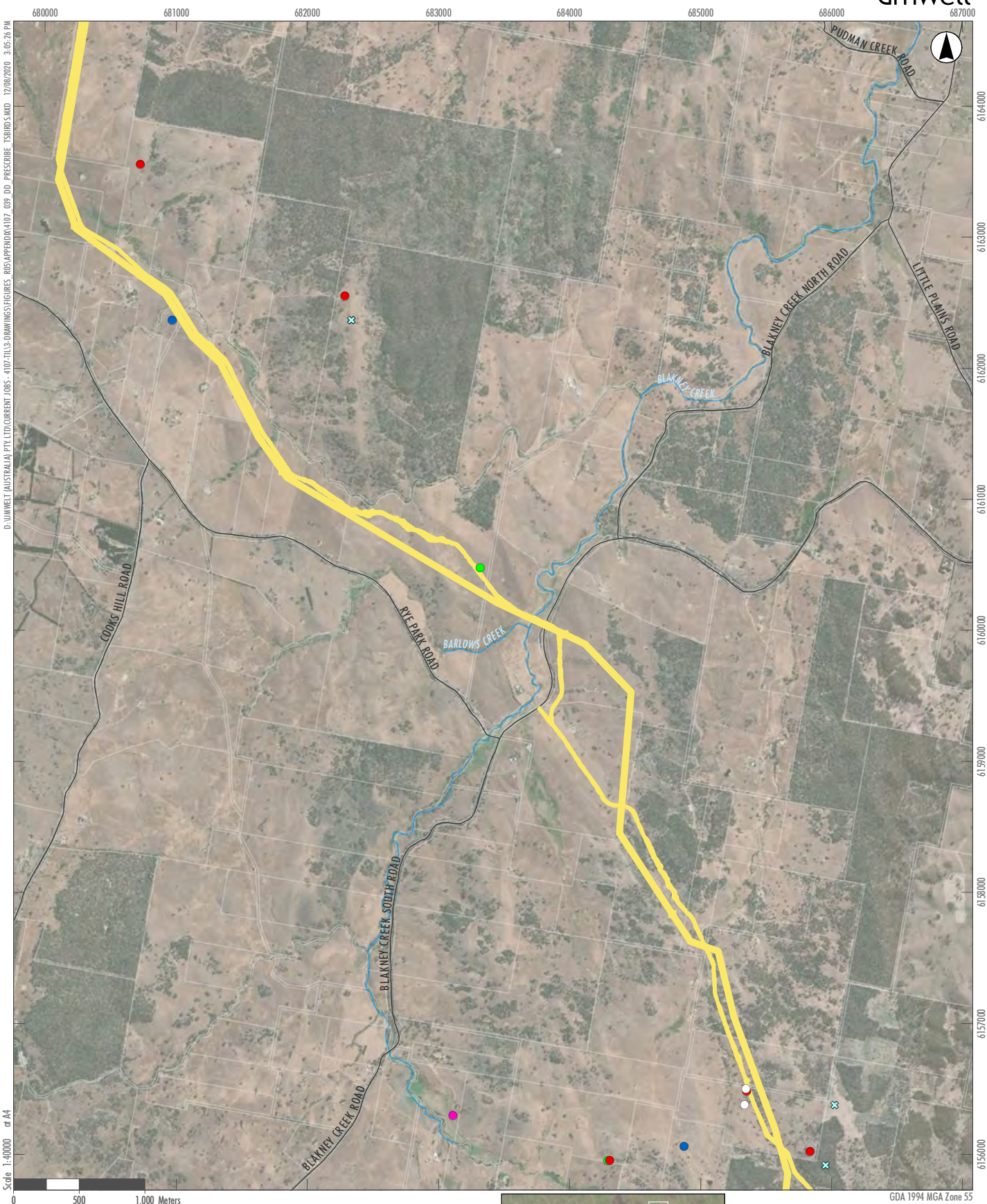


FIGURE 4.1.5

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

EPBC Act Species

- White-throated Needletail

NSW BC Act Species

- Dusky Woodswallow
- Varied Sittella
- Black Falcon
- Little Eagle
- Hooded Robin
- Scarlet Robin
- Flame Robin
- Speckled Warbler
- White-fronted Chat

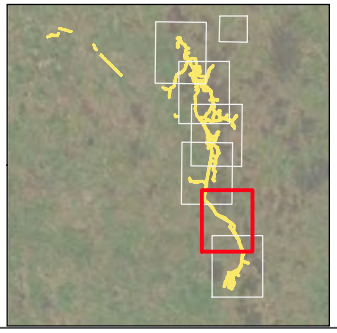
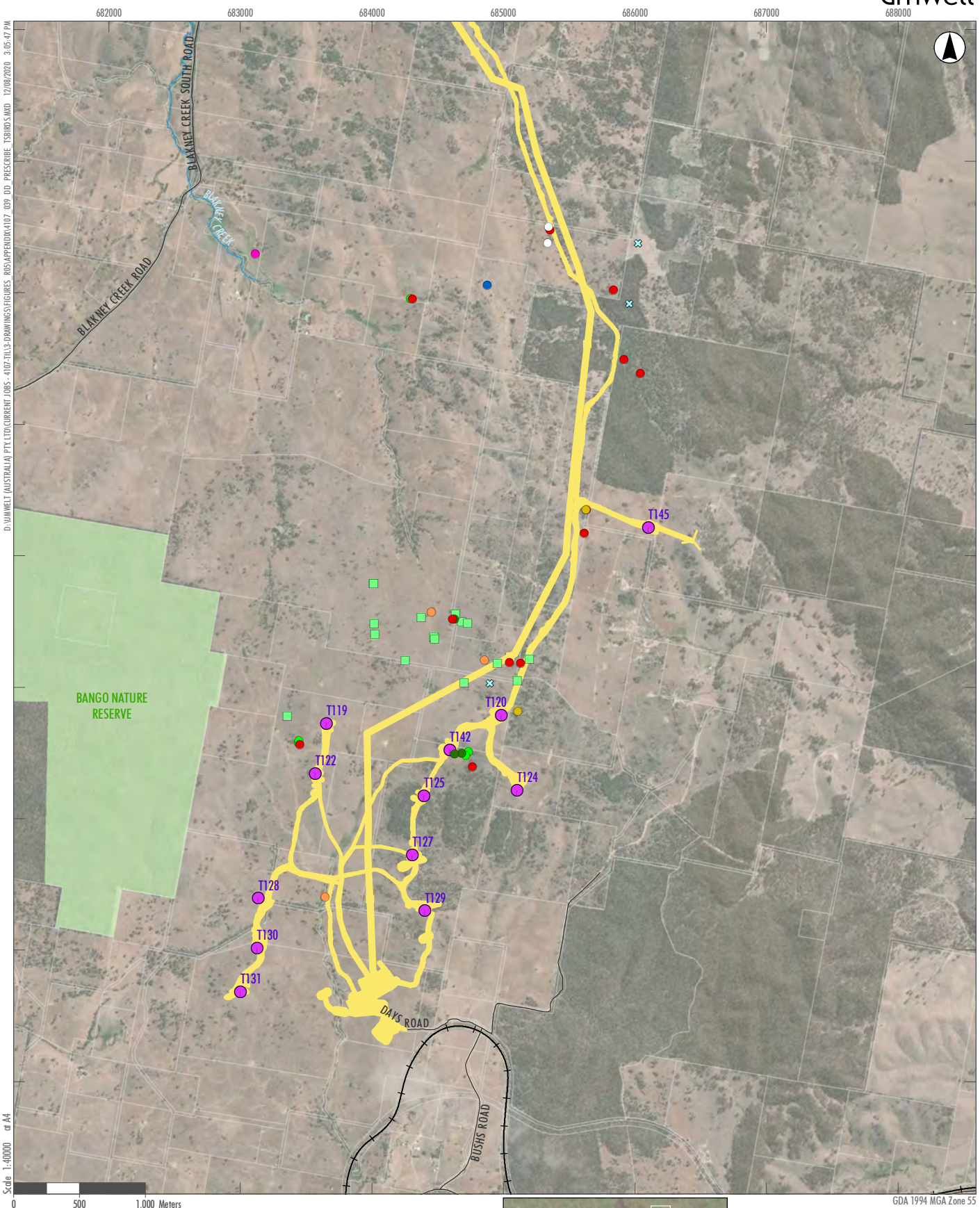


FIGURE 4.1.6

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Railways
- NPWS Estate

EPBC Act Species

- White-throated Needletail

NSW BC Act and EPBC Act Species

- Superb Parrot

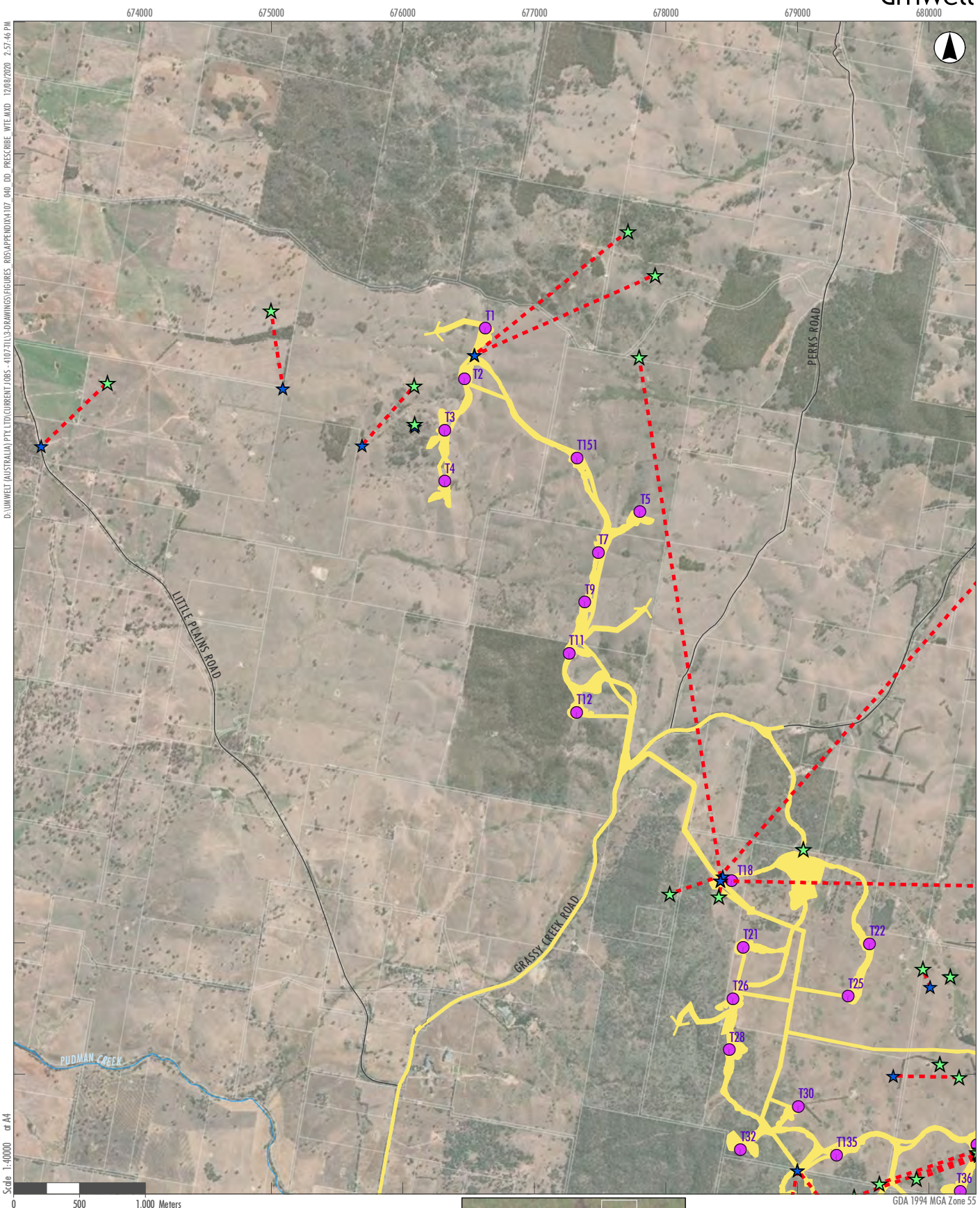
NSW BC Act Species

- Dusky Woodswallow
- Varied Sittella
- Black Falcon
- Little Eagle
- Hooded Robin
- Scarlet Robin
- Flame Robin
- Speckled Warbler
- White-fronted Chat

FIGURE 4.1.7

Location of Threatened Bird Species Records in the Project Area (2018 /19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

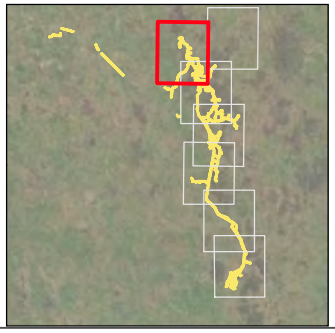
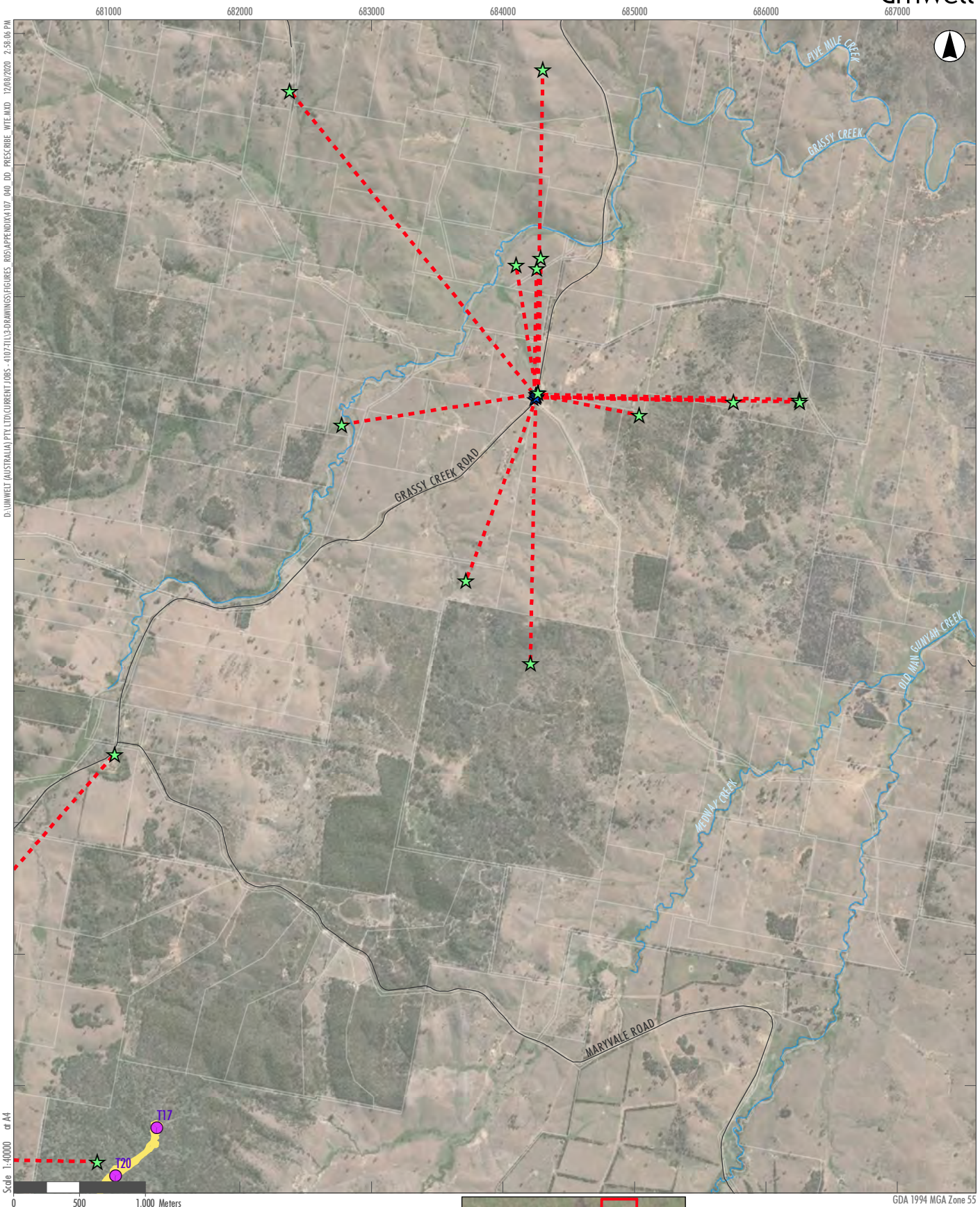


FIGURE 4.2.1

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



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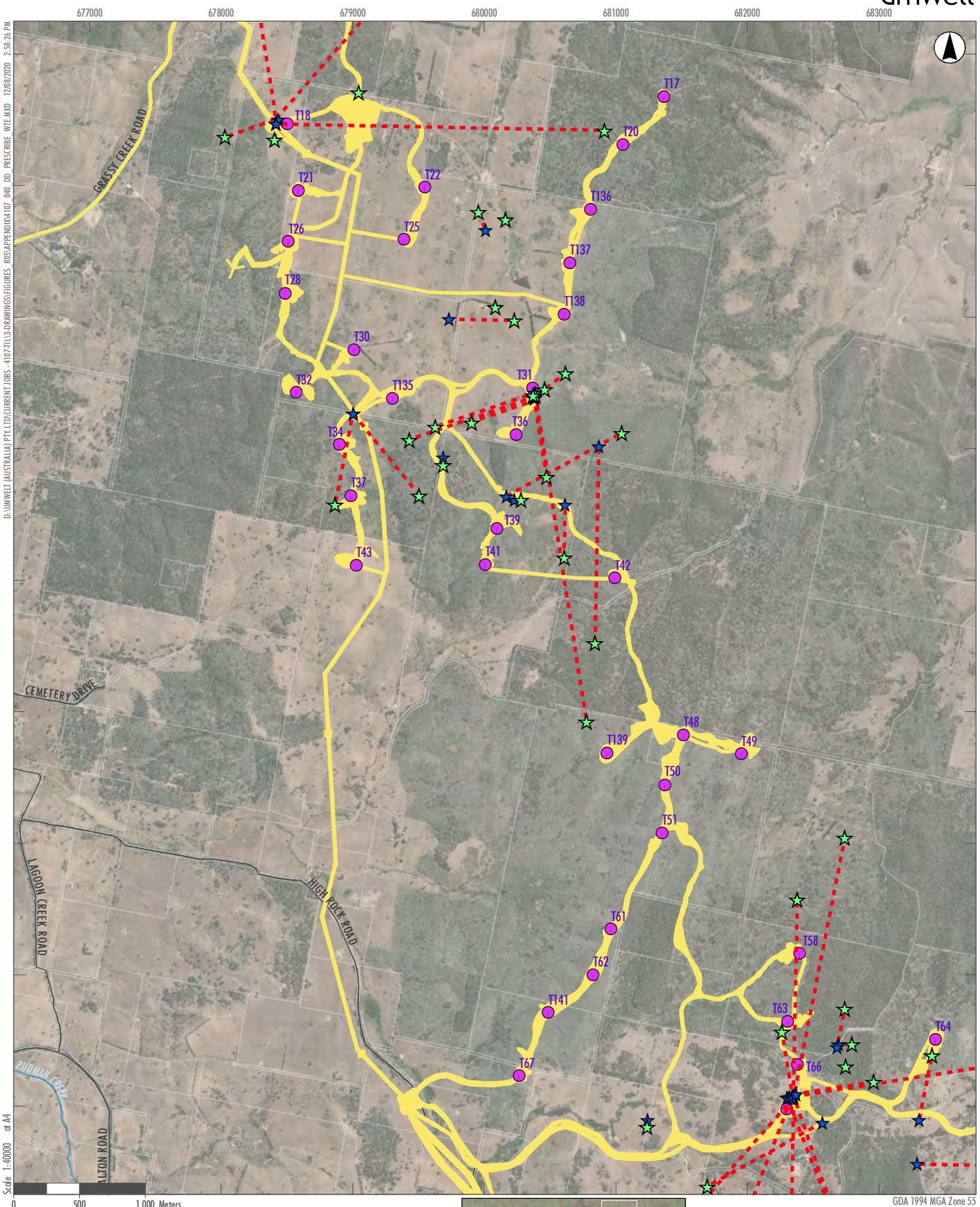
Scale 1:40000 at A4

FIGURE 4.2.2

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

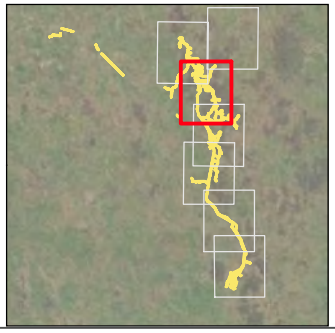
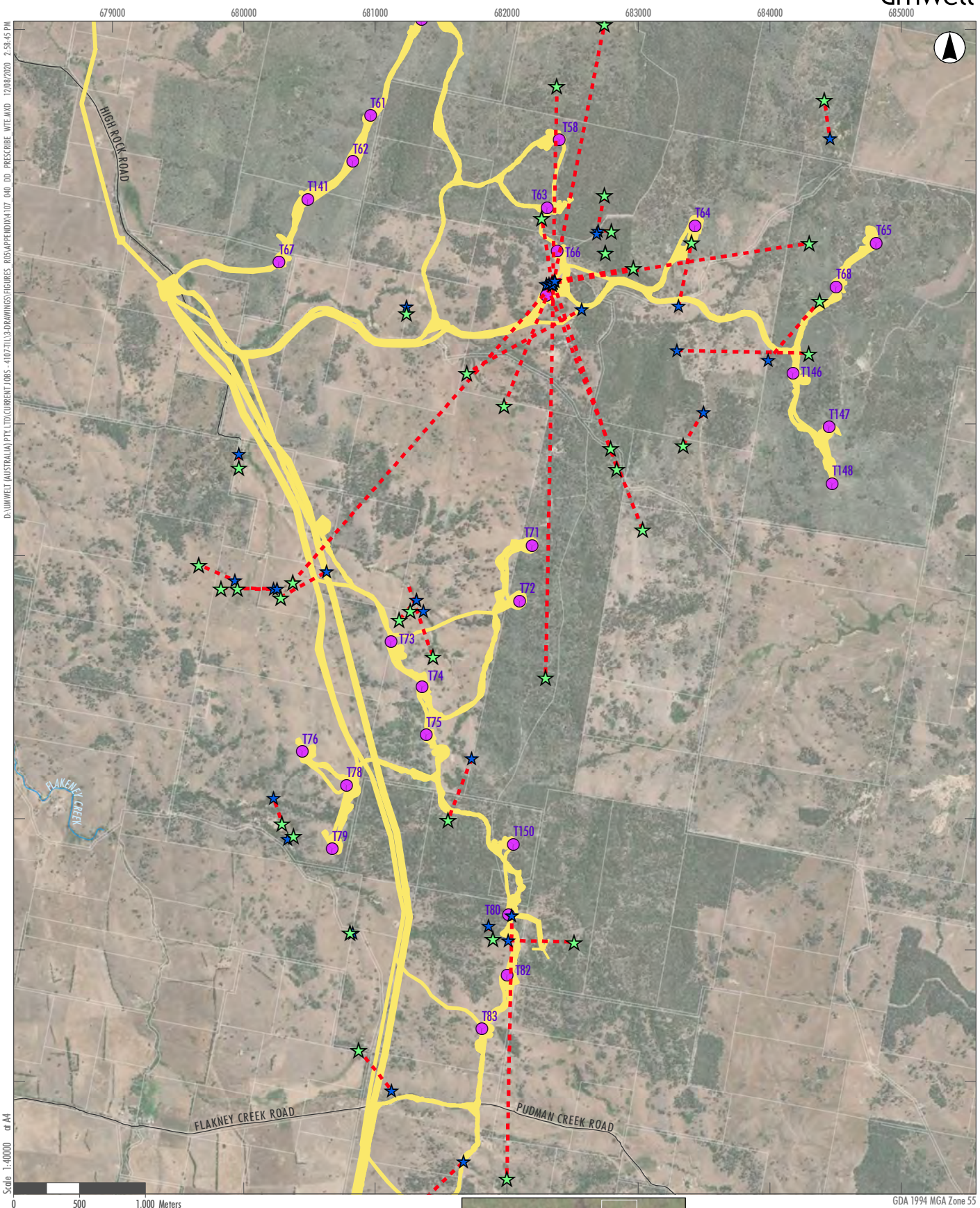


FIGURE 4.2.3

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



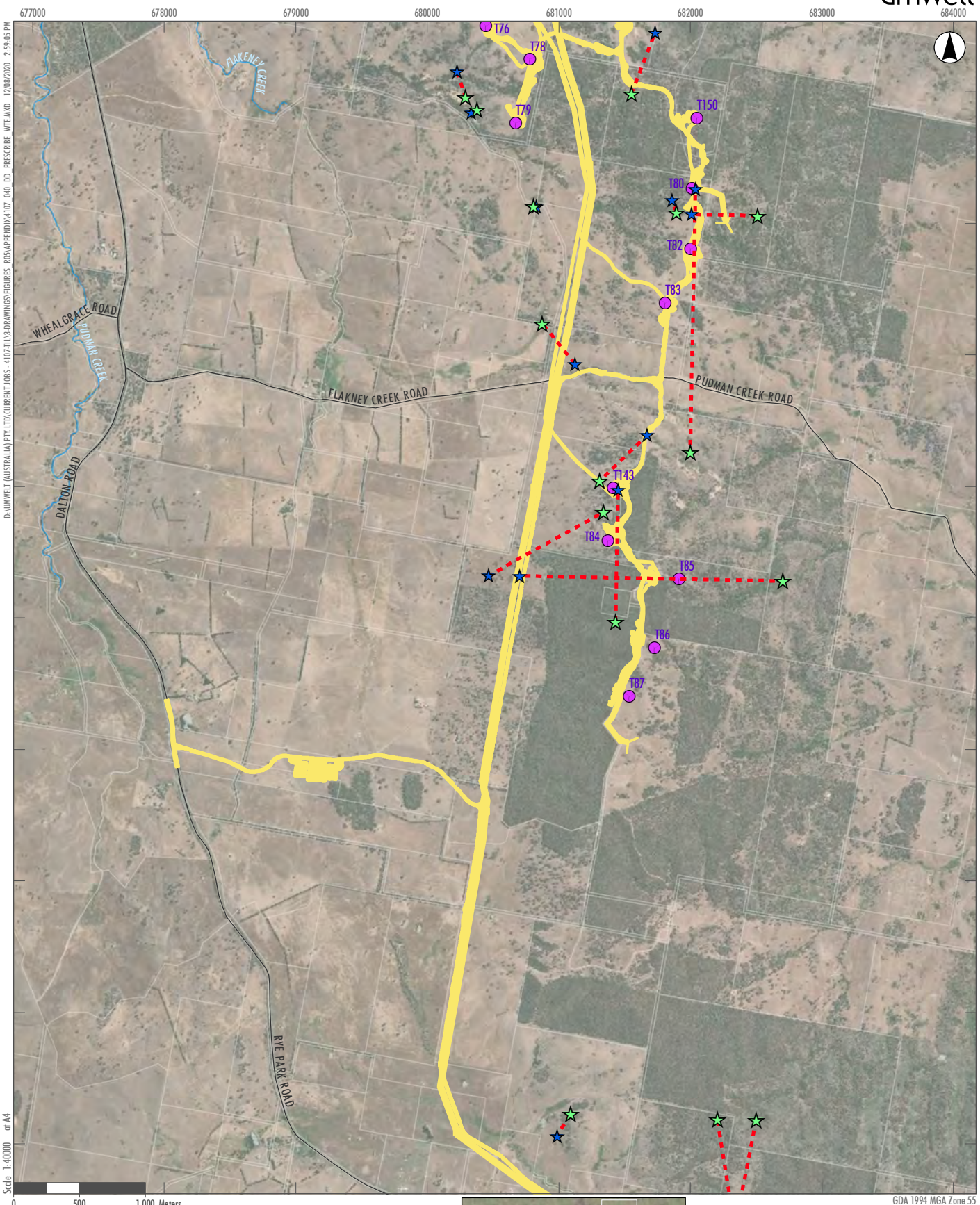
Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

FIGURE 4.2.4

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

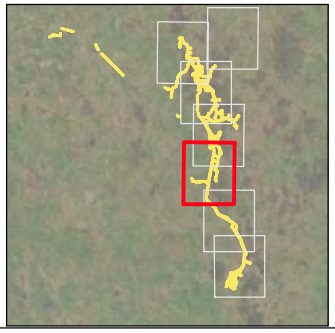
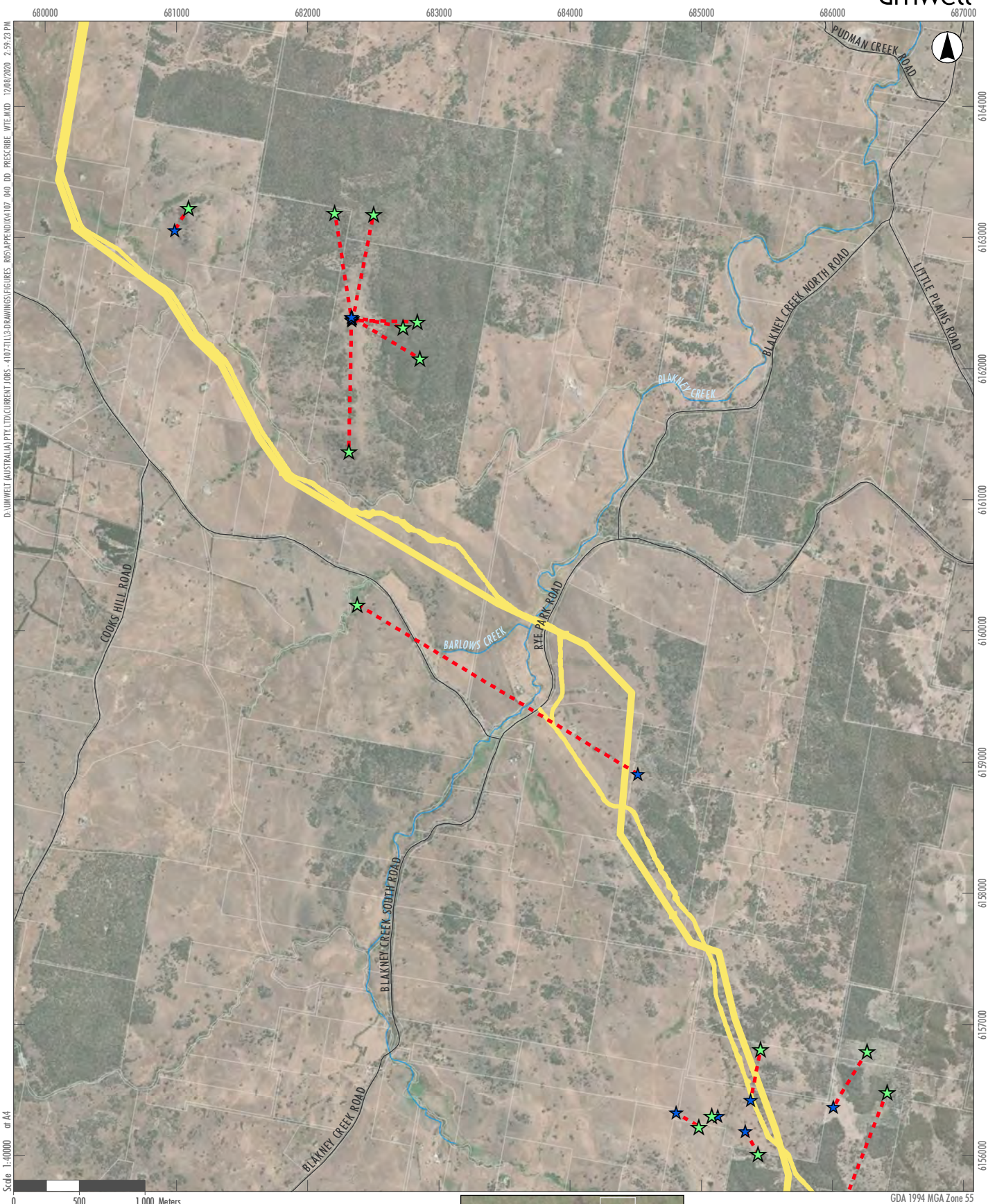


FIGURE 4.2.5

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

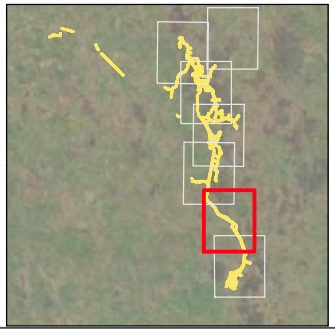
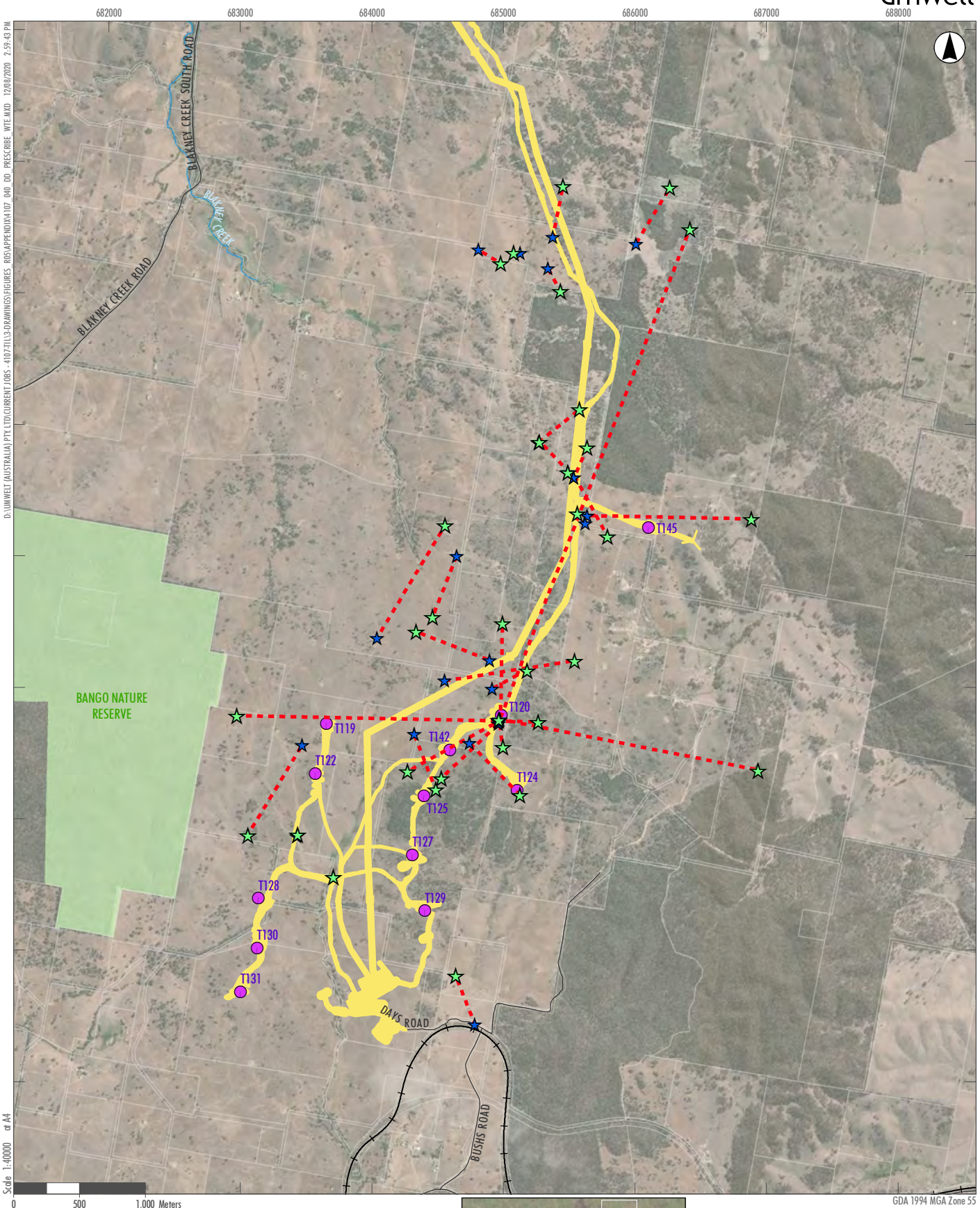


FIGURE 4.2.6

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



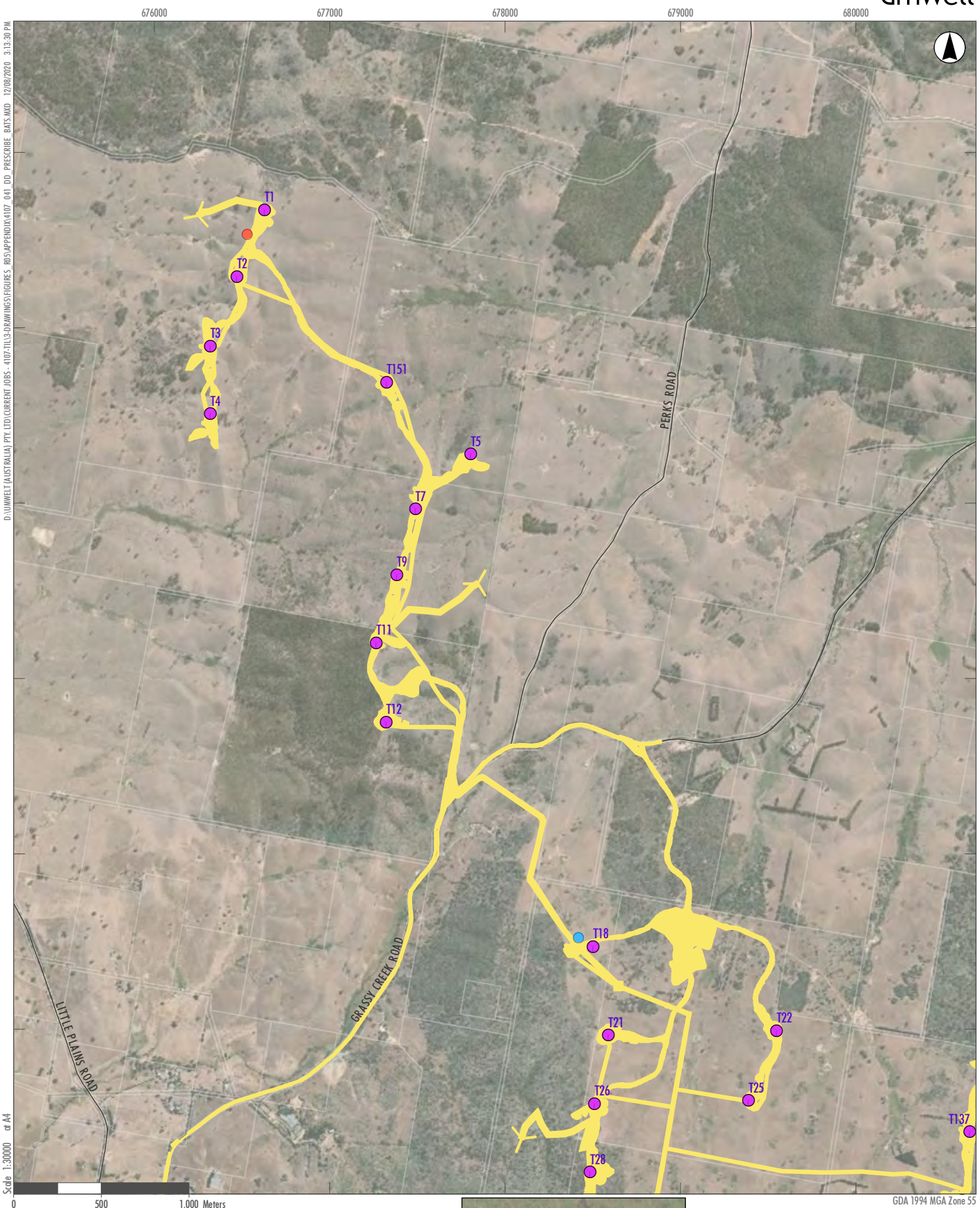
Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Railways
- NPWS Estate
- Observer Location
- Observer Direction and Distance of Wedge-Tailed Eagle Sighting
- Wedge-Tailed Eagle Location

FIGURE 4.2.7

Location of Wedge-Tailed Eagles Records in the Project Area (2018 / 19 Bird Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Myotis macropus (Southern myotis)
- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

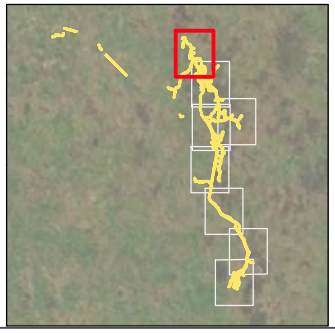
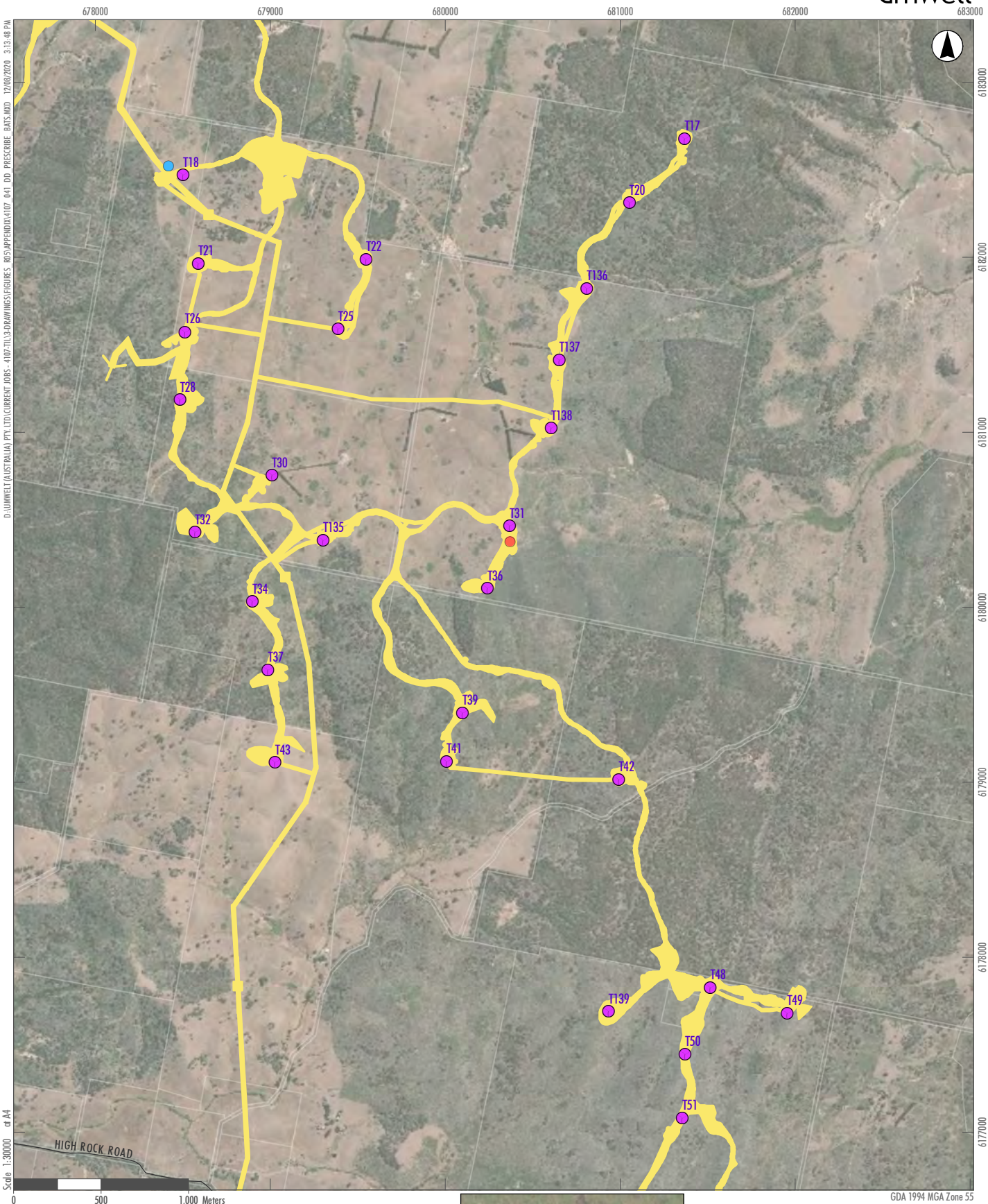


FIGURE 4.3.1

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Myotis macropus (Southern myotis)
- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

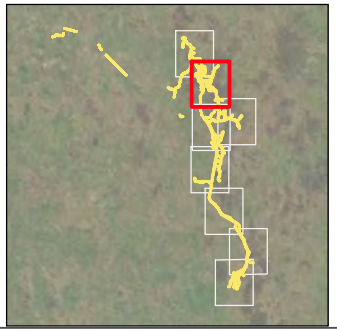
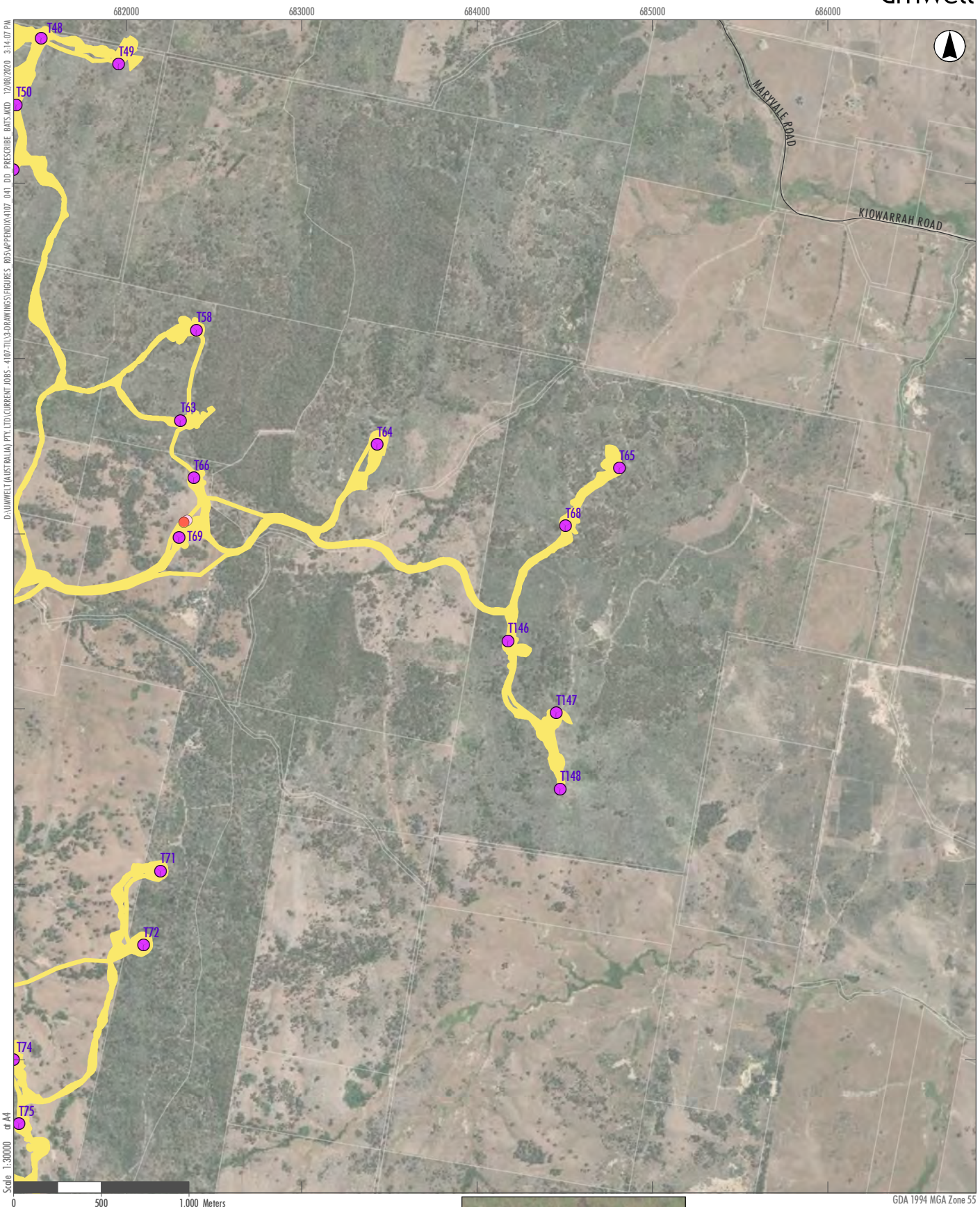


FIGURE 4.3.2

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Falsistrellus tasmaniensis (Eastern false pipistelle)
- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

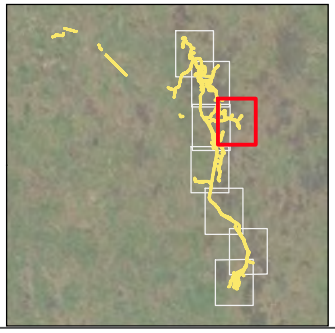
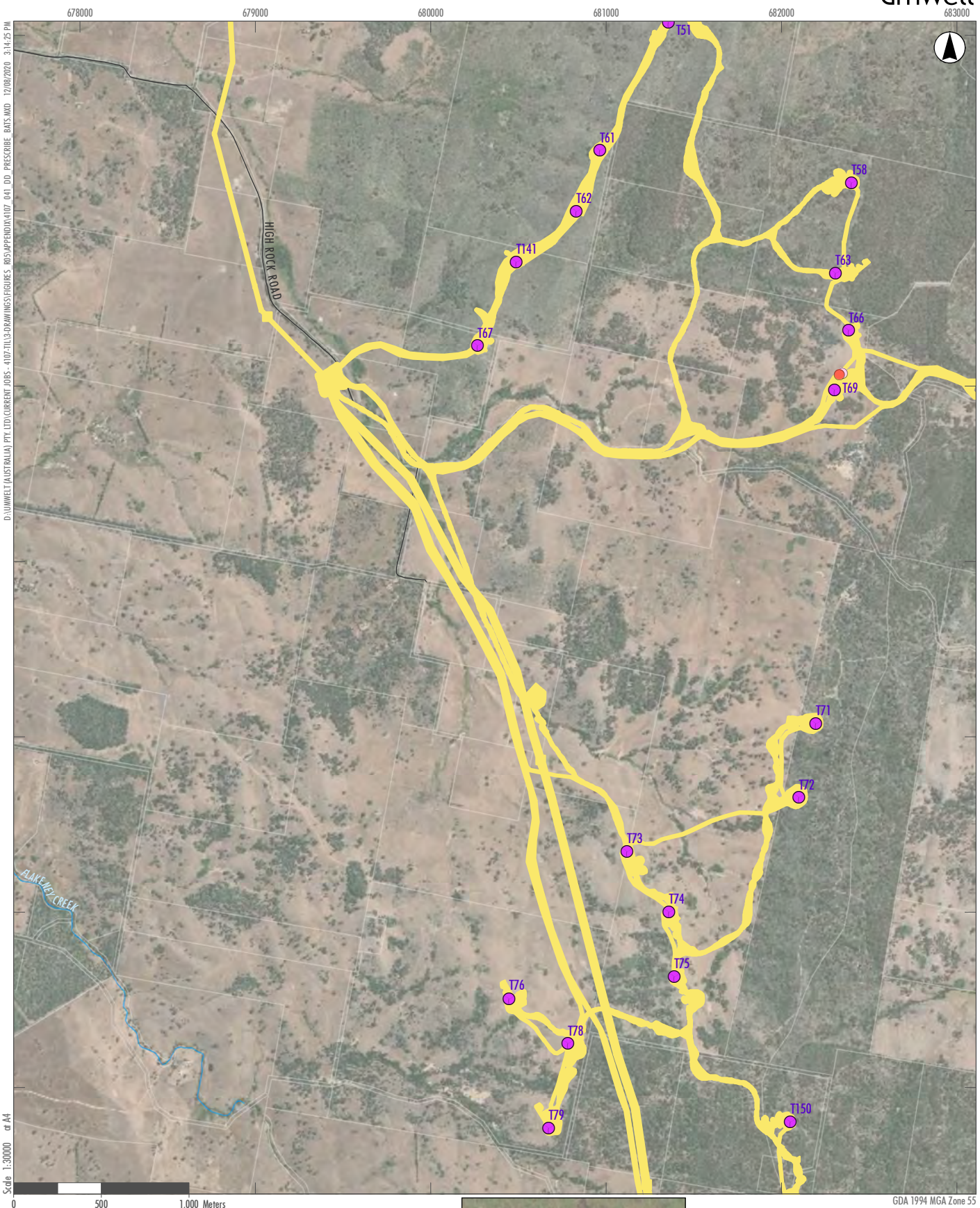


FIGURE 4.3.3

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Falsistrellus tasmaniensis (Eastern false pipistelle)
- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

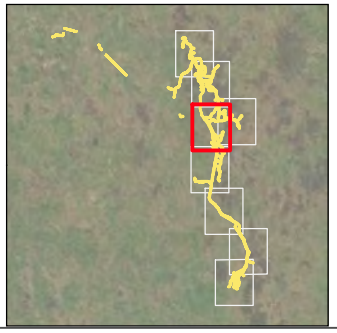
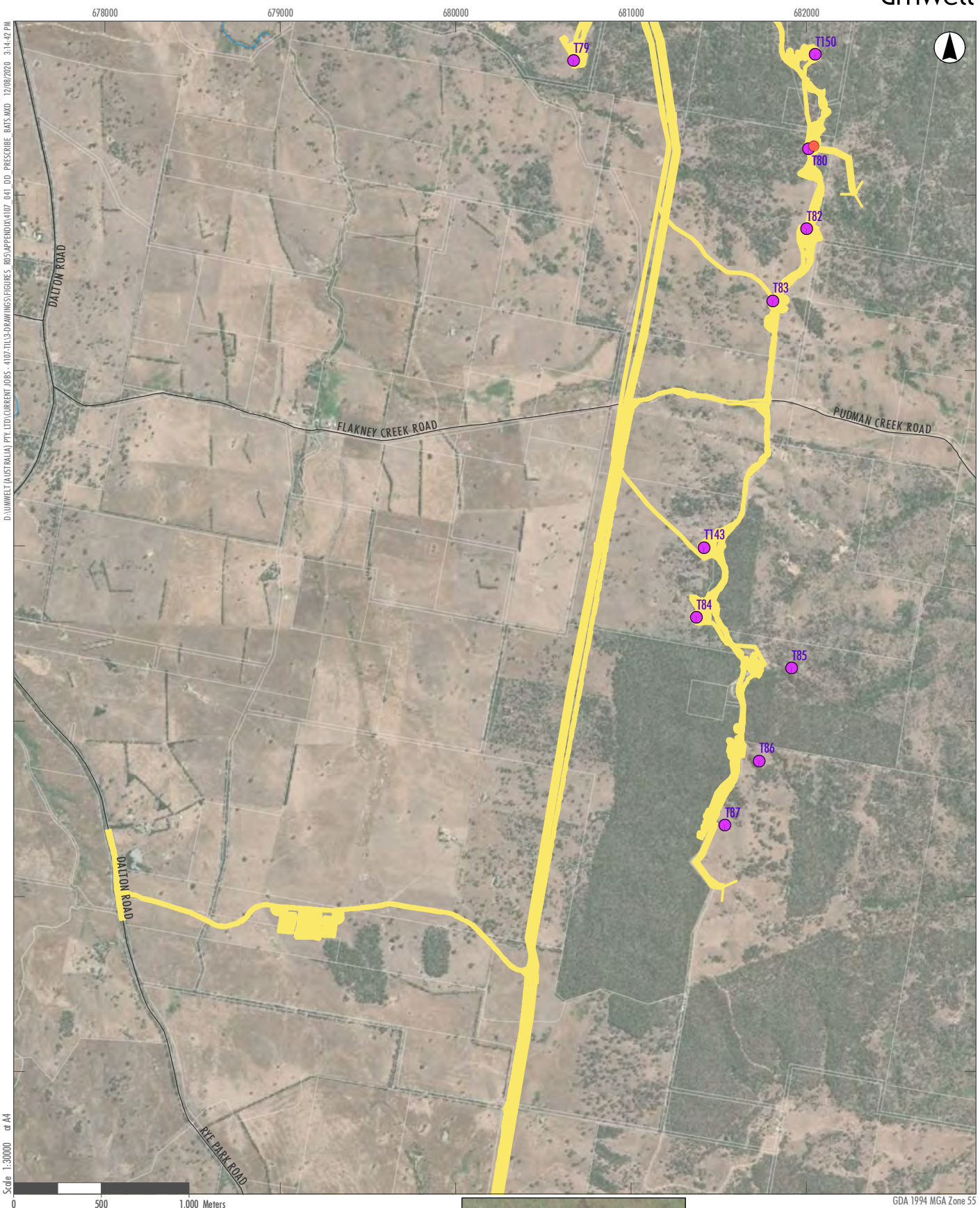


FIGURE 4.3.4

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

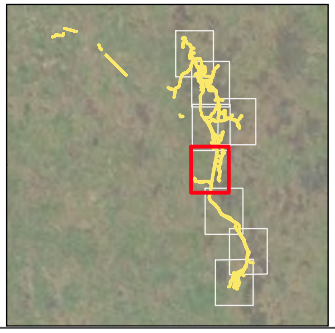


FIGURE 4.3.5

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

FIGURE 4.3.6

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses

Threatened Bat Records

- Saccolaimus flaviventris (Yellow-bellied sheathtail bat)

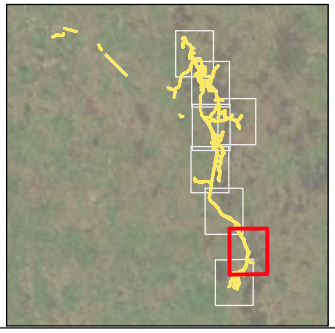
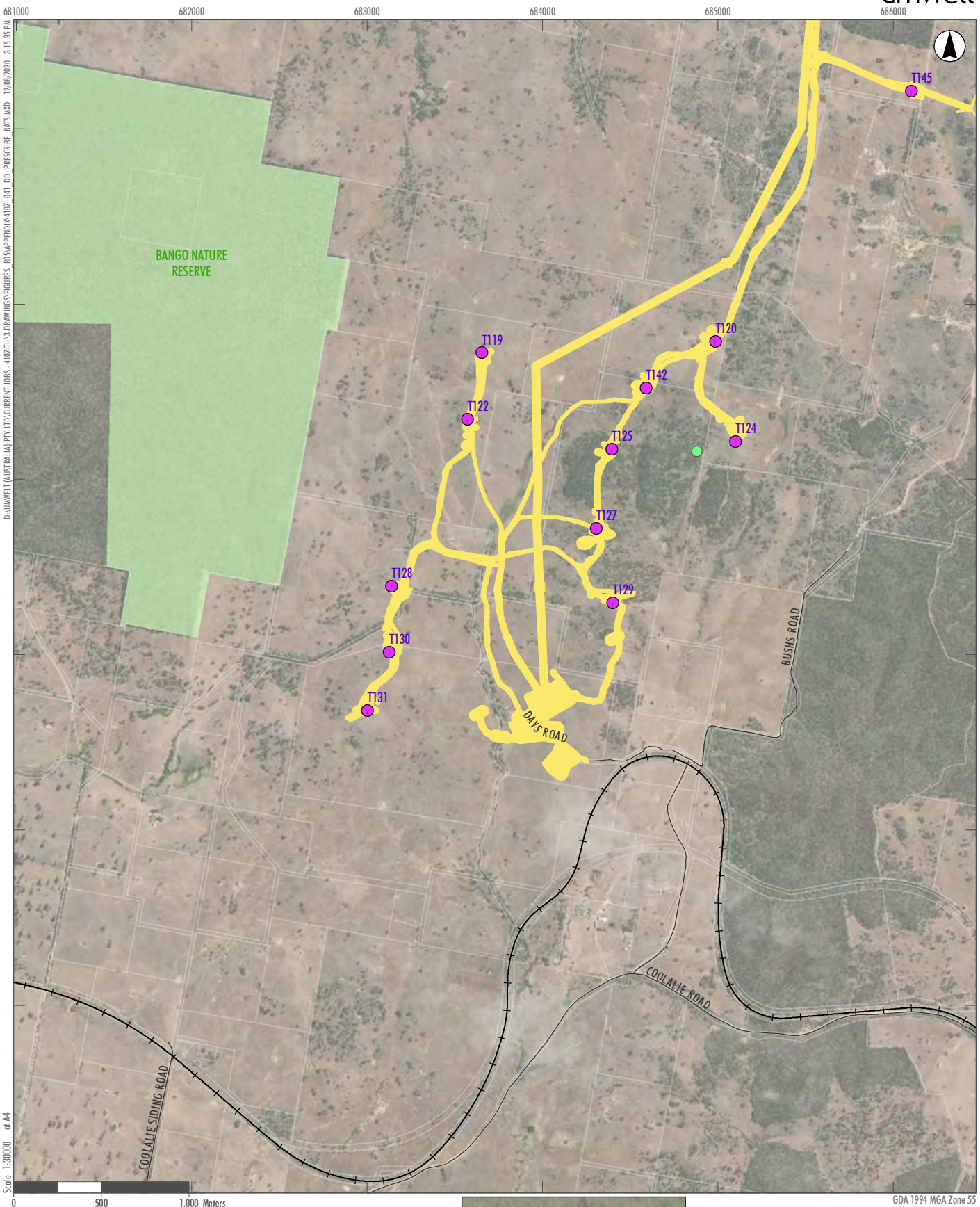


FIGURE 4.3.7

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)



Legend

- Indicative Development Footprints
- Turbines Locations
- Property Boundaries
- Watercourses
- Railways
- NPWS Estate

Threatened Bat Records

- Miniopterus orianae oceanensis (Large bent-winged bat)

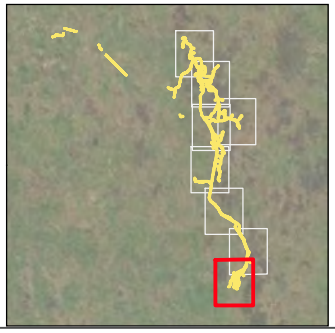


FIGURE 4.3.8

Location of the Threatened Bat Species in the Project Area (2018 / 19 Utilisation Surveys)

Image Source: ESRI Basemap (2020) Data source: NSW LPI (2020); Rye Park Renewable Energy Pty Ltd (2020)

5.0 Predict the consequences of impacts for the persistence of bioregional populations, with reference to relevant literature and other published sources of information

The consequences of impacts for the persistence of the assessed species in the bioregion depends on a range of poorly understood or unknown factors including the following:

- the relative importance of the Project Area for the long-term persistence of the greater population in the bioregion
- the degree of connectivity in regard to the movement of individuals between the Project Area and surrounding areas
- whether likely mortality rates from blade strike in the Project Area would exceed the rate of replacement of individuals either in situ or through dispersal from elsewhere.

Given the lack of data with which to predict estimates and the inherent high uncertainty associated with predictions if attempted, the consequence of impacts for the persistence of bioregional populations is not predicted here.

6.0 Predict the cumulative impacts of the project together with existing wind farms on aerial species mortality and provide justification for these predictions

For the purpose of this section, the following aerial species which have a highly localised population at or near the Project Area are examined:

- Large bent-winged bat
- Superb parrot.

In order to adequately assess cumulative impacts of the Project together with other wind farms in the region, it is first necessary for the effects of all other relevant wind farms to be quantified to a consistent standard and to be available (Moloney et al. 2019). In the absence of this information, a summary including an examination of basic factors such as species distribution relative to nearby wind farms and the total number of turbines in the region is provided below.

The following three operational projects, three projects under construction and one approved project are considered to be in the region (c. 3,000km^2) in which the Project is situated:

- Cullerin Range Wind Farm (operational since 2009), 15 turbines
- Gullen Range Wind Farm (operational since 2013), 73 turbines
- Gunning Wind Farm (operational since 2011), 31 turbines
- Bango Wind Farm (under construction), 46 turbines
- Collector Wind Farm (under construction), 54 turbines
- Biala Wind Farm (under construction), 31 turbines
- Coppabella Wind Farm (approved), 75 turbines.

At present there are a total of 122 operational turbines in the region with a further 131 under construction and 75 approved. Therefore, the installation of 80 turbines approved at Rye Park Wind Farm will result in a 32% increase in the number of turbines in the region (assuming completion of the three wind farms currently under construction). It is noted that the impact of each turbine on the species assessed here would not be equal across the region considering variability in abundance and site occupancy at multiple spatial scales (i.e. landscape scale, within wind farm scale) and variability in turbine specifications would influence the likelihood of collisions.

6.1 Superb parrot

Factors such as the superb parrot's flight behaviour and their movement patterns in the region, coupled with the proportion of their population that occurs in the region highlights the potential for a cumulative impact on this species as a result of the direct and indirect impacts associated with wind farms.

Superb parrots have been recorded at the four wind farms that are approved or under construction in the region and may occur at the three operational wind farms. Due to the location of the three wind farms operational as of July 2020 (Cullerin Wind Farm, Gullen Range Wind Farm and Gunning Wind Farm) on the eastern edge of the superb parrot's range it is likely that the cumulative impact at present is relatively low. However, the introduction of three wind farms in their core range (namely Bango Wind Farm, Coppabella Wind Farm and the Project) has the to result in increase the risk of a cumulative impact in this region once these projects are operational.

The construction of the Project would result in the addition of 80 turbines which corresponds to a 32% increase in the total number of turbines in the region. The degree to which this development will contribute to the overall cumulative impact is unknown however, as discussed in **Section** Error! Reference source not found.**,** certain turbines are likely to pose a greater risk than others. Due to the location of Bango Wind Farm, its position in the landscape and the amount of suitable superb parrot habitat present (ERM 2013), it is considered that that wind farm will pose a greater risk per turbine (and potentially overall) to superb parrot than the Project especially given specific turbines identified by NGH (2014) as posing the highest risk to superb parrots have been removed from the Project's layout.

Research to be conducted on the movement of superb parrots in the Yass region and impact monitoring to be conducted in the Project Area and at the under construction Bango Wind Farm as part of the Superb Parrot Population Monitoring Program is likely to improve our understanding of the susceptibility of this species to blade strike and indirect impacts resulting from the operation of turbines (Rayner 2019). This research may allow an informed cumulative impact assessment to be conducted for this region in the future.

6.2 Large bent-winged bat

Factors such as the large bent-winged bat's flight behaviour, and their movement patterns in the region, coupled the proportion of their population that occurs in the region indicates the potential for a cumulative impact on this species resulting from direct and indirect impacts associated with wind farms.

Large bent-winged bats have been recorded at four wind farms in the region and have potential to occur at the remaining three, for which there is poor availability of ecological survey data. Each of the three operational wind farms, the three under construction wind farms and the two approved wind farms in the region are located within 60 km of known maternity cave sites in the region at Wee Jasper and Bungonia. The movement of large bent-winged bats in this region is poorly understood. Increasing the number of wind farms in the region will increase the chance that a frequently used migratory pathway could be impacted.

The construction of the Project would result in the addition of 80 turbines which corresponds to a 32% increase in the total number of turbines in the region. The degree to which the Project will contribute to the overall cumulative impact is unknown. Data collected during autumn 2019 suggest that whilst the Project Area is located within an area that large bent-winged bats migrate through (Dwyer 1969) there is no evidence that a highly utilised autumn migratory path intersects the Project Area. Examination of mortality rates in the Project Area and at wind farms in the region through robust post-construction monitoring programs is required in order to estimate the magnitude of cumulative impacts on this species in this particular region.

7.0 Predict and map the likely zone of disturbance around wind turbines for aerial species resident in, or likely to fly over, the project area, with reference to relevant literature and other published sources of information

There is currently no information on the degree to which wind turbines disturb aerial species in Australia. For this reason, the likely zone of disturbance around wind turbines is unknown.

8.0 Map significant landscape and habitat features within the zone of disturbance for species likely to be affected, including but not limited to hollow bearing trees and important habitat for migratory species

No mapping of significant landscape and habitat feature mapping has been completed for the purpose of this assessment. Instead, for species for which there is clear spatial variability in site occupancy and abundance across the Project Area (i.e. superb parrot and white-fronted chat), specific areas which are likely to be more important than others are discussed in **Section 4.3**. Locations that are considered to present higher risk to certain species and would therefore be a key consideration of post-construction monitoring will be identified and mapped in the Bird and Bat Adaptive Management Plan (Umwelt, in preparation).

9.0 Predict the likelihood and describe the nature of indirect impacts on aerial species resident in, or likely to fly over, the project area including but not limited to barriers to migratory pathways and breeding, feeding and resting resources

There is currently no information on the degree to which wind turbines create barriers for aerial species in Australia. For this reason, the degree to which the Project may restrict the movement of each of the 14 species assessed in this report is unknown.

10.0 For migratory species, predict the impact of avoidance behaviour relative to migration distances and the availability of suitable habitat for breeding, feeding and resting over the migration route, with reference to relevant literature and other sources of published information

The potential influence that indirect impacts may have on migratory or partly migratory species is difficult to predict given the lack of relevant information available. Species for which a high proportion of their population exhibits migratory behaviour such as white-throated needletail, large bent-winged bat, superb parrot, little eagle and dusky woodswallow, may be more likely to be affected by indirect impacts than sedentary species though the magnitude and nature of such impacts on each is unknown.

11.0 Justify predictions of likelihood and nature of impact, with reference to relevant literature and other published sources of information

See response to **Section 9.0.**

12.0 Predict the cumulative impacts of the project together with existing wind farms with respect to movement patterns and use of adjacent habitat and provide justification for these predictions

There is currently no information on the degree to which wind farms effect movement patterns or use of adjacent habitat for any species in Australia. For this reason, the cumulative impacts of indirect impacts on movement patterns and use of adjacent habitat throughout the region in which the Project Area is located is not predicted.

13.0 Conclusion

Of the 14 species assessed five are considered a high risk, six are considered a moderate risk and three are considered a minor risk of being impacted by the Project (**Table 13.1**). The resultant risk rating for these species is primarily due to their relative abundance in the Project Area, their predicted or observed flight behaviour in the Project Area and/or their known susceptibility to blade strike at wind farms in south-east Australia. For each of the five species assigned an overall risk rating of high, the likelihood of collisions was considered high whilst the consequence of collisions was considered moderate.

The risk rating for the black falcon and little eagle largely reflects the potentially high consequence of small numbers of instances of blade strike of this species. The risk rating for white-throated needletail largely reflects the high likelihood of collision of birds in the Project Area given their known susceptibility to blade strike at other wind farms in Australia and the number and nature of observations in the Project Area during 2018/19. The risk rating for superb parrot and large bent-winged bat partly reflects the high importance of the greater region for both species, combined with factors such as the number and nature of observations in the Project Area.

Table 13.1 Risk Assessment Summary

Common Name	Latin Name	Likelihood	Consequence	Risk Rating
Little eagle	*Hieraaetus morphnoides*	High	Moderate	High
Black falcon	*Falco subniger*	High	Moderate	High
Wedge-tailed eagle	*Aquila audax*	High	Low	Moderate
Superb parrot	*Polytelis swainsonii*	High	Moderate	High
White-throated needletail	*Hirundapus caudacutus*	High	Moderate	High
White-fronted chat	*Epthianura albifrons*	High	Low	Moderate
Brown treecreeper	*Climacteris picumnus victoriae*	Low	Moderate	Minor
Varied sittella	*Daphoenositta chrysoptera*	Moderate	Low	Minor
Painted honeyeater	*Grantiella picta*	Moderate	Moderate	Moderate
Dusky woodswallow	*Artamus cyanopterus*	High	Low	Moderate
Large bent-winged bat	*Miniopterus schreibersii oceanensis*	High	Moderate	High
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	Moderate	Moderate	Moderate
Southern myotis	*Myotis macropus*	Low	Moderate	Minor
Eastern false pipistrelle	*Falsistrellus tasmaniensis*	Moderate	Moderate	Moderate

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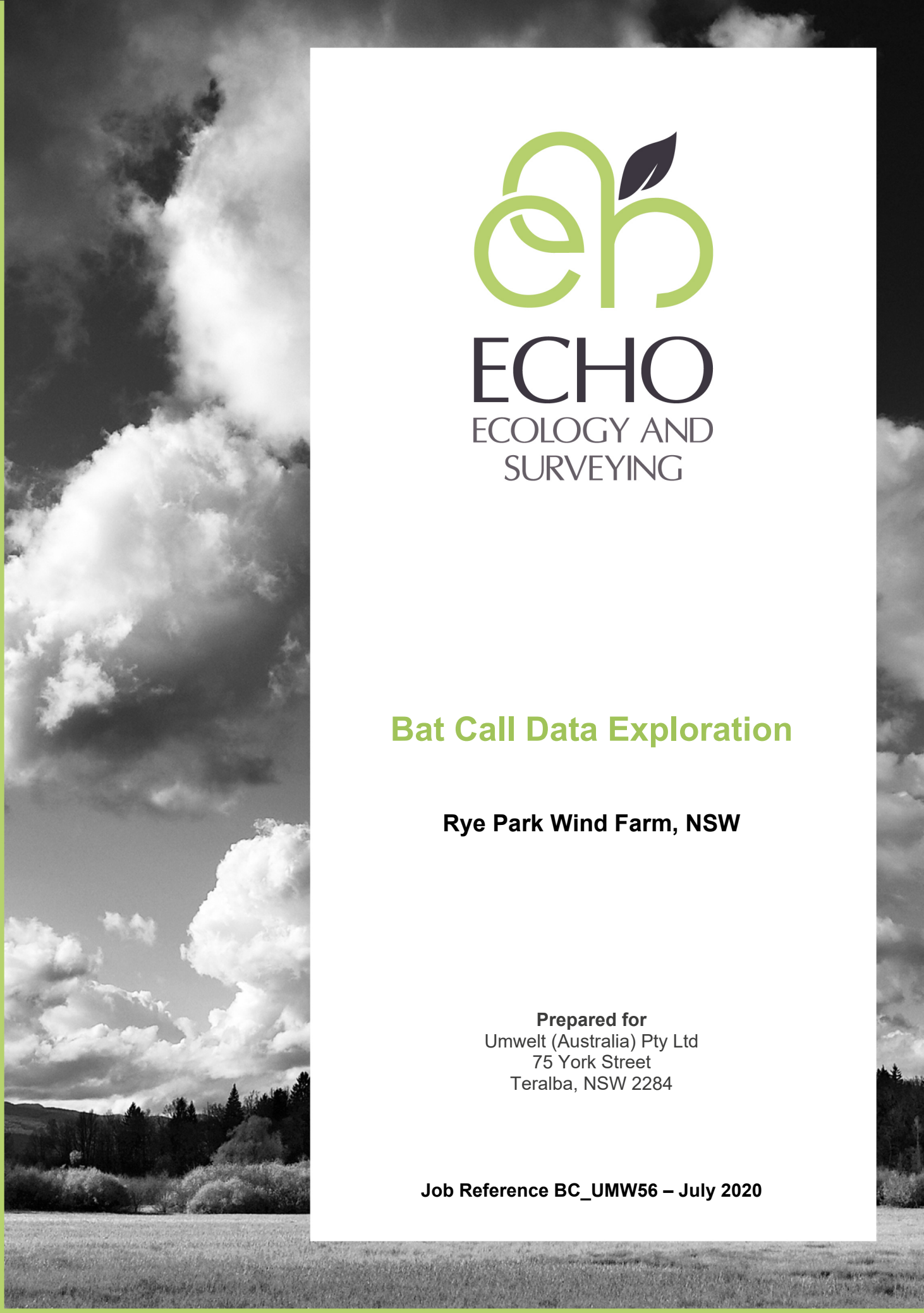
APPENDIX E1

Bat Call Data Exploration Report



ECHO
ECOLOGY AND
SURVEYING

Bat Call Data Exploration

Rye Park Wind Farm, NSW

Prepared for
Umwelt (Australia) Pty Ltd
75 York Street
Teralba, NSW 2284

Job Reference BC_UMW56 – July 2020

Echo Ecology and Surveying • PO Box 4132 Crescent Head
Ecology - 0423 801 779 • **Surveying** - 0418 604 460 • **E:** info@echoecology.com.au • **W:** echoecology.com.au

This report has been prepared to document the analysis of digital ultrasonic bat echolocation data received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

Dr Anna McConville
PhD, B.Env.Sc.

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1.0 INTRODUCTION

This report has been commissioned by Umwelt (Australia) Pty Ltd to explore trends in the echolocation call data collected from Rye Park, NSW.

Comments have been received from the NSW Government requesting further information. The relevant received from the NSW Government are as follows:

> BCD commends the Applicant for the large number of sites surveyed both at ground level and elevation for microbats. However, there are a large number of 'possible' Large Bent-winged Bat calls in shown in Tables 4.3 and 4.4, relative to the number of 'definite' and 'probable' calls. This a trigger for further and more detailed investigation. It is recommended that the following information is provided:
>
> - Description on the method used to classify calls into 'definite' 'probably and 'possible' categories.
> - Information on the temporal distribution of the possible calls in terms of mean number of calls per hour and per day including whether there any noticeable spikes in activity or were these calls a consistent 'background' noise.
> - Information on whether there a similar level of uncertainty about the number of calls detected for Eastern False Pipistrelle, Yellow-bellied Sheathtail bat and Southern Myotis.

The first and third comments above have been addressed in the original bat call identification report prepared for the project: Echo Ecology and Surveying 2020 *Bat Call Identification: Rye Park Wind Farm, NSW*, prepared for Umwelt (Australia) Pty Ltd. We recommend supplying this report to BCD.

The overall aim of this report is to provide further data analysis of the bat call data for the Rye Park Wind Farm project. In particular,

- Use descriptive statistics and/or graphs to explore possible *Miniopterus orianae oceanensis* activity patterns:
    - the seasonal activity patterns (e.g. comparing mean nightly activity) of possible *M.o.oceanensis* calls with the aim of detecting any activity 'spikes' that may indicate *M.o.oceanensis* seasonal migration;
    - the nightly activity patterns (activity per hour) of possible *M.o.oceanensis* calls with the aim of determining nightly activity peaks
    - elevational activity patterns (e.g. 2m and 45m AGL sites) to determine whether possible *M.o.oceanensis* activity trends at height are similar to those at ground (seasonal and nightly)
- Review the seasonal and activity patterns of the other bat species with potential to occur at the site using similar methods as above.

2.0 METHODS

File identification reports were extracted from previously identified bat calls (Echo Ecology and Surveying, 2020) in Anabat Insight (Version 1.9.3, Titley Electronics) to tally the number of passes per species (or species group) per night and per hour.

As very few confident *M.o.oceanensis* identifications were made, we pooled these with all calls that may have been possibly from *M.o.oceanensis* to create a "possible *M.o.oceanensis*" dataset (often abbreviated in graphs and text as "Moo / Vespadelus"). This included the following species identifications:

- *Miniopterus orianae oceanensis* (Definite)
- *Chalinolobus morio / Miniopterus orianae oceanensis / Vespadelus vulturnus*
- *Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus / Vespadelus vulturnus*
- *Miniopterus orianae oceanensis / Vespadelus regulus*
- *Miniopterus orianae oceanensis / Vespadelus regulus / Vespadelus vulturnus*
- *Miniopterus orianae oceanensis / Vespadelus vulturnus*

As *M.o.oceanensis* most frequently overlaps in characteristics with *Vespadelus* spp. we also created a possible *Vespadelus* spp dataset (often abbreviated in graphs as "Vespadelus spp.") that included the following identifications:

- *Vespadelus vulturnus (Definite, Probable, Possible)*
- *Vespadelus darlingtoni (Definite, Probable, Possible)*
- *Vespadelus darlingtoni / Vespadelus regulus*
- *Vespadelus darlingtoni / Vespadelus regulus / Vespadelus vulturnus*
- *Vespadelus regulus / Vespadelus vulturnus*
- *Chalinolobus morio / Vespadelus vulturnus*

For the analyses and graphs involving other species, we only used confident classifications (Definite and Probable pooled together).

For the purposes of exploring the data we assigned sample dates to the categories outlined in Table 2-1 based on *M.o.oceanensis* breeding and migration status. The purpose of these categories were to allow a review of what 'background' activity patterns may be at different times of year. The Autumn migration start date is reasonably accurate based on those provided to Umwelt by the NSW Government. The other dates have been roughly extrapolated based on this Autumn migration date and only include the dates that were sampled.

Table 2-1: *M.o.oceanensis* season breeding and migration status dates

Moo Season	Date Start	Date End
1.Staging	5/11/2018	1/12/2018
2.Maternity	21/01/2019	18/03/2019
3.Weaning	18/03/2019	24/03/2019
4.AutumnMigration	25/03/2019	10/04/2019
5.Post-Migration	11/04/2019	1/05/2019

We added the following variables to the data:

- Site name
- Night
- Month
- Elevation (from ground)
    - 2m
    - 45m
- Habitat Type
    - Cleared Hilltop
    - Forest includes woodland and forest/woodland edge sites
    - Riparian
- Moo Season
    - 1.Staging
    - 2.Maternity
    - 3.Weaning
    - 4.Autumn Migration
    - 5.Post-Migration

Site details are provided in Appendix A.

We excluded nights with missing or incomplete data as best we could determine from microphone errors in log files, notes from the field ecologists and rainy nights where no data was recorded after a certain time (likely due to rain droplets covering the microphone).

To investigate seasonal activity levels we calculated average nightly site activity (average no. passes per site) for each seasonal category (Moo Season or Month), then graphed the mean ± SE of the average nightly activity. Whereas, hourly data graphs have pooled data (not first averaged per site).

All analyses and graphs were prepared using JMP (Version 15.1.0, SAS Institute Inc.).

2.1 Limitations

We have undertaken basic descriptive statistics and graphing to explore activity patterns. More complex statistical models and analyses may be able to better account for the effects of site, habitat type and differences in sample dates. However, this requires advanced statistics methods and is beyond the scope of this report.

We have most often used mean ± SE to summarise bat activity as it is easily viewed on graphs, but it should be noted that median values are often much lower.

3.0 RESULTS & DISCUSSION

A total of 1107 sample nights were included in the analyses from 30 different sites. Descriptive statistics are provided in Table 3-1 below (all nights pooled).

Table 3-1: Descriptive statistics for total bat activity and Moo / Vespadelus activity by variable. Results per night, all sites pooled.

Variable		n	Total Bat Activity				Moo/Vespadelus Activity			
			Mean	Median	SE	Range	Mean	Median	SE	Range
Month	Nov-18	262	188.98	66.5	15.64	0-3002	43.96	2	5.67	0-1910
	Jan-19	115	247.72	150	23.61	6-1995	41.46	4	8.56	0-534
	Feb-19	223	224.92	132	16.96	3-1381	29.61	1	6.14	0-620
	Mar-19	349	124.81	77	13.55	0-1057	1.28	0	4.91	0-23
	Apr-19	158	116.94	20.5	20.14	0-1624	27.04	0	7.30	0-725
Elevation	2m	744	216.22	112.5	9.15	0-3002	36.89	2	3.36	0-1910
	45m	363	80.79	46	13.10	0-523	0.43	0	4.81	0-27
Habitat Type	Cleared Hilltop	815	111.03	63	8.28	0-1057	1.93	0	2.97	0-131
	Forest	215	326.24	206	16.12	0-2762	82.49	32	5.78	0-1910

Variable		n	Total Bat Activity				Moo/Vespadelus Activity			
			Mean	Median	SE	Range	Mean	Median	SE	Range
	Riparian	77	383.97	246	26.93	0-3002	107.71	52	9.66	0-927
Moo Season	1.Staging	262	188.98	66.5	15..61	0-3002	43.96	2	5.72	0-1910
	2.Maternity	549	208.81	126	10.78	3-1995	21.33	1	3.95	0-620
	3.Weaning	72	87.50	50.5	29.78	6-575	1.07	0	10.92	0-15
	4.Autumn Migration	209	88.75	16	17.48	0-1624	19.88	0	6.41	0-725
	5.Post-Migration	15	79.53	25	65.24	6-346	9.80	0	23.92	0-45

3.1 Habitat Type

3.1.1 *Miniopterus orianae oceanensis*

Overall, Moo / Vespadelus spp. activity was much lower at cleared hilltop sites than either forest or riparian sites (Figure 3-1). This pattern is consistent when split by *M.o.oceanensis* season (not graphed here).

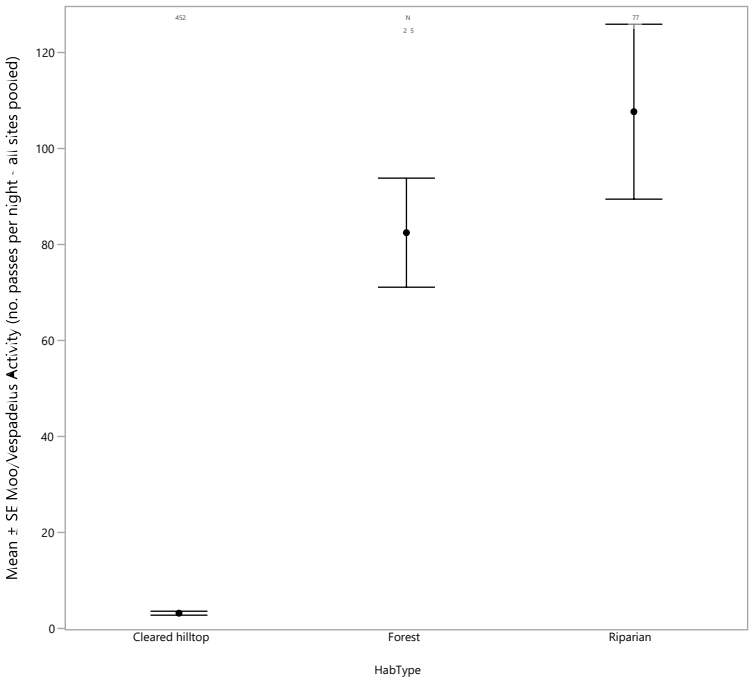

Figure 3-1: Mean ± SE nightly *Moo / Vespadelus* spp. activity by habitat type. All sites pooled and 45m sites excluded. n is shown at the top of the graph

3.2 Seasonal Activity Patterns

3.2.1 *Miniopterus orianae oceanensis*

There is no clear and consistent spike in Moo/Vespadelus activity during the Autumn migration season. When all activity data is pooled together (45m elevation sites excluded), there appears to be an increase in activity during the Autumn Migration period compared to both Weaning and Post-migration (Figure 3-2). However, when investigated by habitat type (Figure 3-3) or per site (see Appendix B), the trend appears to be a result of unequal sampling effort among the seasons (ie not all sites were sampled in every season and sampling was not always concurrent among sites). In this case, the 'Cleared Hilltop' sites are the only sites sampled during the 'Weaning' season and these sites typically had much lower activity levels than forest or riparian habitats. As such, we have often subset graphs by habitat type and we have included graphs of activity levels for individual sites in Appendix B so that these 'spikes' can be viewed in the context of site activity and sample effort.

In addition, activity patterns of Moo/Vespadelus are very similar to those of the *Vespadelus* spp. group (Figure 3-3) suggesting that other factors may also be influencing activity levels.

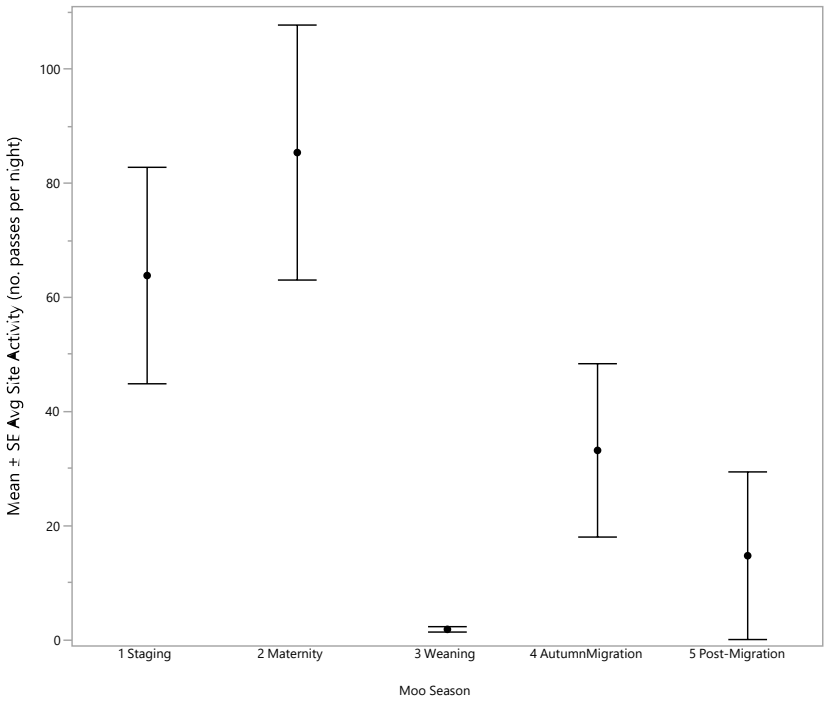

Figure 3-2: Mean ± SE Average nightly *Moo / Vespadelus* spp. activity by Moo season. 45m sites excluded.

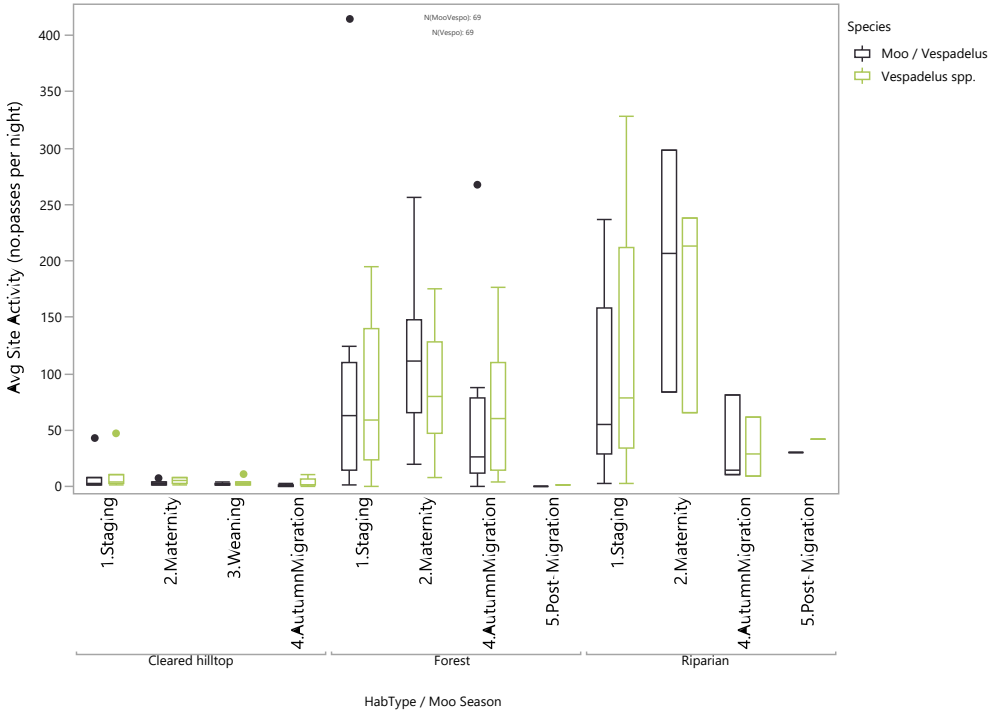

Figure 3-3: Average Site *Moo / Vespadelus* spp. and *Vespadelus* spp. activity by Moo season and habitat type. 45m sites excluded. n is shown at the top of the graph

Individual nights of high Moo/Vespadelus activity were detected as outliers in Figure 3-4; Figure 3-5; Figure 3-6 for sites BGIRP2, BGIRP3, BGIYAS, BGIRP8, BGI02 and BGI12. Activity on the 23/3/2019 at cleared hilltop sites and on 3/4/2019 at forested sites also

appears to be greater than surrounding dates (though variable as indicated by the large boxplot range). The high activity on 3/4/2019 (Figure 3-5) appears to be driven (as indicated by relatively low median value and large box plot range) by activity spikes at Site BGI02 and Site BGI09 on 3/4/2019 where 725 and 383 Moo/Vespadelus passes were recorded respectively (see Appendix B). Sample sizes for riparian sites are quite low either side of the *M.o.oceanensis* Autumn migration period and interpretation of this data should be cautious (Figure 3-6).

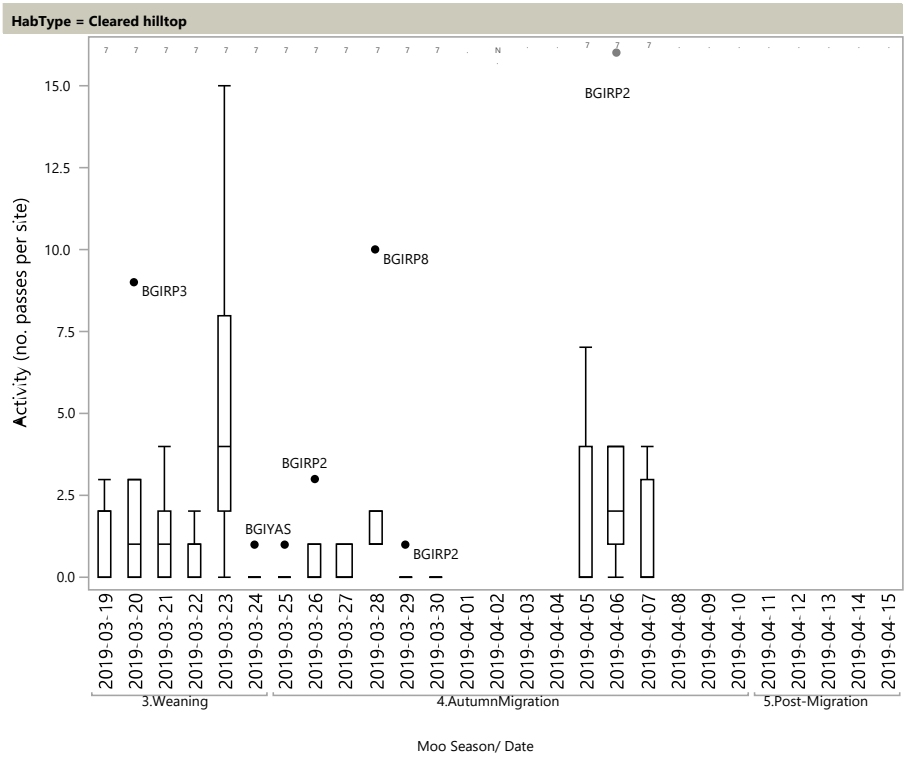

Figure 3-4: Cleared Hilltop Nightly *Moo/Vespadelus* spp. activity surrounding the Moo Autumn Migration season by habitat type. All sites pooled, cleared hilltop habitat only and 45m sites excluded. n is shown at the top of the graph and all outliers are labelled with site name

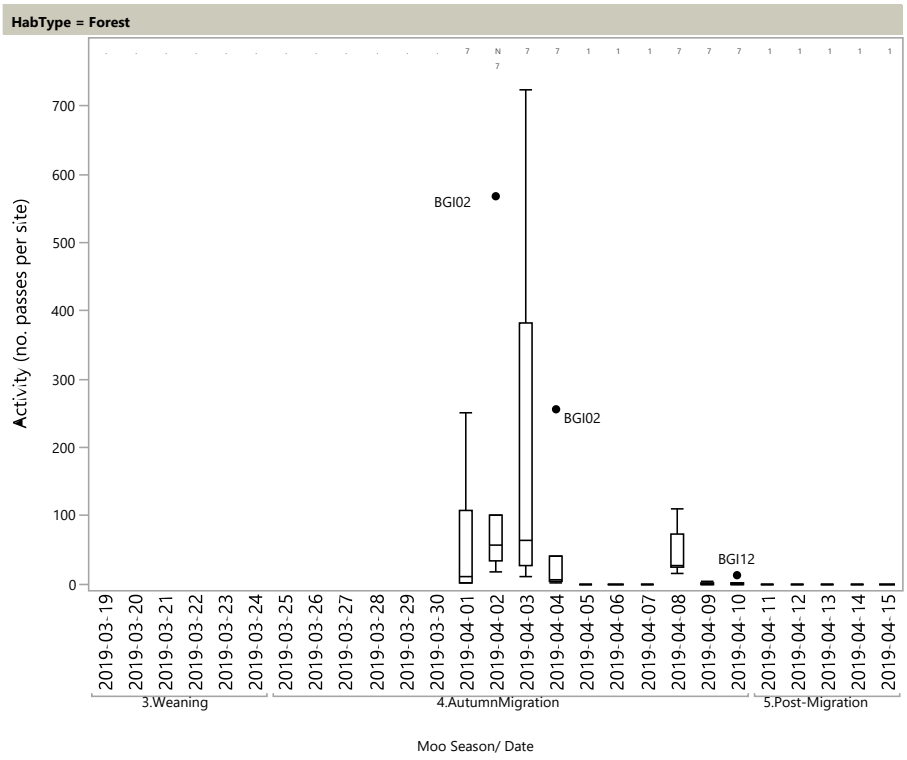

Figure 3-5: Forest Nightly *Moo/Vespadelus* spp. activity surrounding the Moo Autumn Migration season by habitat type. All sites pooled, forest habitat only and 45m sites excluded. n is shown at the top of the graph and all outliers are labelled with site name

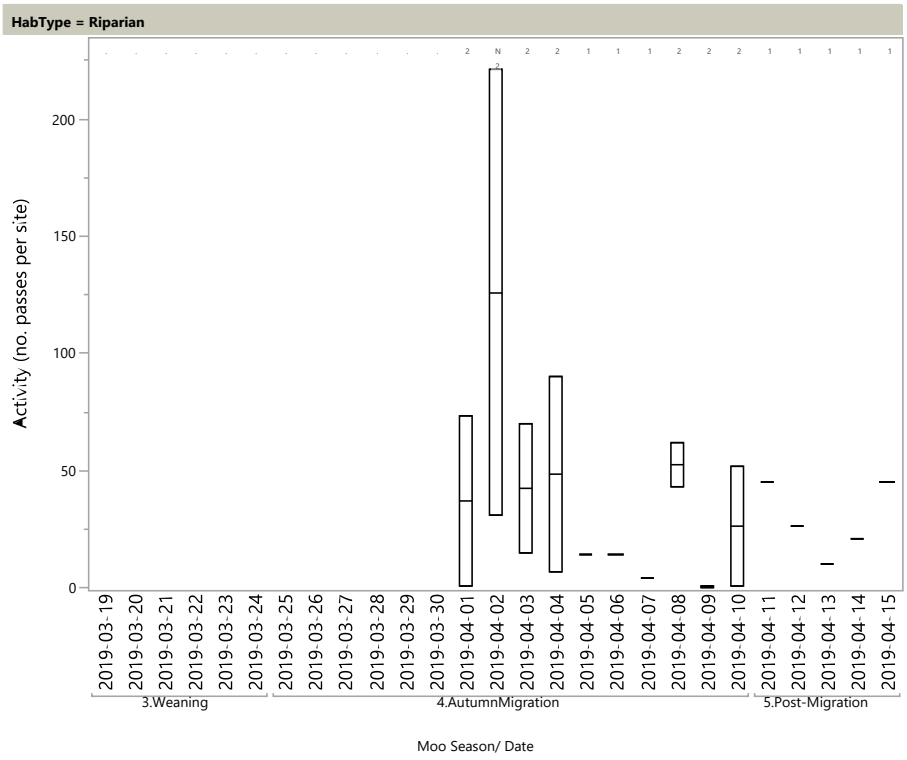

Figure 3-6: Riparian Nightly *Moo/Vespadelus* spp. activity surrounding the Moo Autumn Migration season by habitat type. All sites pooled, riparian habitat only and 45m sites excluded. n is shown at the top of the graph and all outliers are labelled with site name

3.2.2 Other Bat Species

Total bat activity was variable among sites, with April showing less activity overall than all other months (Figure 3-7)

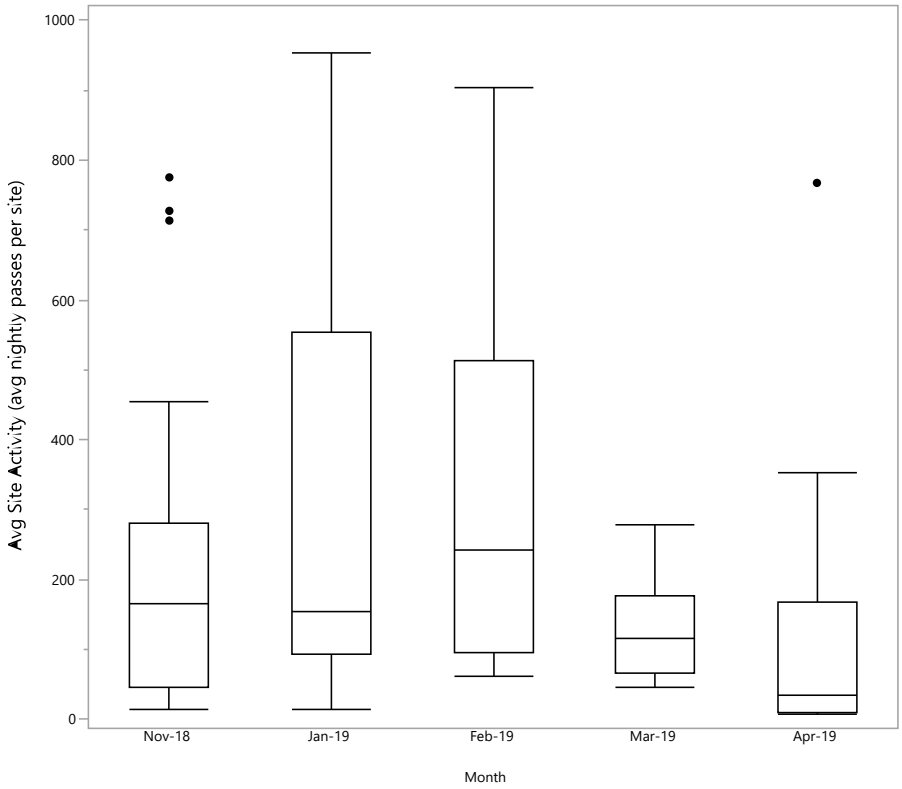

Figure 3-7: Average Total Bat Activity (average nightly passes per site) by month.

Direct comparison of activity levels among species is not recommended due to differences in detection and identification probabilities for each species. However, exploring whether there are seasonal changes in activity for each species may be useful for wind turbine operation.

Austronomus australis displayed the most obvious seasonal trend, showing high summer activity which decreased in spring and autumn in all habitat types (Figure 3-8). It is speculated by some researchers that *Austronomus australis* may migrate during winter in southern Australia and this may explain this activity pattern. However, other factors may also be responsible for this pattern such as maternity roost location, insect abundance or young beginning to fly.

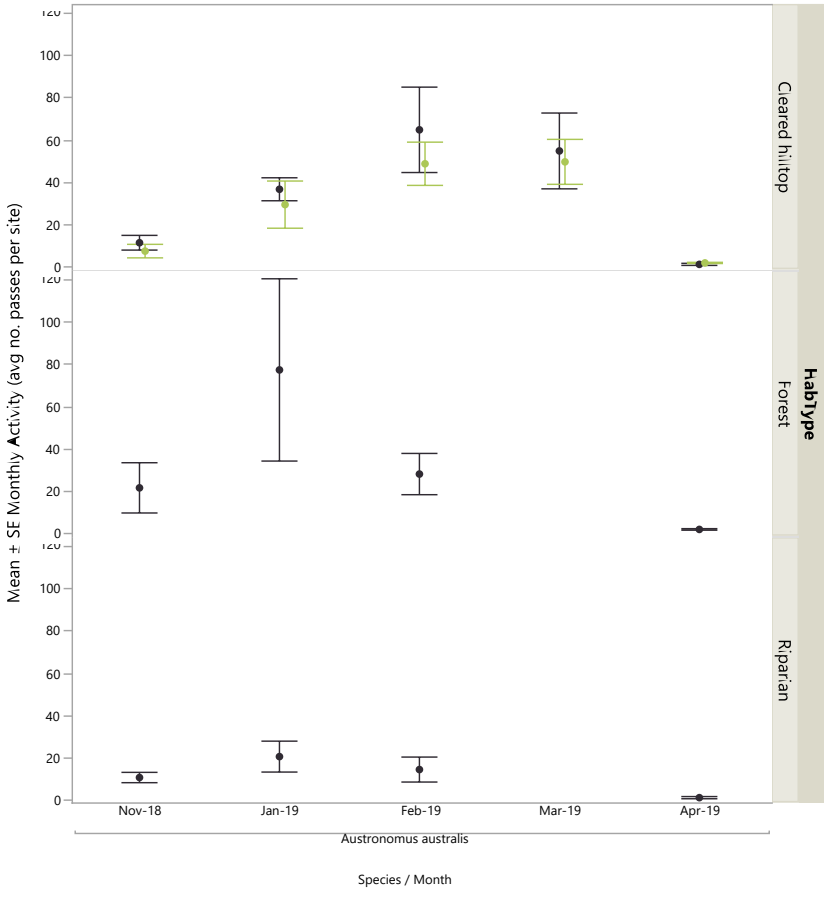

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Figure 3-8: Mean ± SE *Austronomus australis* Average nightly activity by month and habitat type.

The seasonal trend of other species is presented below in Figure 3-9, Figure 3-10 and Figure 3-11.

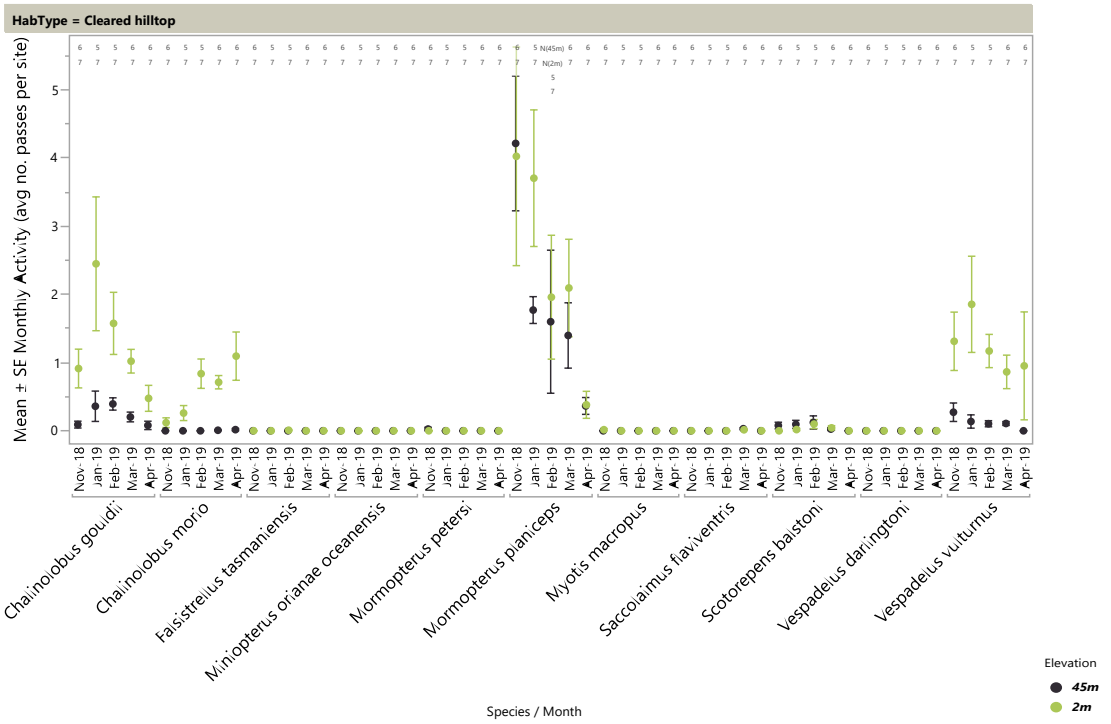


Figure 3-9: Cleared Hilltop Mean ± SE bat average nightly activity by month and habitat type.. Cleared hilltop habitat only. *Austronomus australis* excluded. n shown at top of graph.

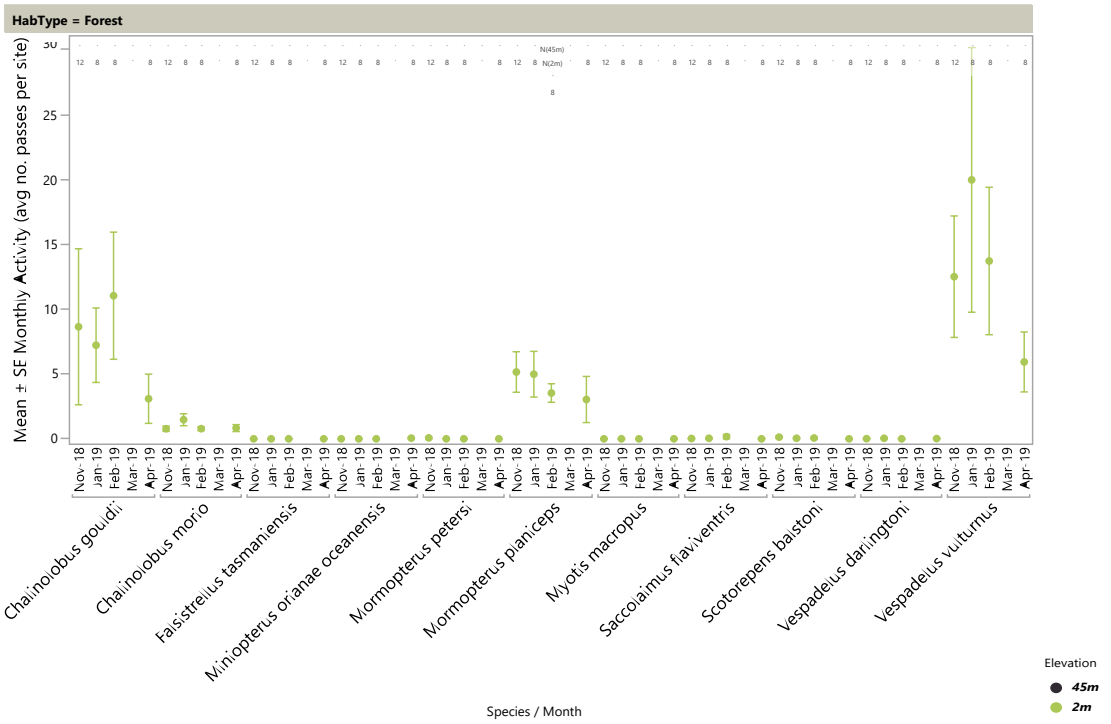


Figure 3-10: Forest Mean ± SE bat average nightly activity by month and habitat type. Forest habitat only. *Austronomus australis* excluded. n shown at top of graph.

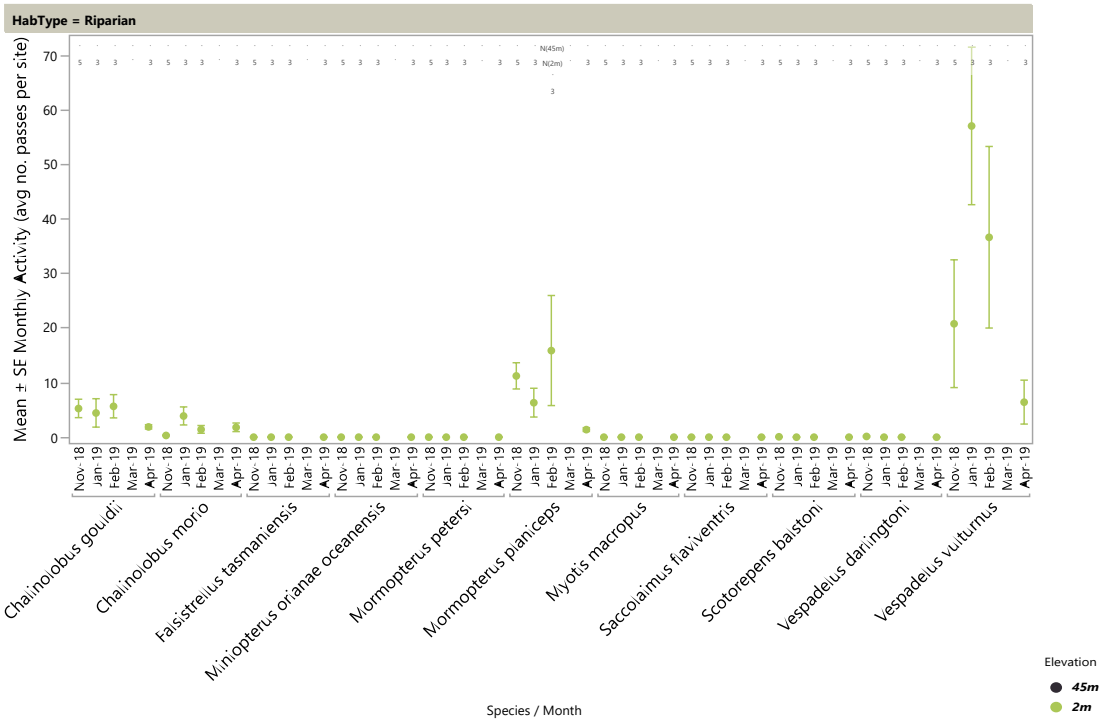


Figure 3-11: Riparian Mean ± SE bat average nightly activity by month and habitat type.. Riparian habitat only. *Austronomus australis* excluded. n shown at top of graph.

3.3 Elevational Activity Patterns

3.3.1 *Miniopterus orianae oceanensis*

A similar trend in seasonal Moo/Vespadelus and Vespadelus spp. activity is found at both 2m and 45m above ground elevation sites (Figure 3-12).

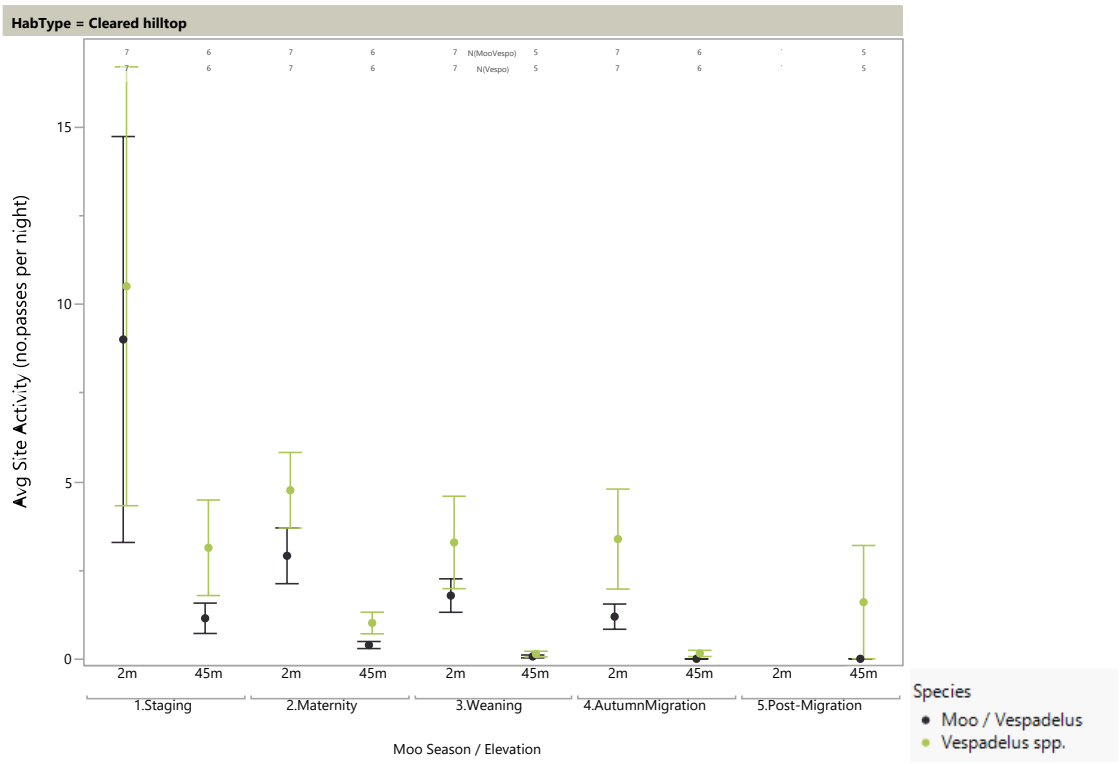


Figure 3-12: Mean ± SE average nightly *Moo / Vespadelus* spp. and *Vespadelus* spp. activity by Moo season and elevation from ground. Cleared Hilltop sites only. n is shown at the top of the graph

3.3.2 Other Bat Species

A total of eight species were confidently recorded (Definite and Probable identifications) at the 45m elevation above ground sites (Figure 3-9), being:

- *Austronomus australis;*
- *Chalinolobus gouldii;*
- *Chalinolobus morio;*
- *Mormopterus petersi;*
- *Mormopterus planiceps;*
- *Saccolaimus flaviventris;*
- *Scotorepens balstoni; and*
- *Vespadelus vulturnus*.

Only *Austronomus australis* and *Mormopterus planiceps* showed consistent activity at the 45 m elevation sites (Figure 3-8; Figure 3-9);. *Chalinolobus gouldii, Scotorepens balstoni* and *Vespadelus vulturnus* showed occasional low activity (Figure 3-9) and the remaining species (*Chalinolobus morio, Mormopterus petersi* and *Saccolaimus flaviventris*) had only 1-2 passes on 1-2 separate nights.

Austronomus australis showed only slightly lower activity levels at the 45m sites as the 2m sites (Figure 3-8). *Chalinolobus gouldii* and *Vespadelus vulturnus* were much more active at the 2m above ground sites, than the 45m sites (Figure 3-9).

3.4 Nightly Activity Patterns

3.4.1 *Miniopterus orianae oceanensis*

The nightly activity patterns of Moo/Vespadelus calls by *M.o.oceanensis* season are presented in Figure 3-13, Figure 3-14 and Figure 3-15 below.

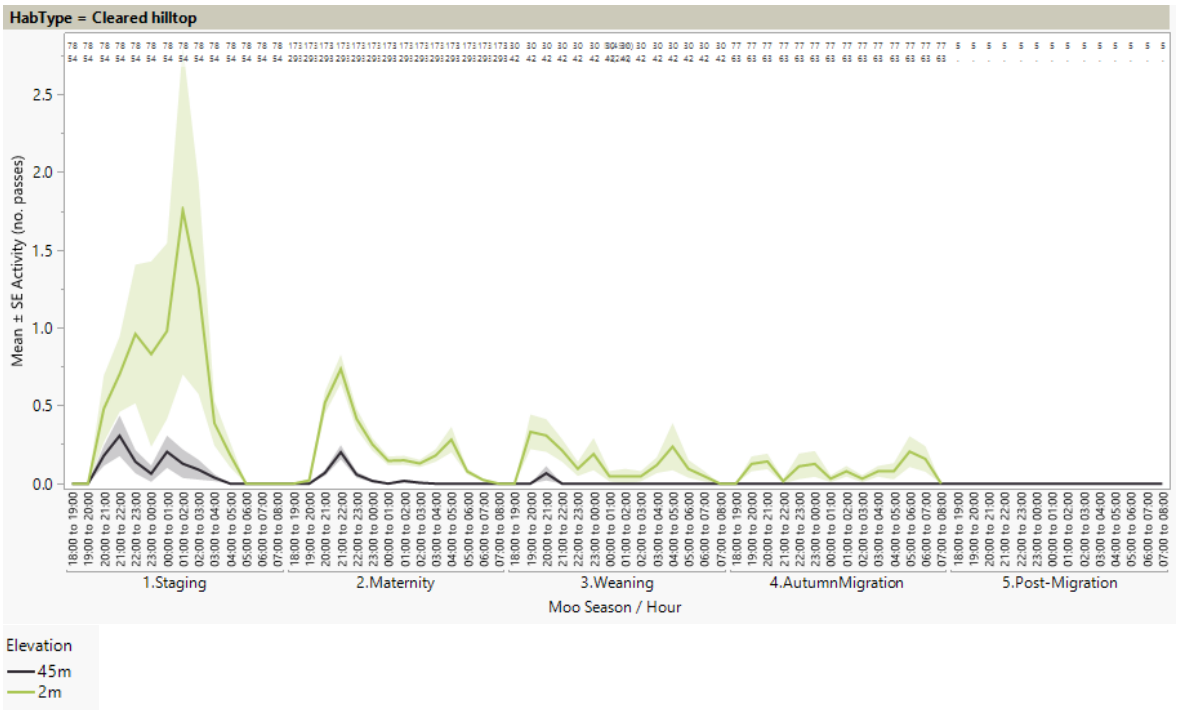


Figure 3-13: Mean ± SE hourly *Moo/Vespadelus* spp. activity by hour, Moo season and elevation from ground. Cleared Hilltop sites only. All sites pooled. n is shown at the top of the graph. Times have not been converted to time since sunset.

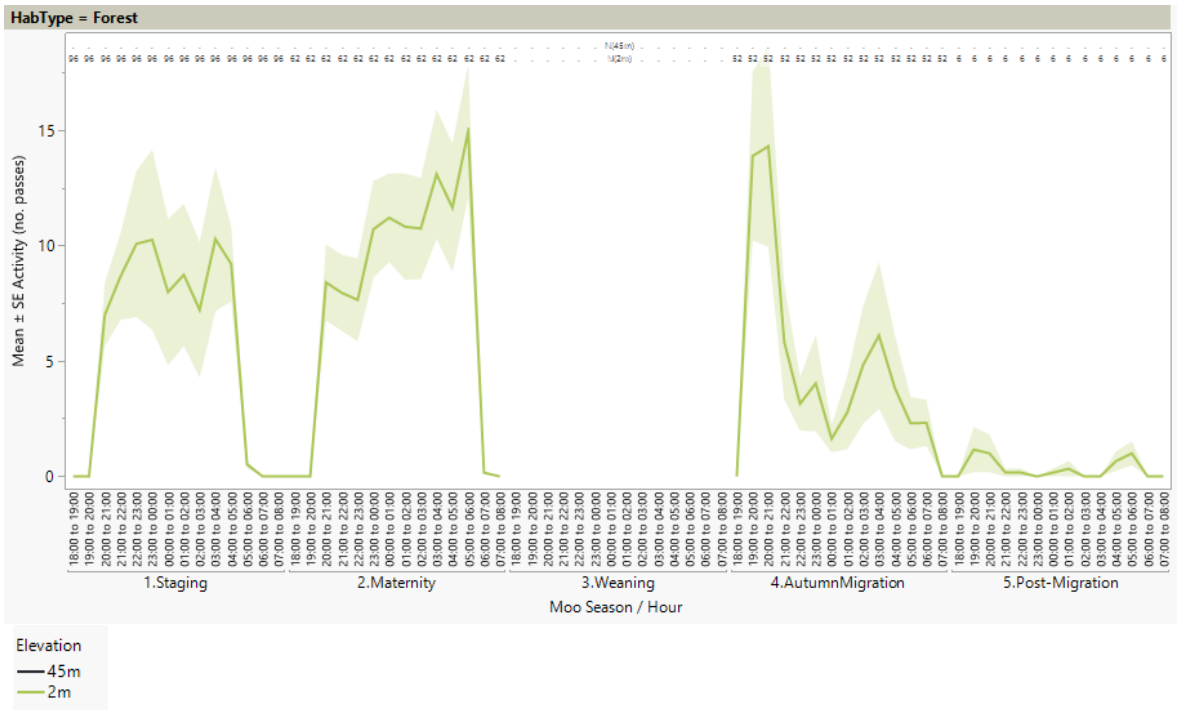


Figure 3-14: Mean ± SE hourly *Moo/Vespadelus* spp. activity by hour, Moo season and elevation from ground. Forest sites only. All sites pooled. n is shown at the top of the graph. Times have not been converted to time since sunset.

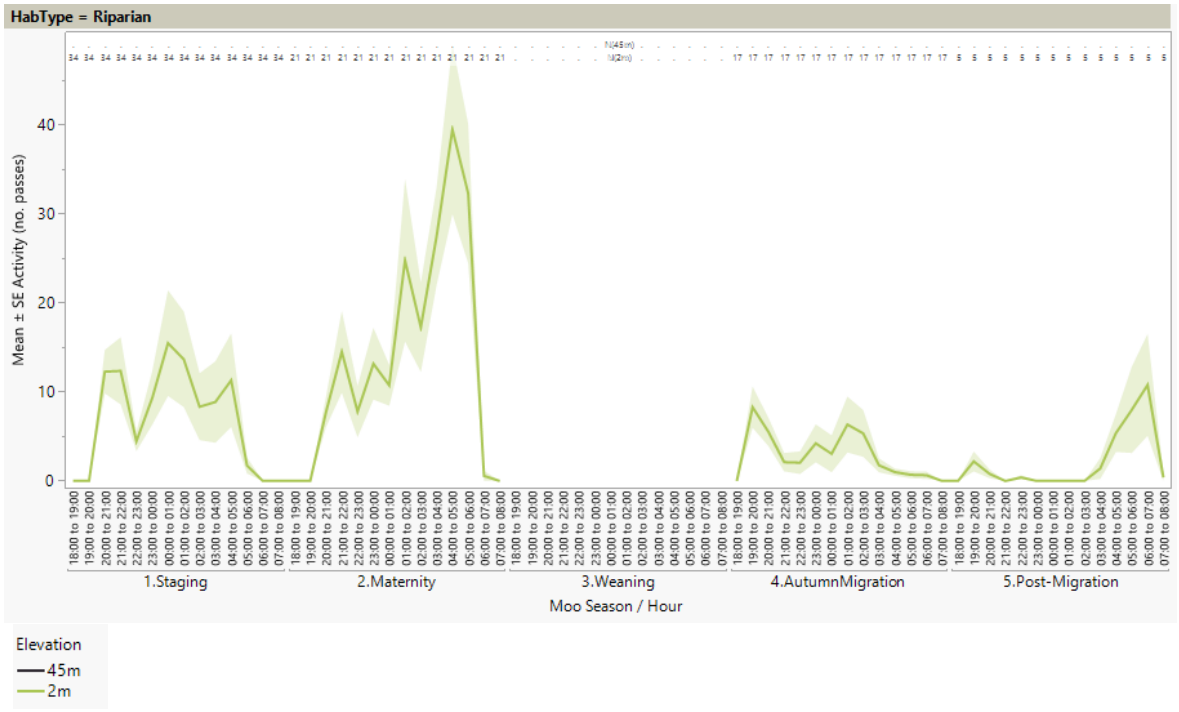


Figure 3-15: Mean ± SE hourly *Moo/Vespadelus* spp. activity by hour, Moo season and elevation from ground. Riparian sites only. All sites pooled. n is shown at the top of the graph. Times have not been converted to time since sunset.

3.4.2 Other Bat Species

During warmer months total bat activity peaked on dusk and then gradually dropped off after midnight (Figure 3-16). However, in April, when conditions are often cooler, bat activity peaks on dusk and drops off much more steeply after the first 2-3 hours (Figure 3-16).

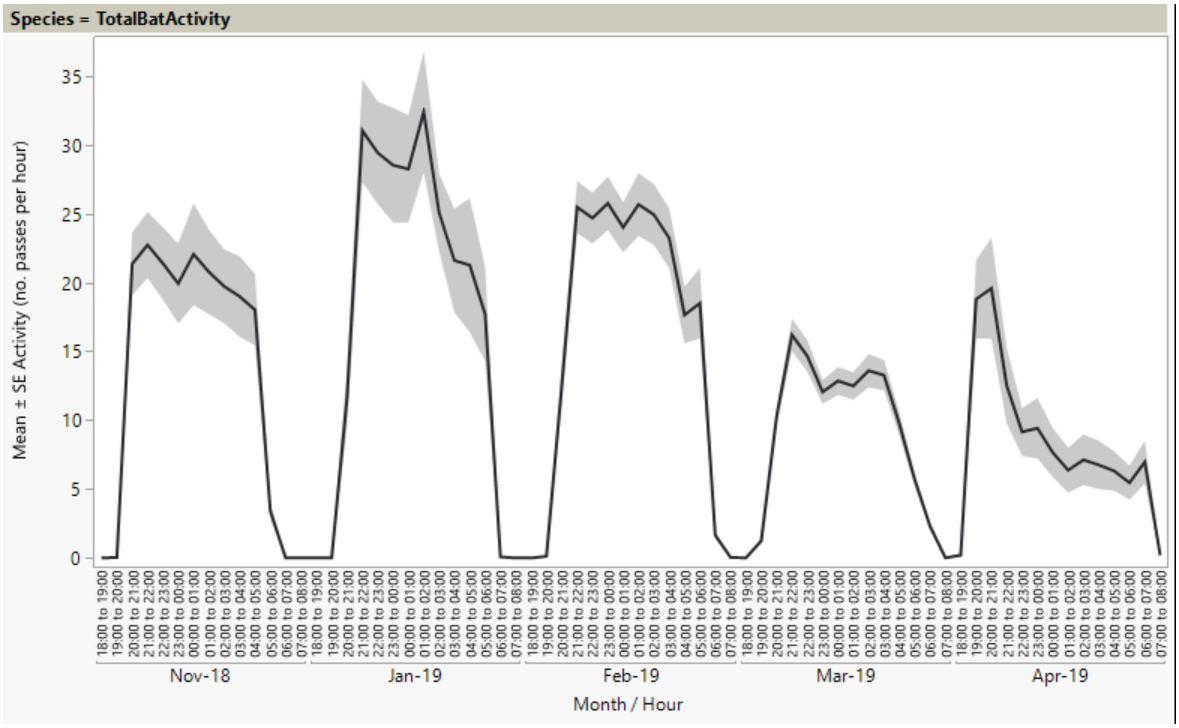


Figure 3-16: Mean ± SE hourly total bat activity by month. All sites pooled. Times have not been converted to time since sunset.

The nightly activity patterns for other bat species (only species with > 0.5 average passes per hour have been included in graphs) are shown below in Figure 3-17, Figure 3-18, Figure 3-19 and Figure 3-20.

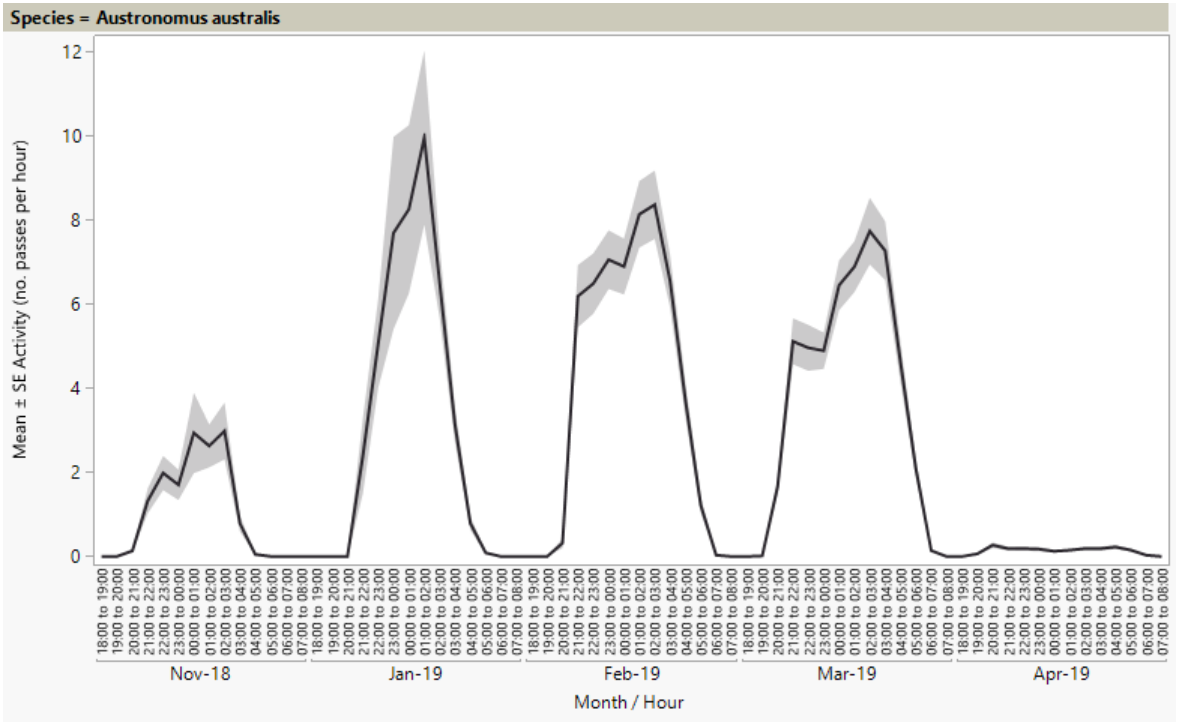


Figure 3-17: Mean ± SE hourly *Austronomus australis* activity by month. All sites pooled. Times have not been converted to time since sunset.

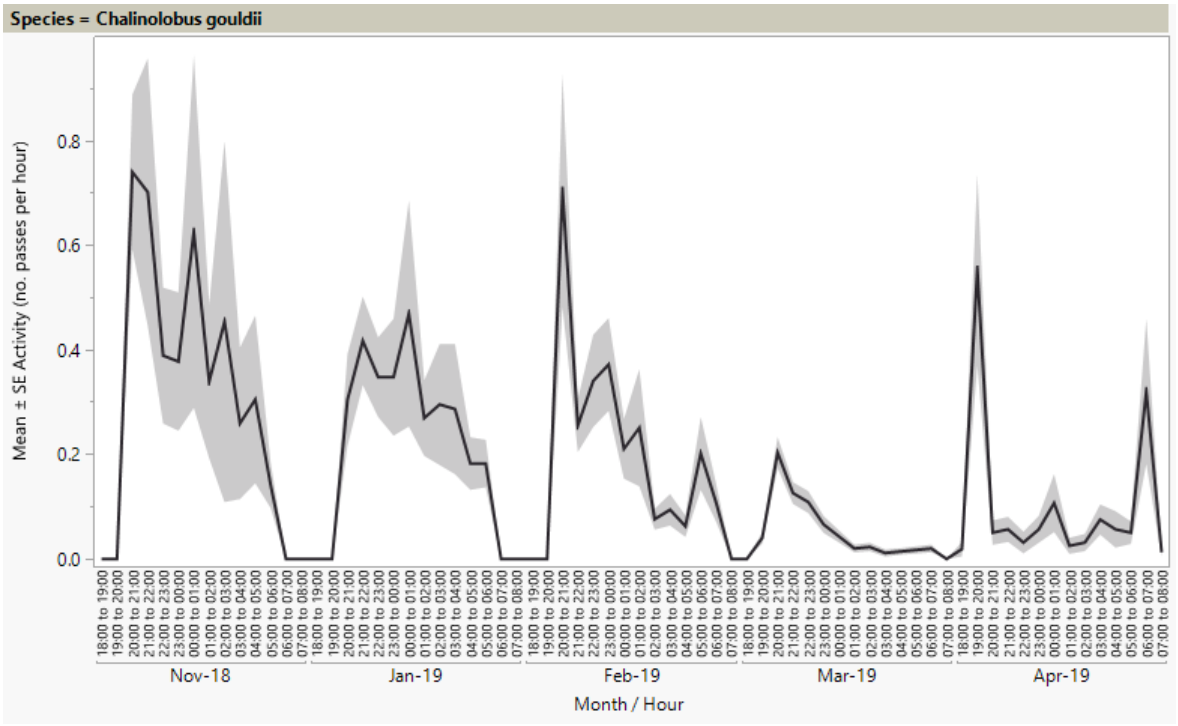


Figure 3-18: Mean ± SE hourly *Chalinolobus gouldii* activity by month. All sites pooled. Times have not been converted to time since sunset.

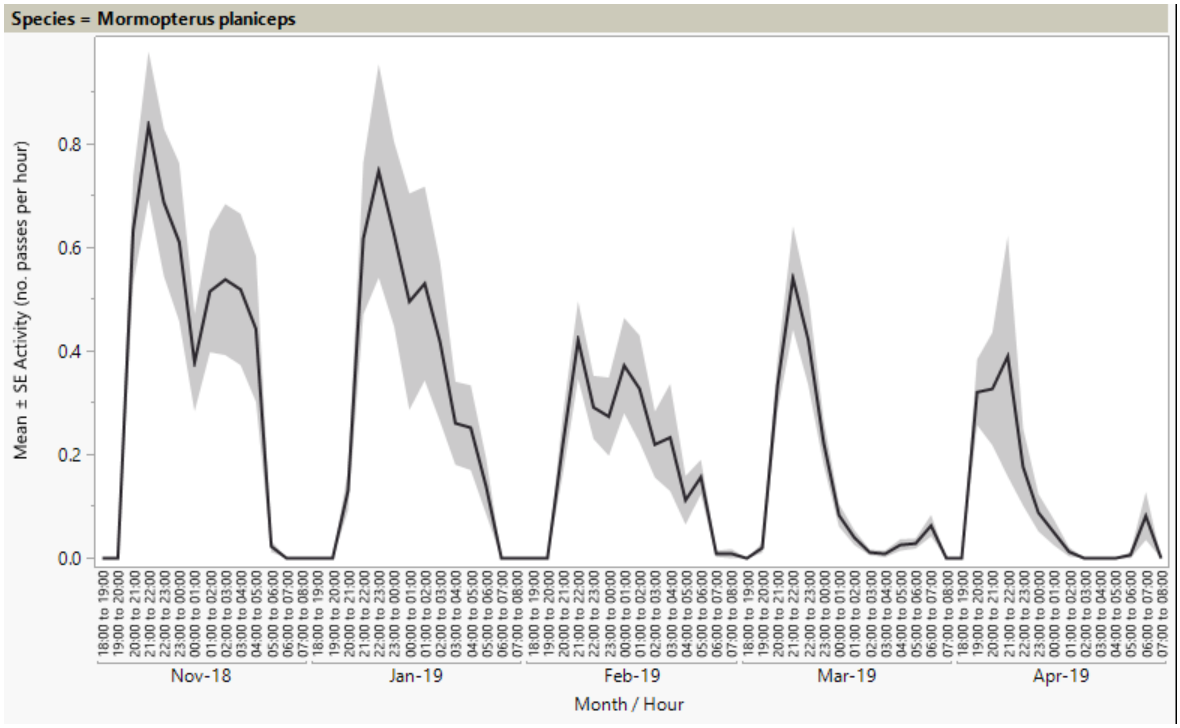


Figure 3-19: Mean ± SE hourly *Mormopterus planiceps* activity by month. All sites pooled. Times have not been converted to time since sunset.

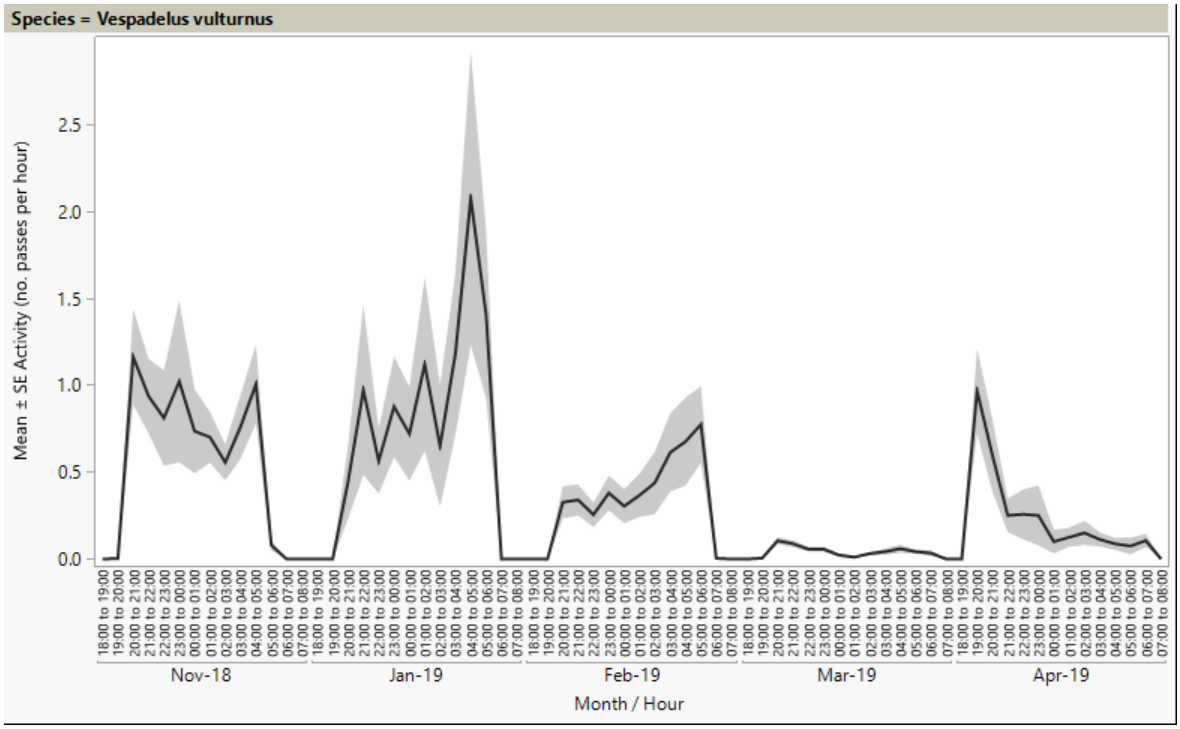


Figure 3-20: Mean ± SE hourly *Vespadelus vulturnus* activity by month. All sites pooled. Times have not been converted to time since sunset.

4.0 REFERENCES

Echo Ecology and Surveying 2020 *Bat Call Identification: Rye Park Wind Farm, NSW*, prepared for Umwelt (Australia) Pty Ltd.

APPENDIX A SITE DETAILS

Site	HabType	Elevation	Description
BGC01	Riparian	2m	Paddock tree amongst scattered E. melliodora, water in minor creek approx. 30 m from detector.
BGC02	Riparian	2m	Paddock tree amongst scattered E. melliodora, water in minor creek approx. 30 m from detector.
BGC03	Riparian	2m	On box-gum woodland edge, over shallow gully with dense Typha.
BGC04	Forest	2m	On edge of open box-gum woodland and *E. rossii/ E. macrorhyncha* dry sclerophyll forest.
BGC05	Forest	2m	In dense shrubland.
BGCRP4	Cleared hilltop	2m	Located on bare hilltop
BGI01	Riparian	2m	On box-gum woodland edge, over gully containing occasional small pools.
BGI02	Forest	2m	On edge of small clearing in *E. rossii/ E. macrorhyncha* dry sclerophyll forest.
BGI03	Forest	2m	In patch of *E. rossii/ E. macrorhyncha* dry sclerophyll forest. No water nearby.
BGI04	Forest	2m	Dense *rossii/ E. macrorhyncha* dry sclerophyll forest on hill slope near top of ridge.
BGI05	Forest	2m	Dense *rossii/ E. macrorhyncha* dry sclerophyll forest on hill slope near top of ridge.
BGI06	Forest	2m	In patch of *E. rossii/ E. macrorhyncha* dry sclerophyll forest.
BGI07	Riparian	2m	Paddock tree amongst scattered E. melliodora, water in minor creek approx. 30 m from detector.
BGI08	Forest	2m	In patch of *E. rossii/ E. macrorhyncha* dry sclerophyll forest. No water nearby.
BGI09	Forest	2m	On edge of *E. rossii/ E. macrorhyncha* dry sclerophyll forest near shrubland.
BGI10	Forest	2m	In very small patch of *E. rossii/ E. macrorhyncha* dry sclerophyll forest. Surrounded by shrubland.

Site	HabType	Elevation	Description
BGI11	Forest	2m	In patch of *E. rossii/ E. macrorhyncha* dry sclerophyll forest.
BGI12	Forest	2m	On edge of *E. rossii/ E. macrorhyncha* dry sclerophyll forest above dry gully.
BGIRP2	Cleared hilltop	2m	Located on bare hilltop
BGIRP3	Cleared hilltop	2m	Located on bare hilltop
BGIRP5	Cleared hilltop	2m	Located on bare hilltop
BGIRP6	Cleared hilltop	2m	Located on bare hilltop
BGIRP8	Cleared hilltop	2m	Located on bare hilltop
BGIYAS	Cleared hilltop	2m	Located on bare hilltop
BMCRP 4	Cleared hilltop	45m	Located on bare hilltop
BMIRP2	Cleared hilltop	45m	Located on bare hilltop
BMIRP3	Cleared hilltop	45m	Located on bare hilltop
BMIRP5	Cleared hilltop	45m	Located on bare hilltop
BMIRP6	Cleared hilltop	45m	Located on bare hilltop
BMIRP8	Cleared hilltop	45m	Located on bare hilltop

APPENDIX B PER SITE GRAPHS

Autumn Migration Moo/Vespadelus Activity Per Night Per Site

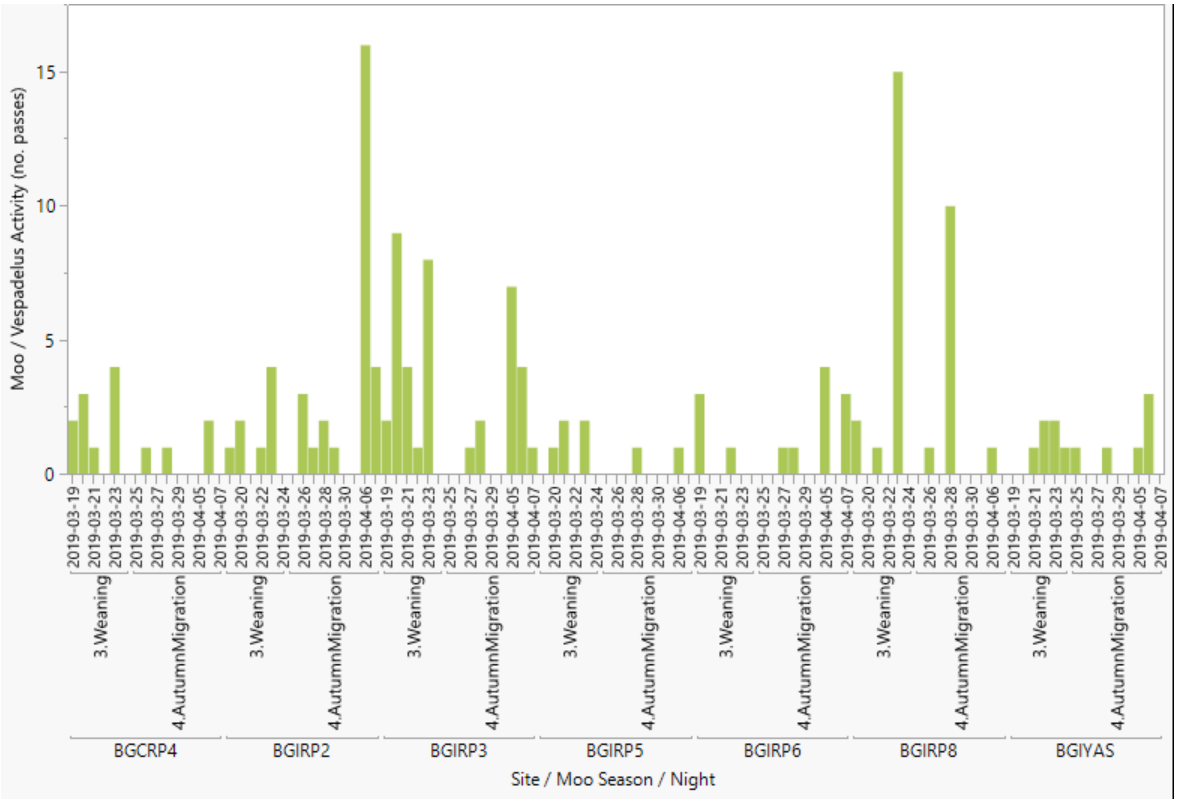


Figure A1: Cleared Hilltop 2m Nightly Moo/Vespadelus activity during the Autumn migration period (including immediately before and after) by site for 2m above ground sites on cleared hilltops only.

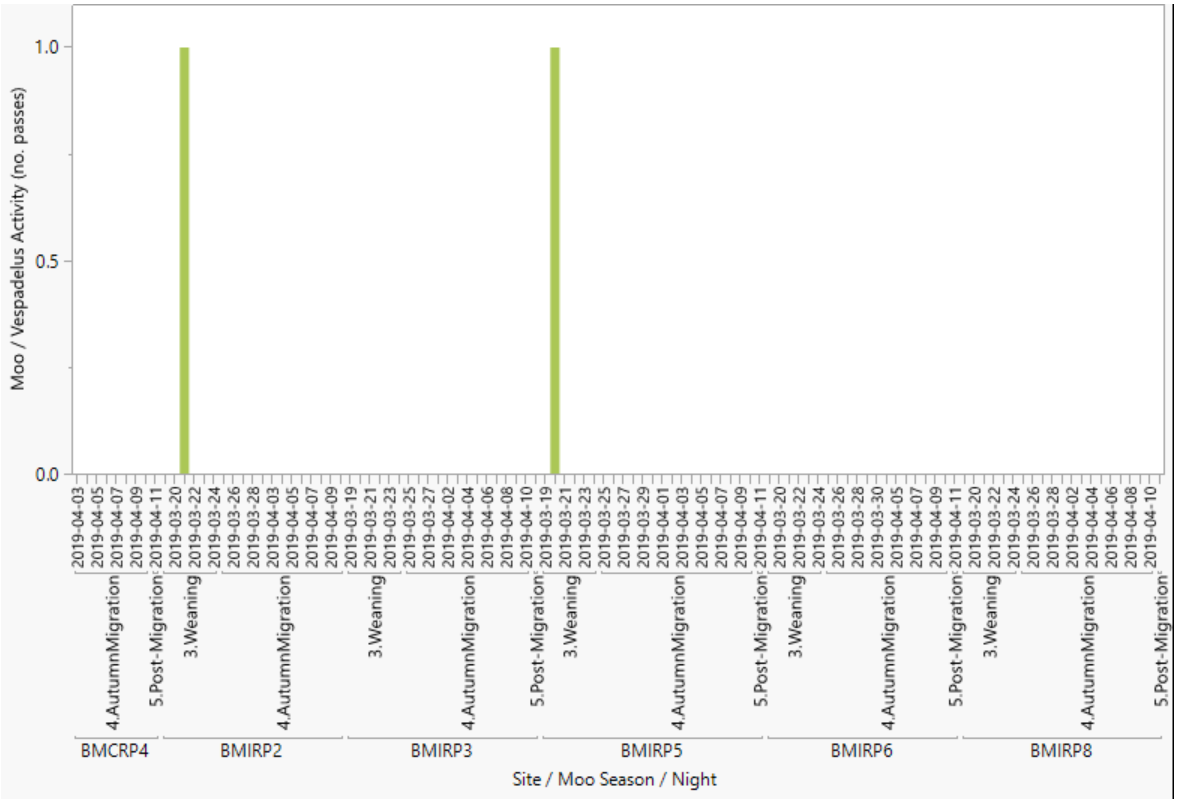


Figure A2: Cleared Hilltop 45m Nightly Moo/Vespadelus activity during the Autumn migration period (including immediately before and after) by site for 45m above ground sites on cleared hilltops only.

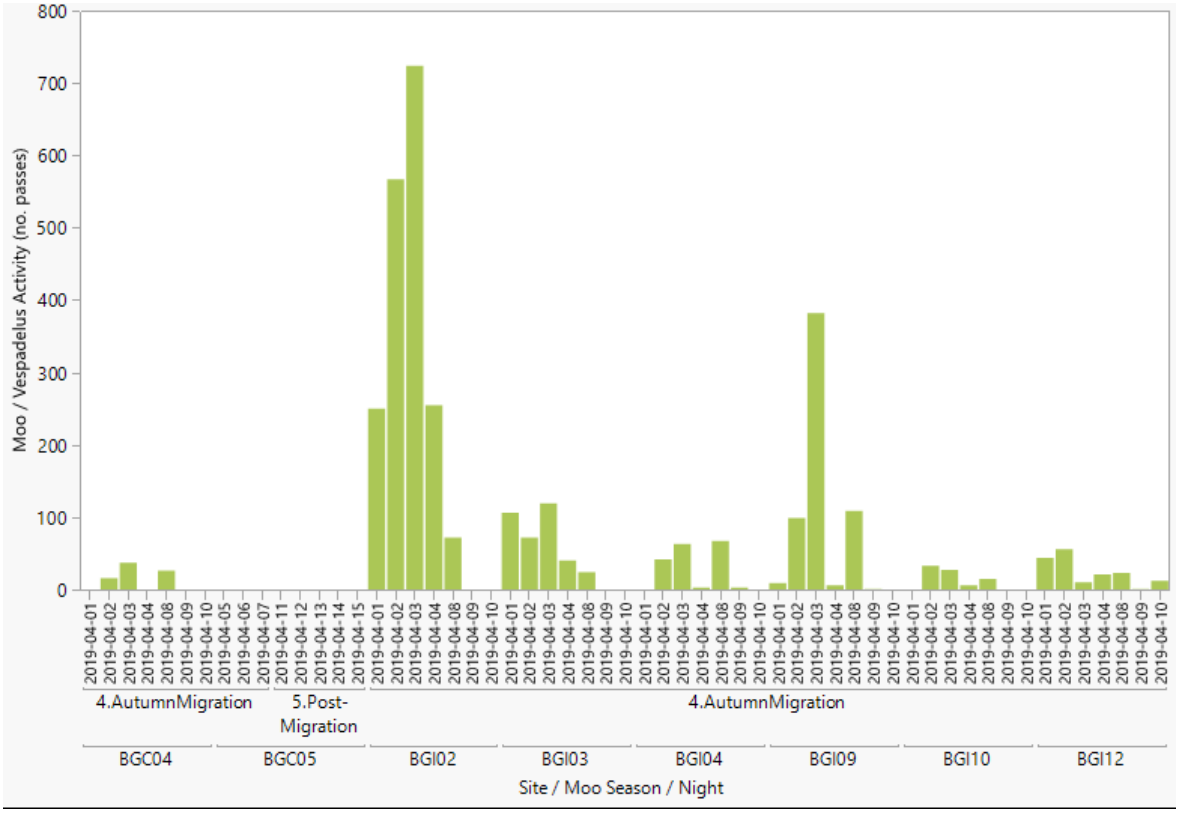


Figure A3: Forest 2m Nightly Moo/Vespadelus activity during the Autumn migration period (including immediately before and after) by site and including forested sites only.

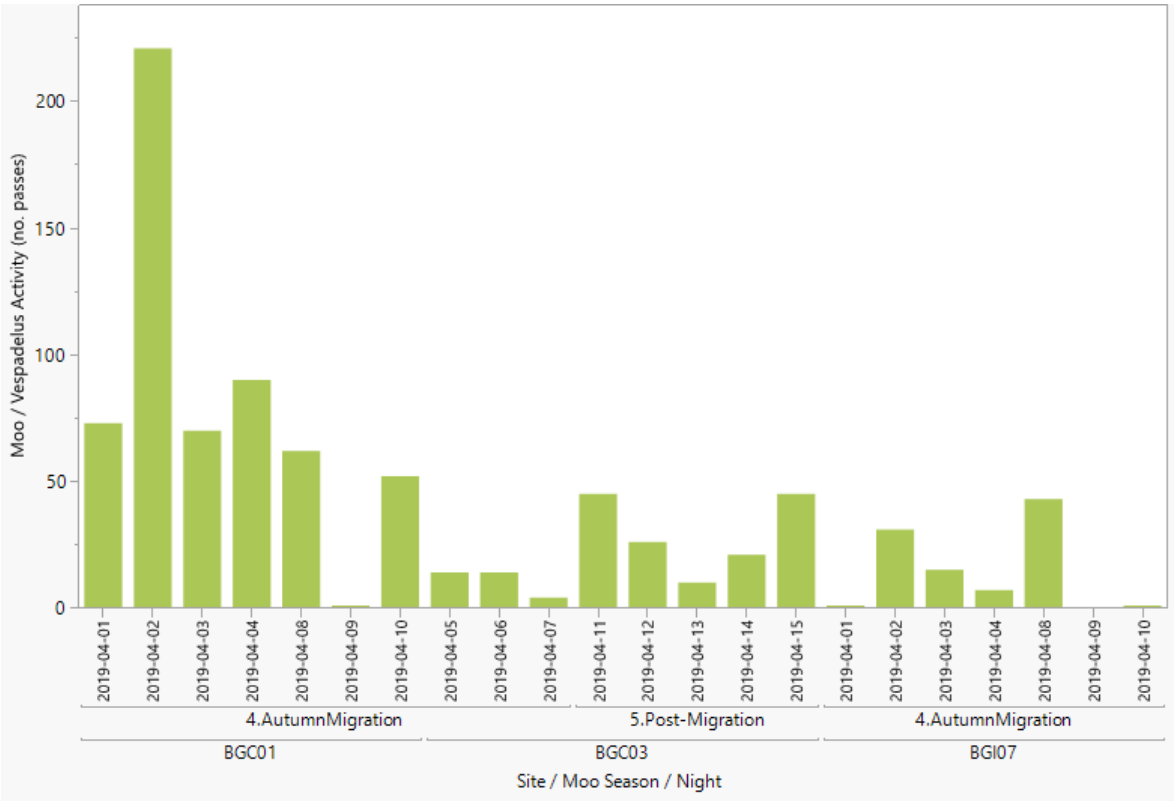
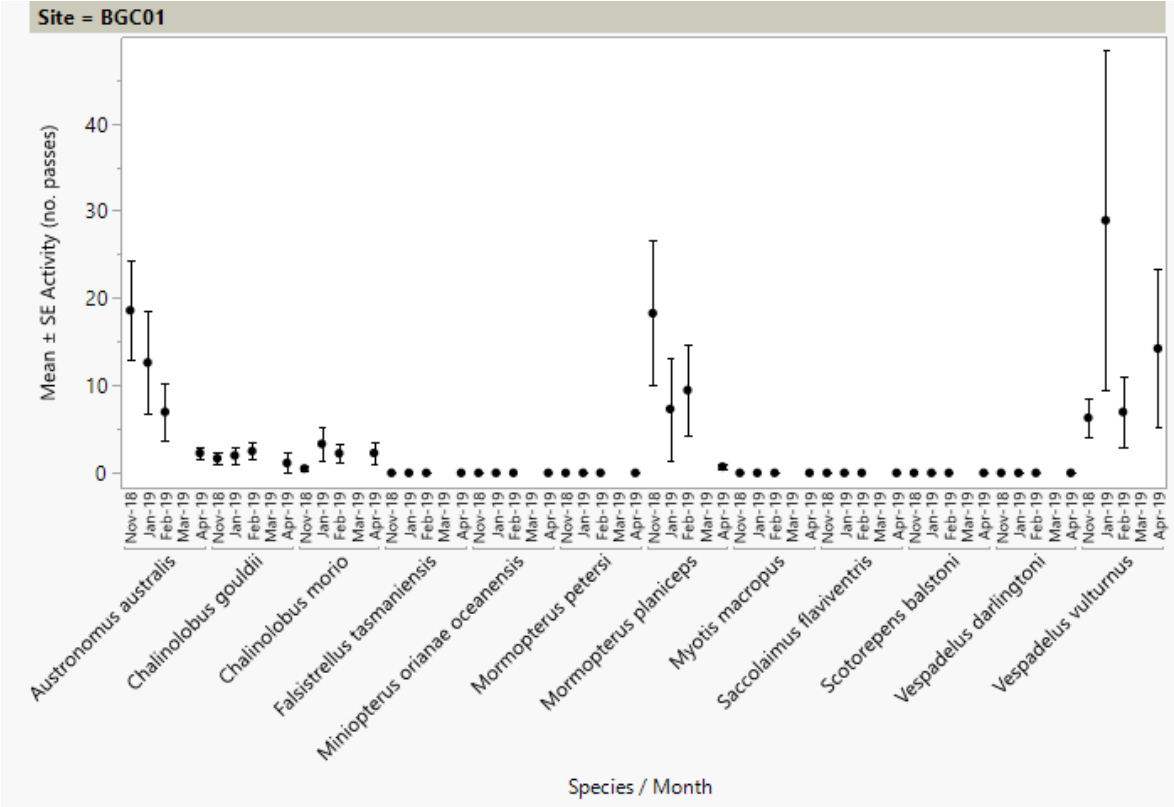
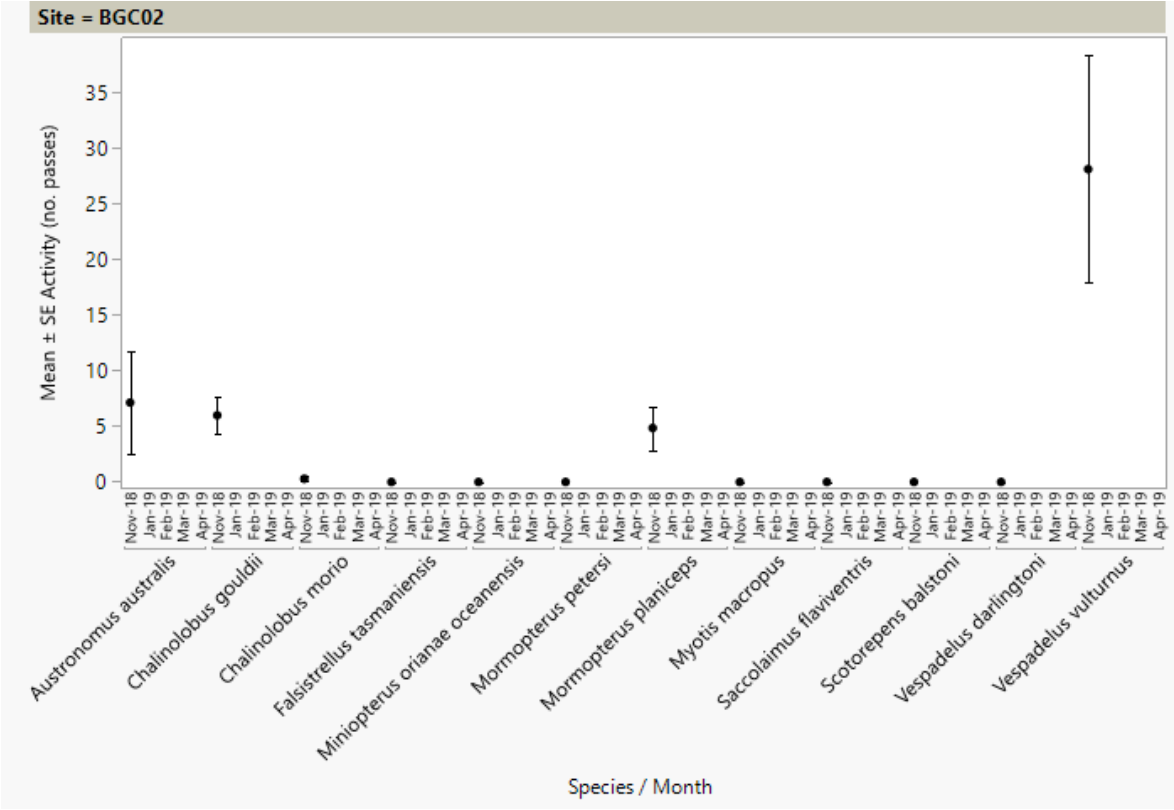
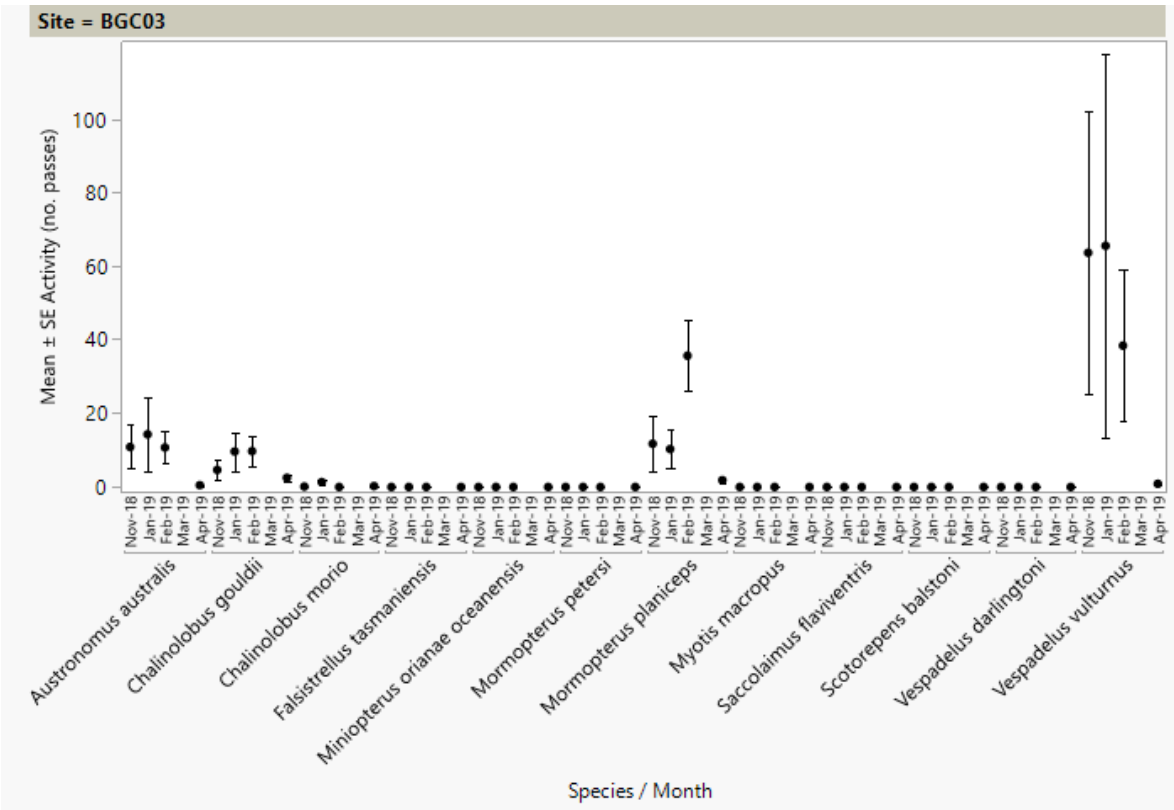


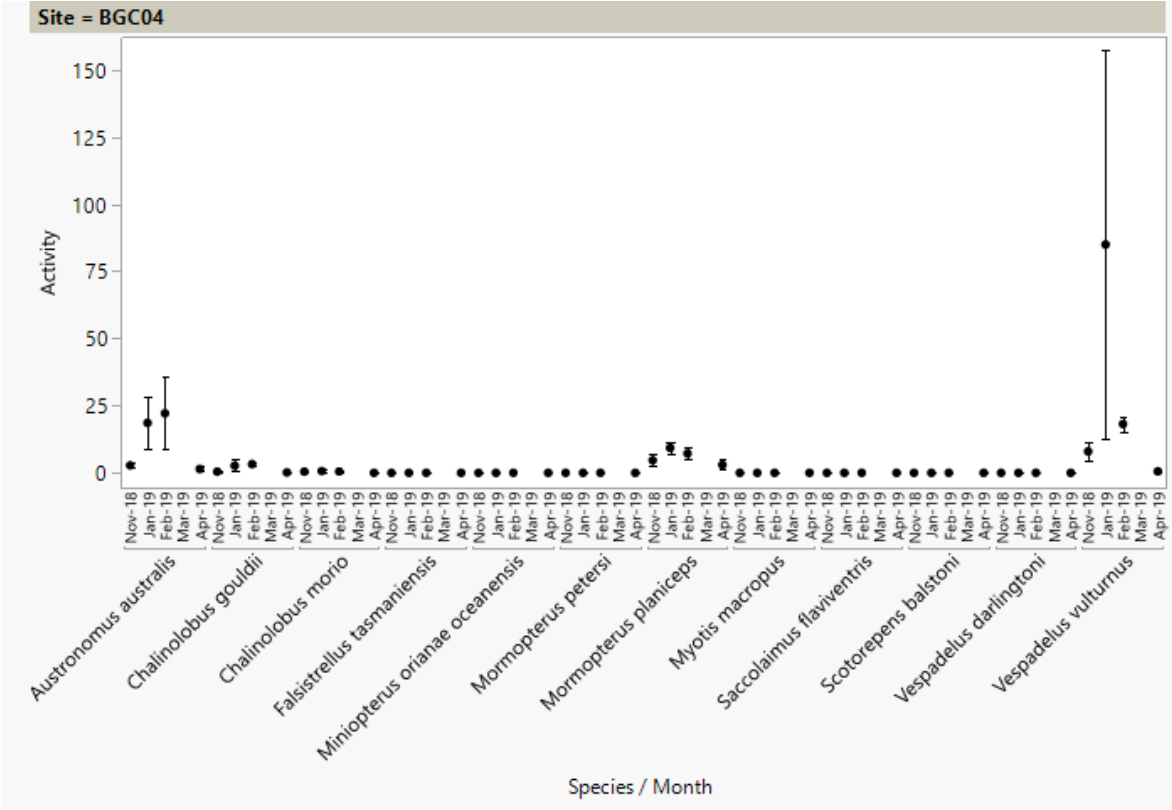
Figure A4: Riparian 2m Nightly Moo/Vespadelus activity during the Autumn migration period (including immediately before and after) by site and including riparian sites only.

All Species Activity




Site = BGC02
Mean ± SE Activity (no. passes)
0
5
10
15
20
25
30
35
Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month


Site = BGC03
Mean ± SE Activity (no. passes)
0
20
40
60
80
100
Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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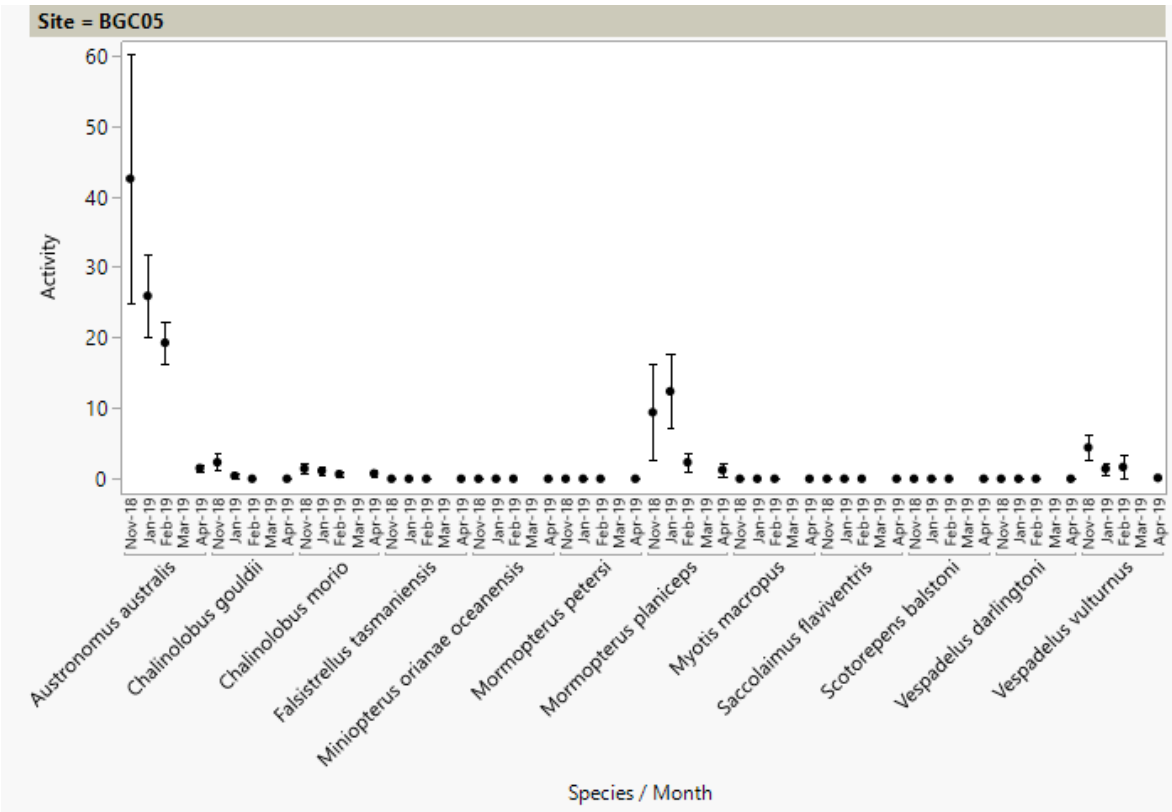
Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
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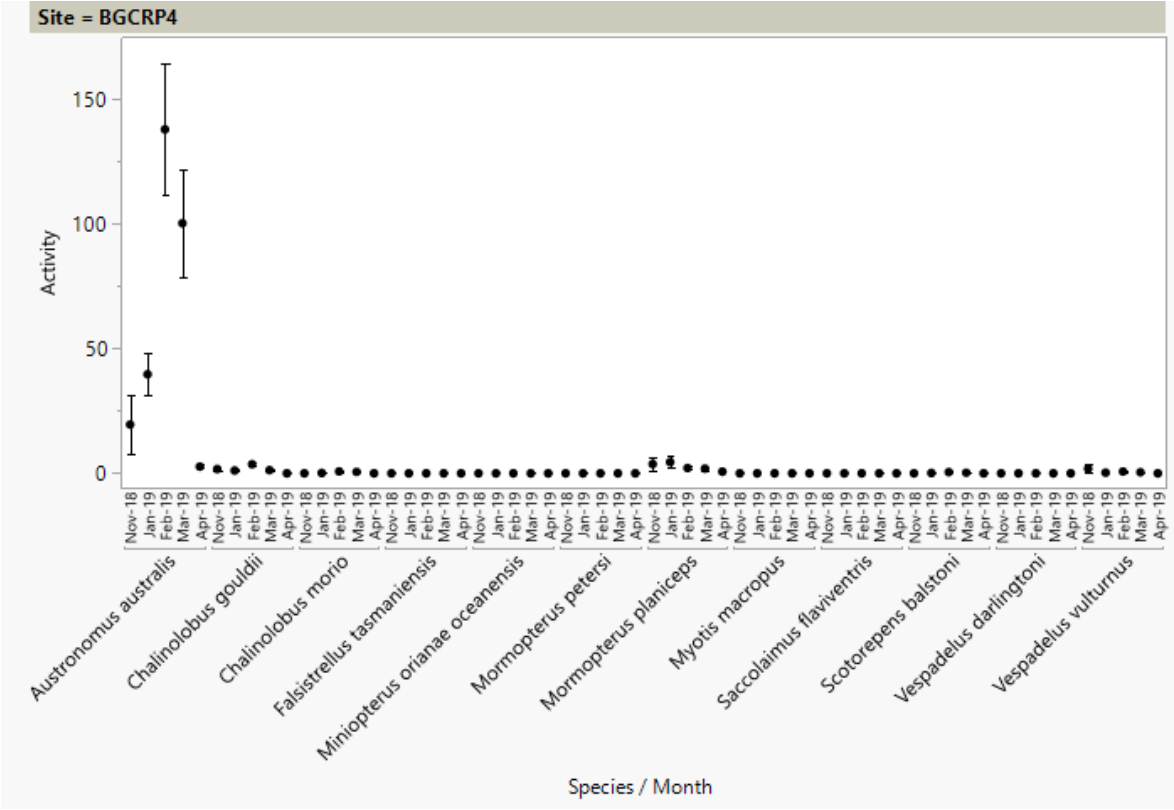
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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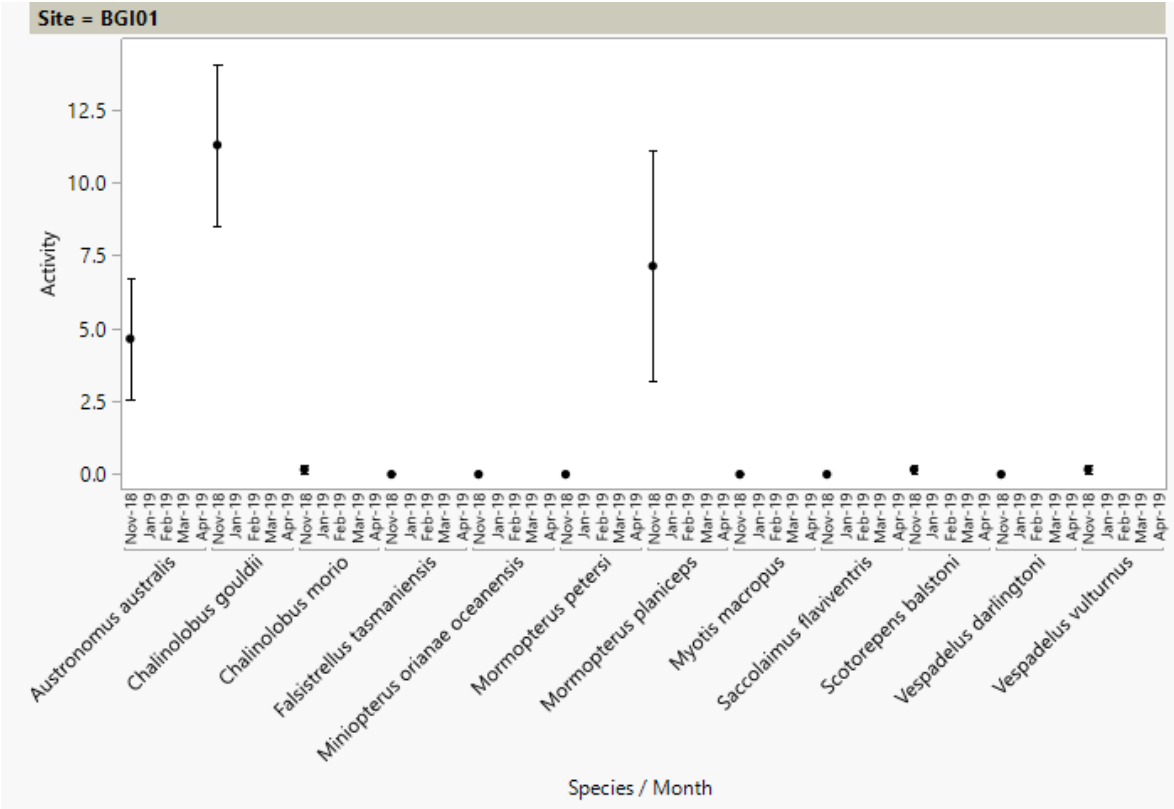
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Mar-19
Apr-19
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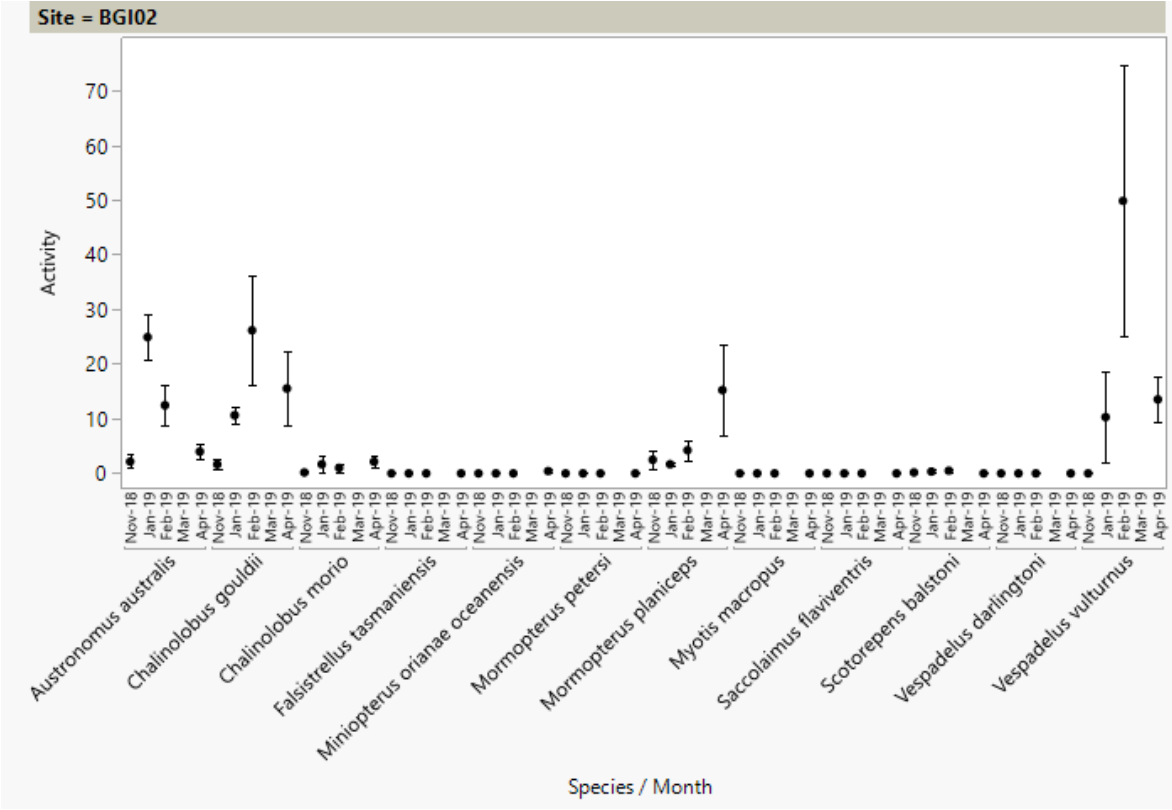
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Nov-18
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Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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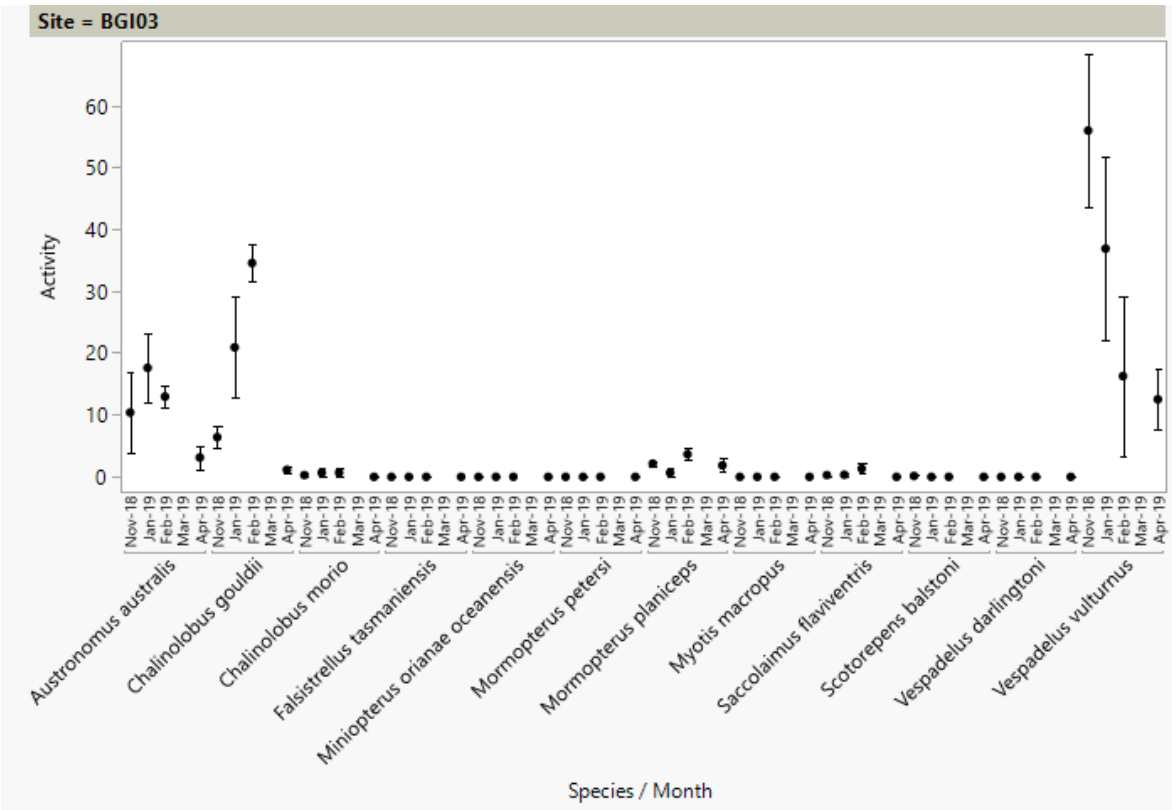
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
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Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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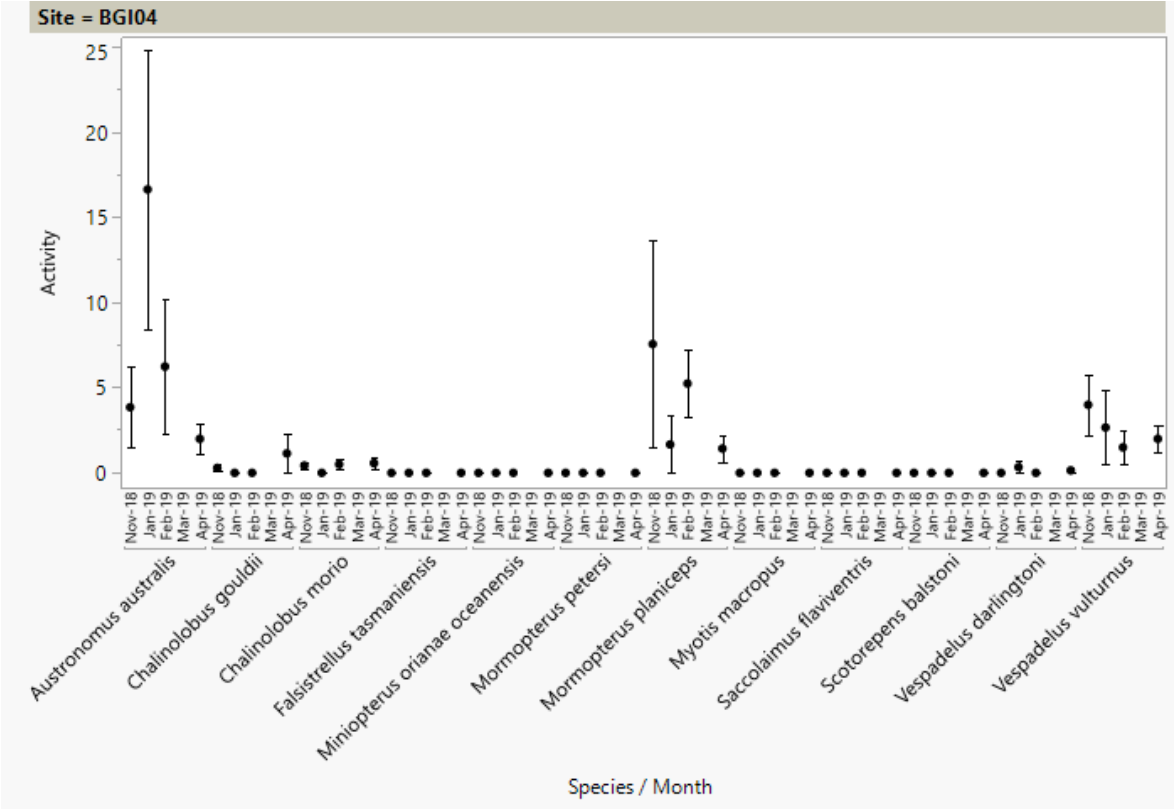
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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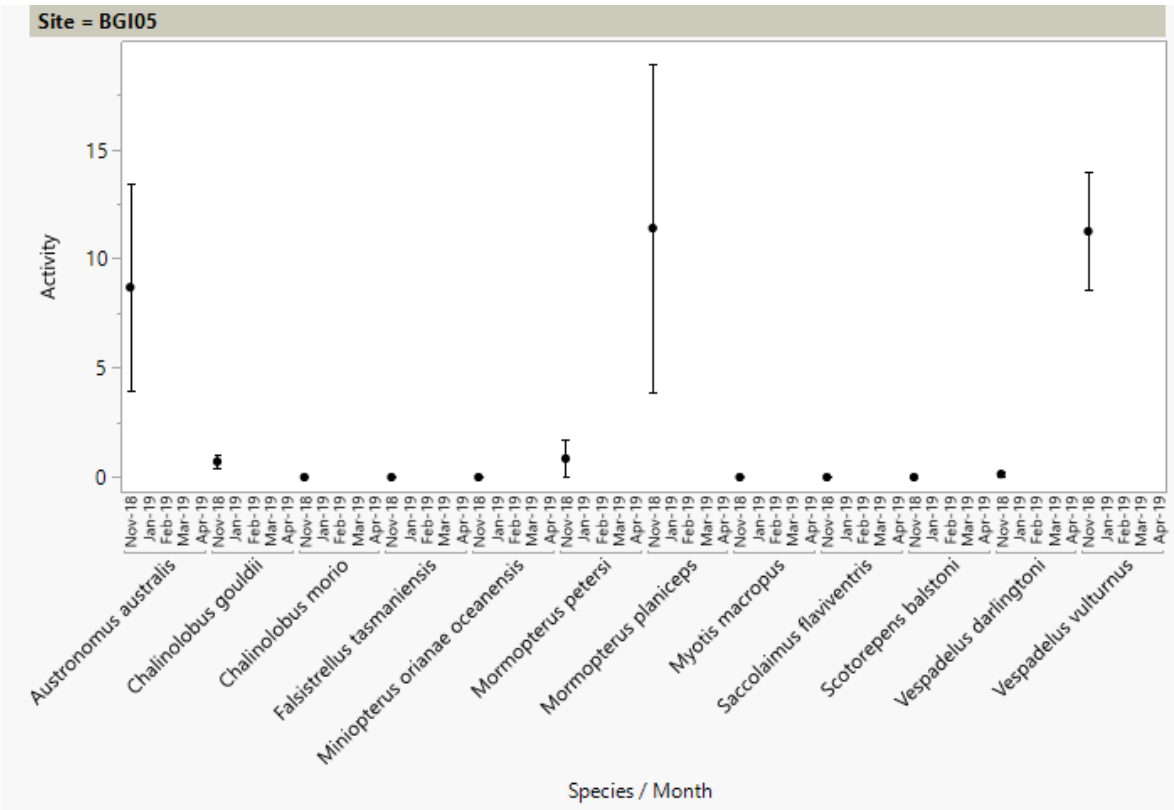
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
Feb-19
Mar-19
Apr-19
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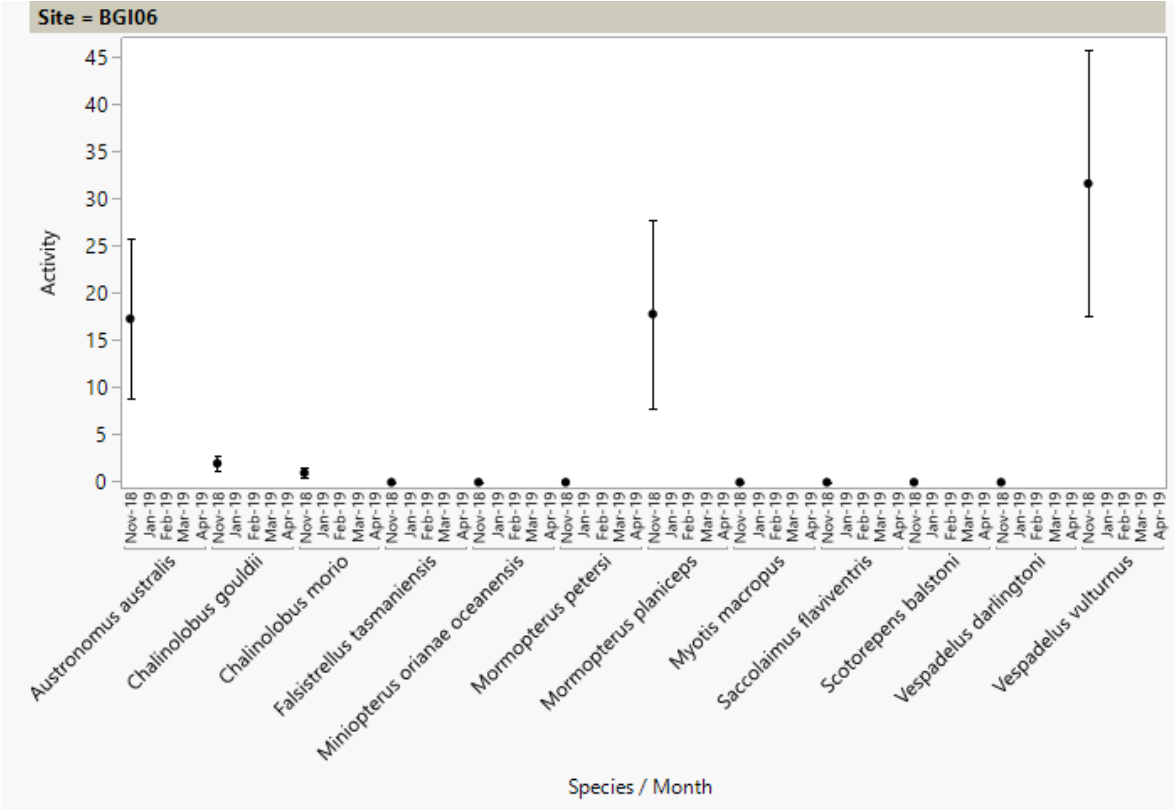
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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35
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45
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Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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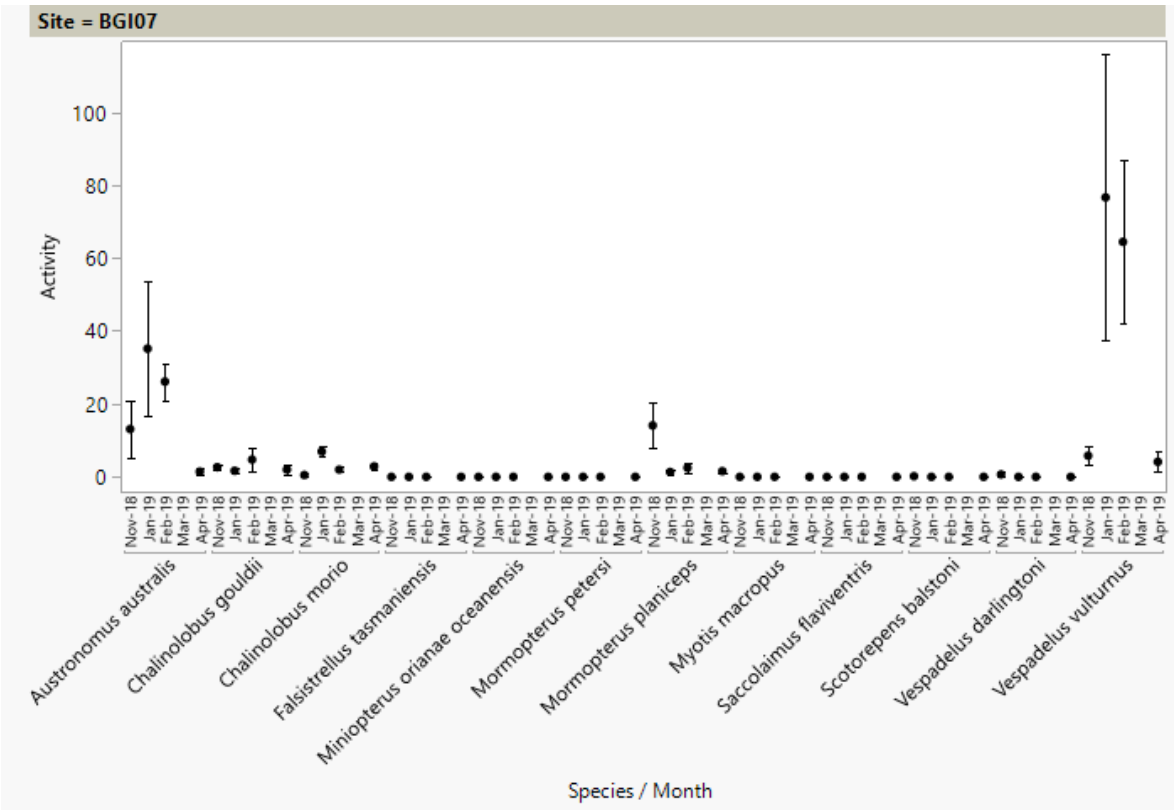
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
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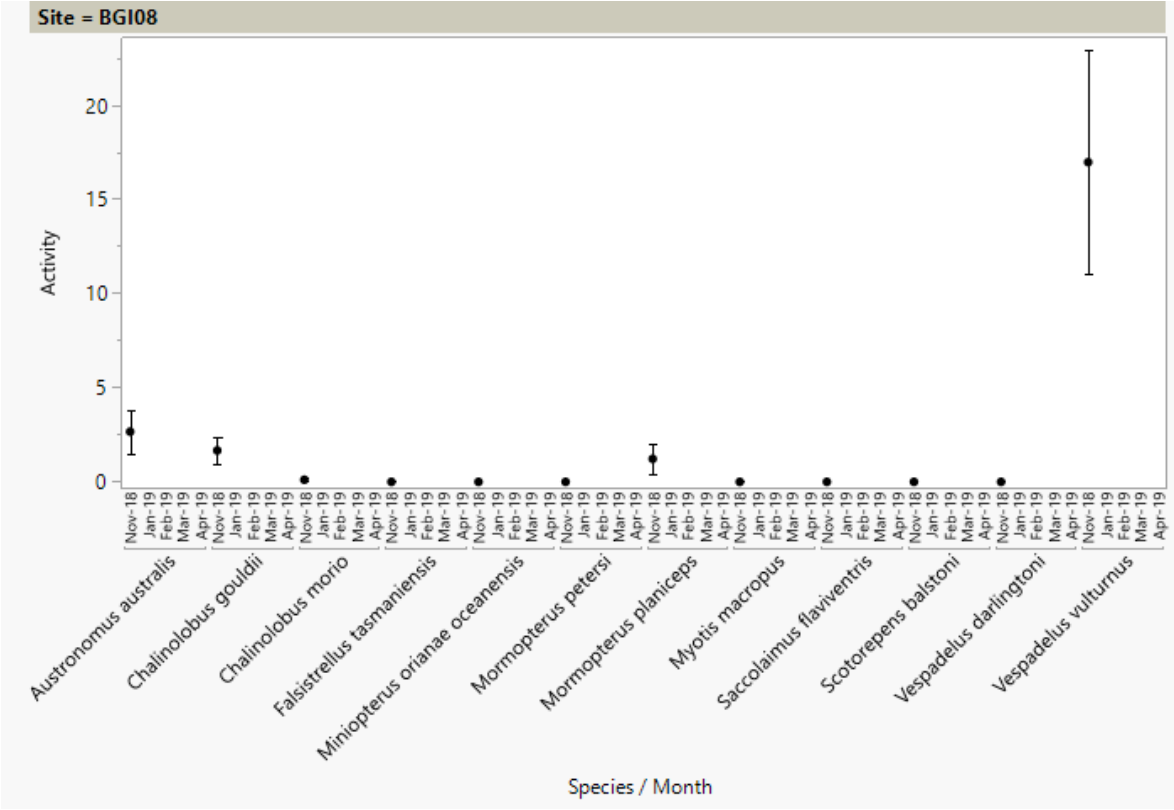
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Mar-19
Apr-19
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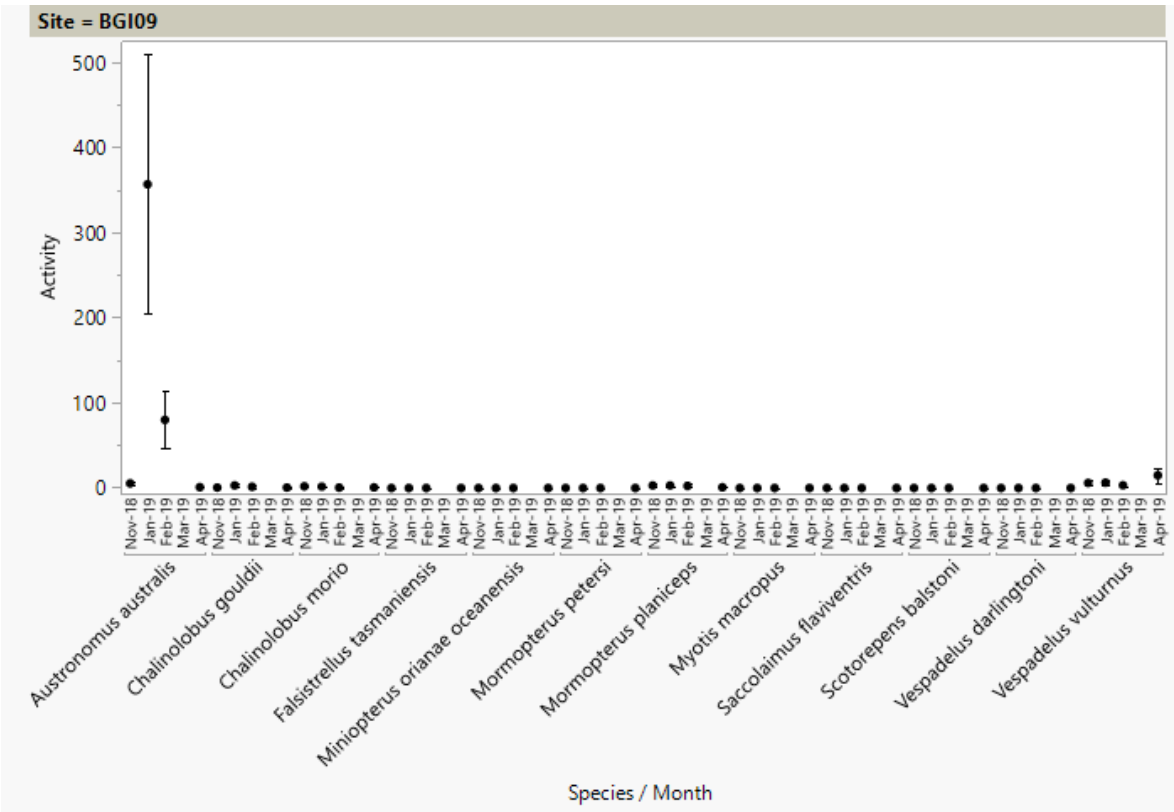
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
Feb-19
Mar-19
Apr-19
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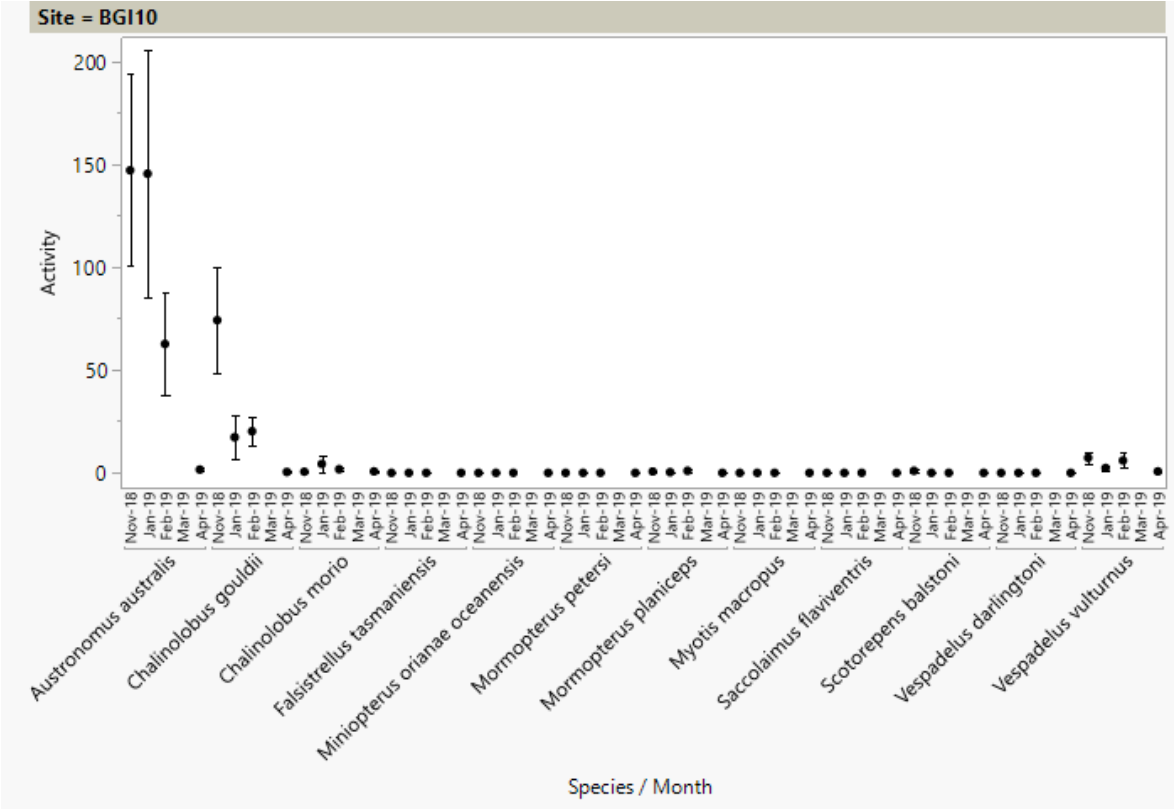
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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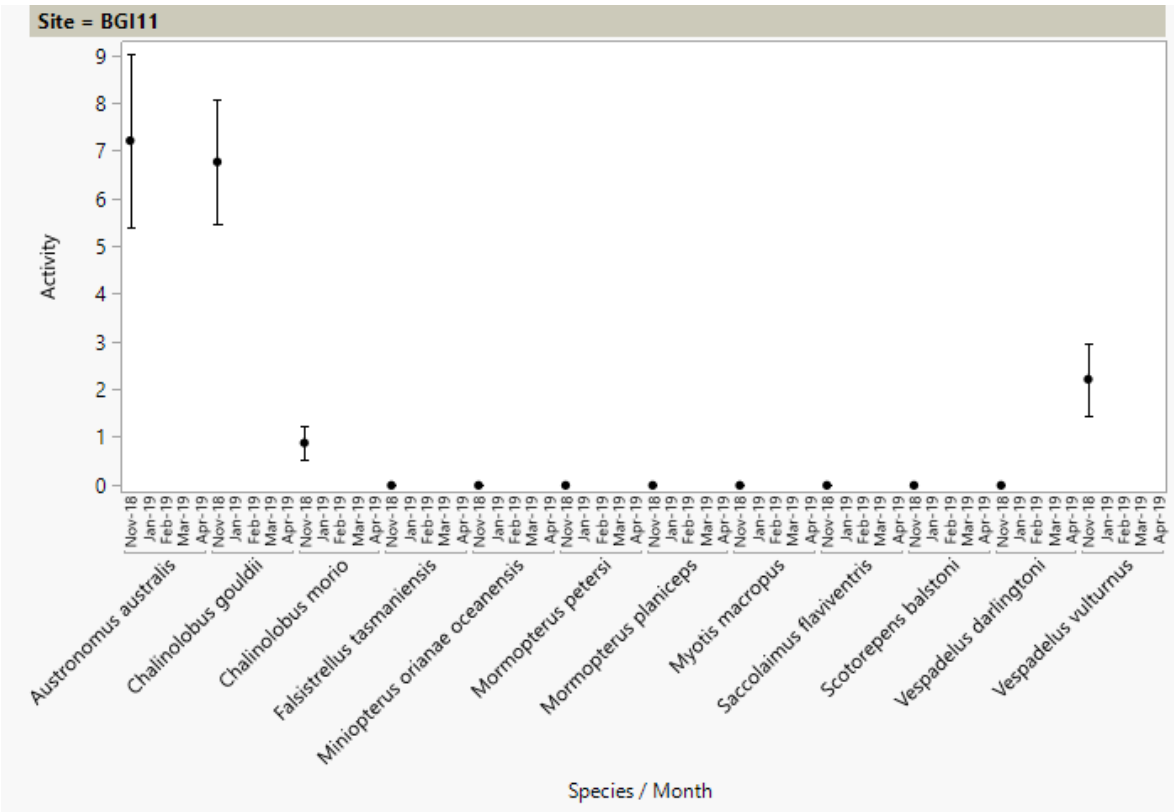
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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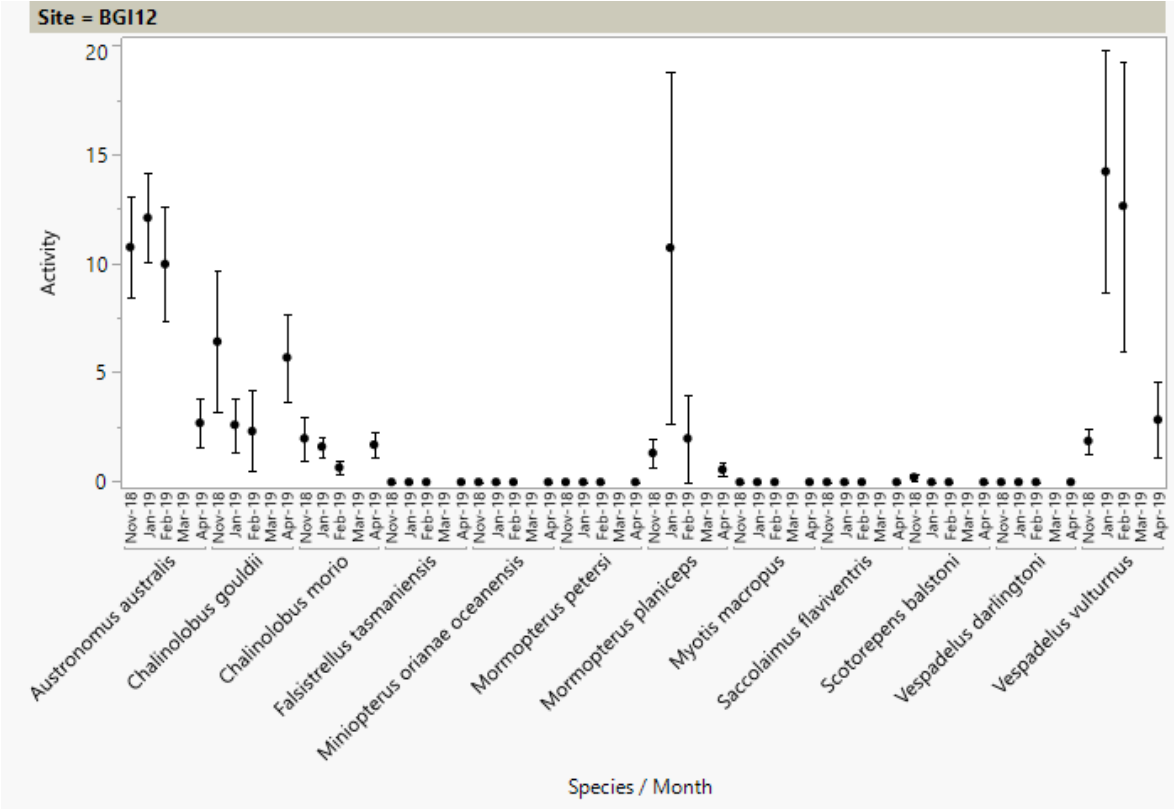
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Mar-19
Apr-19
Austronomus australis
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Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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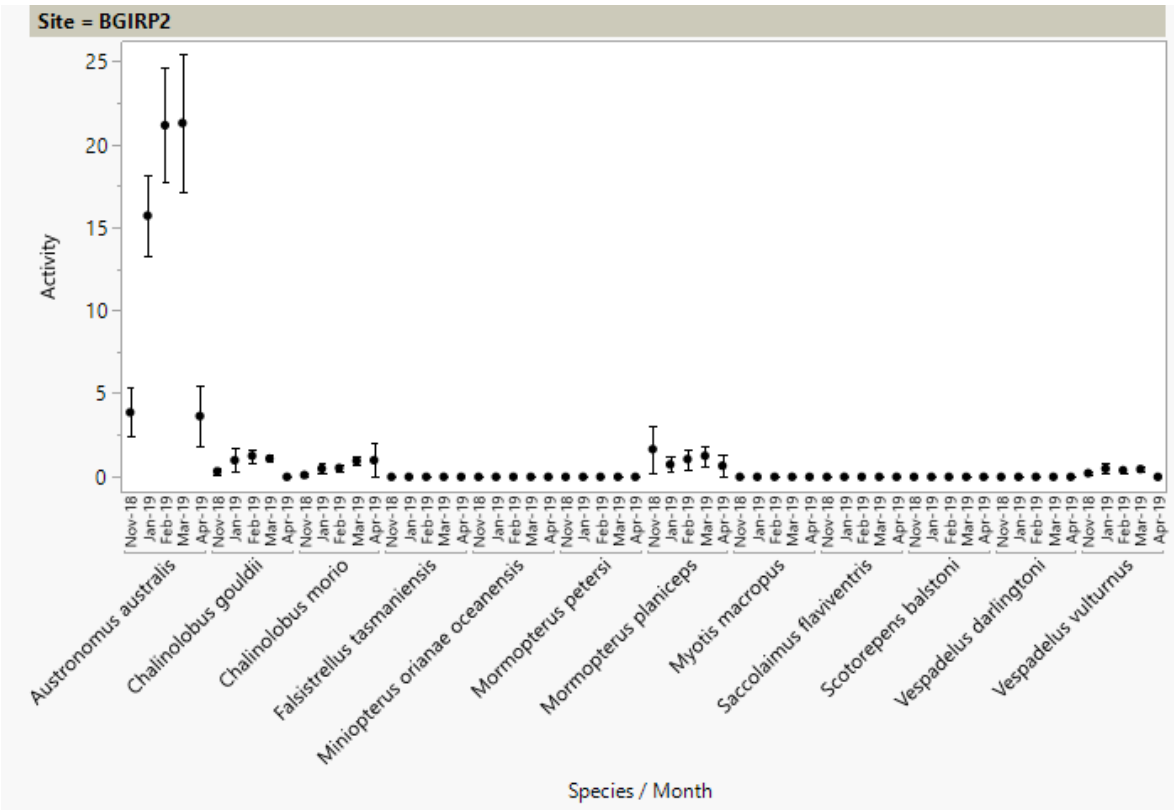
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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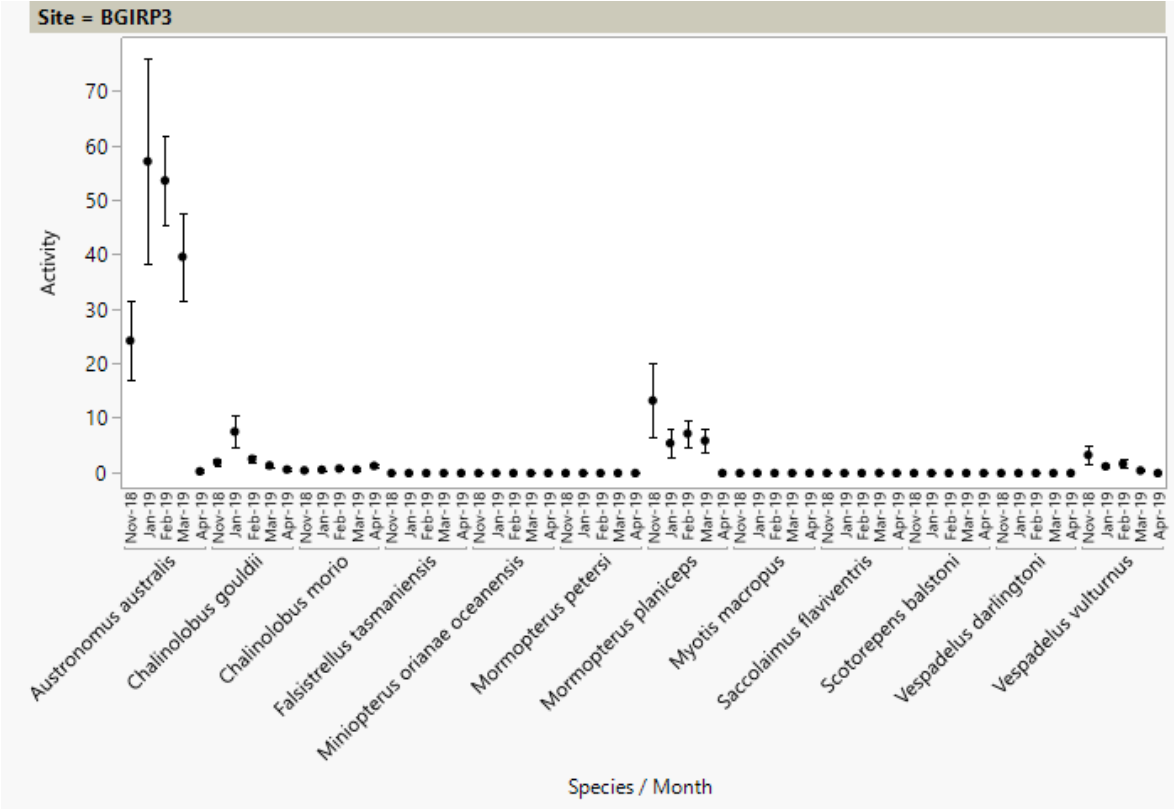
Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Feb-19
Mar-19
Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
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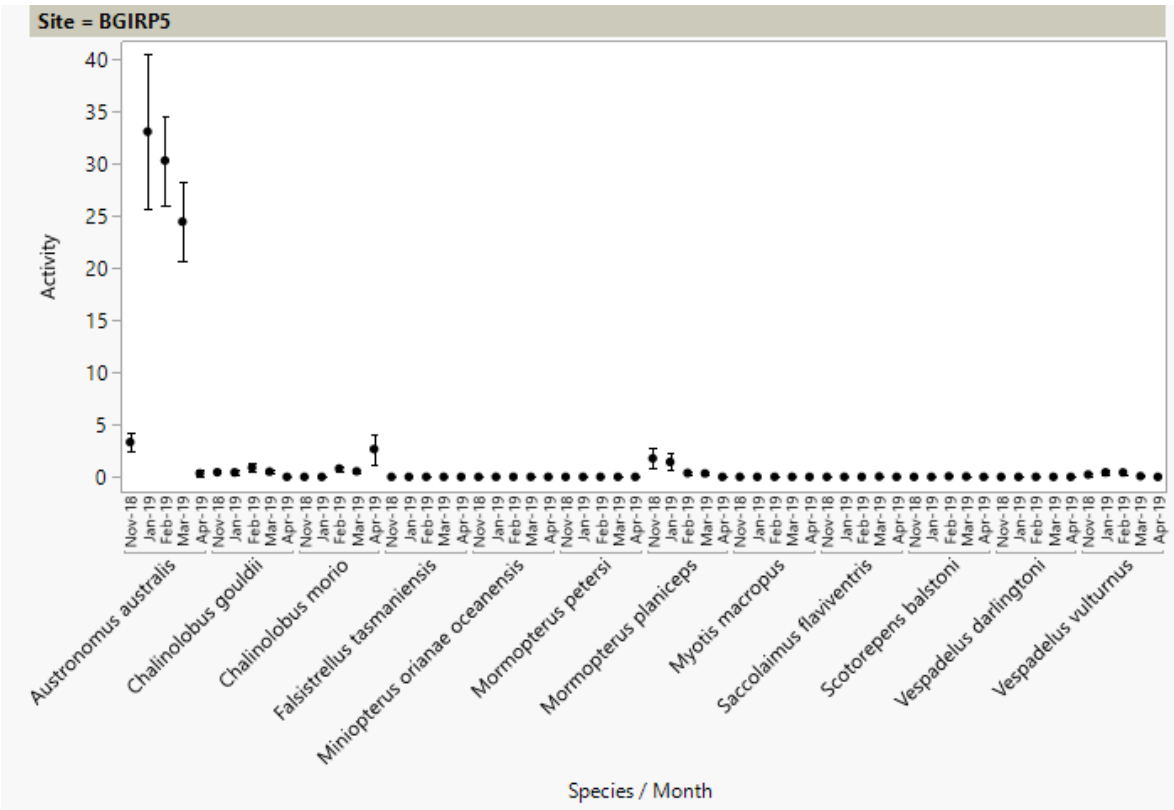
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Mar-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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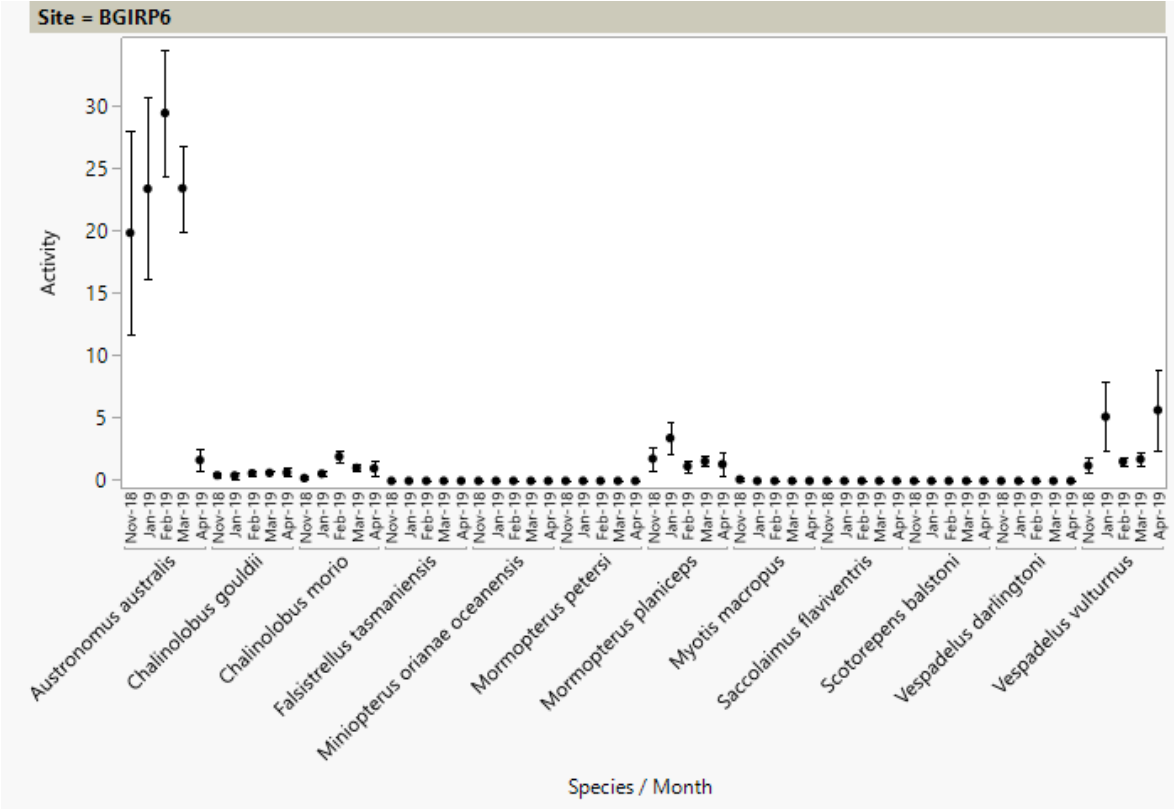
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
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Mar-19
Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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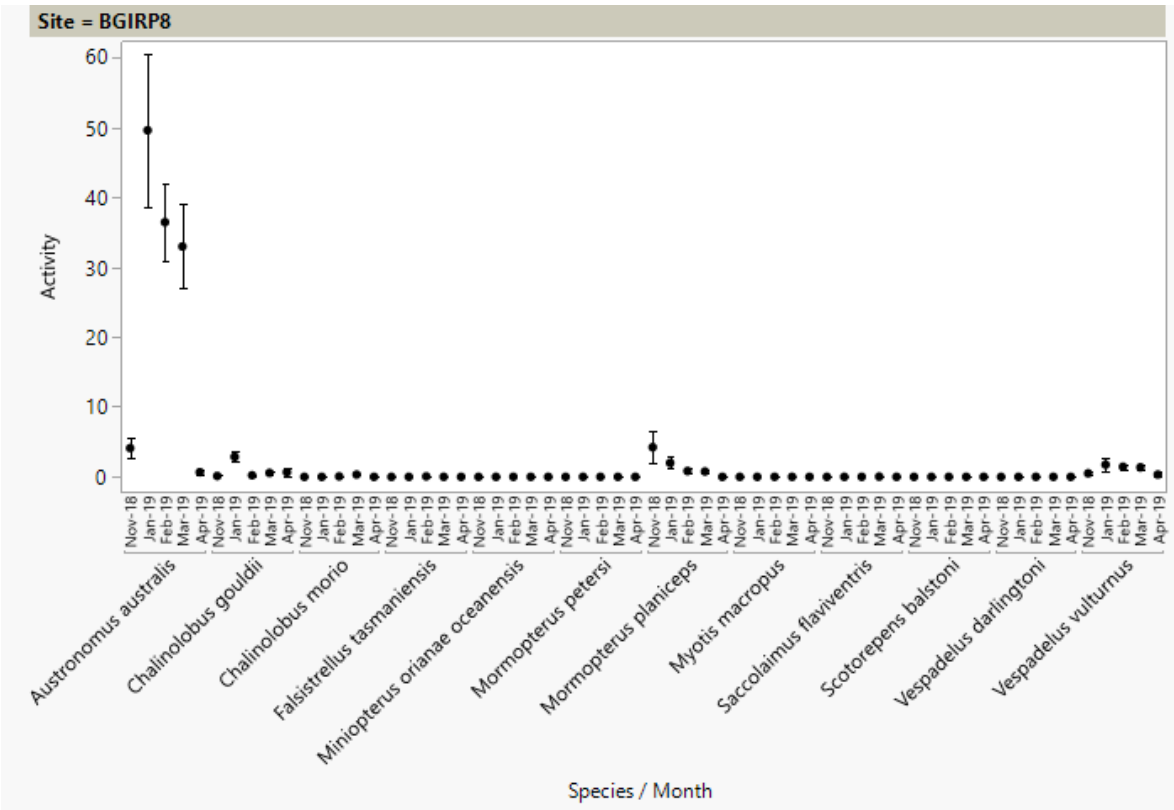
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Jan-19
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Mar-19
Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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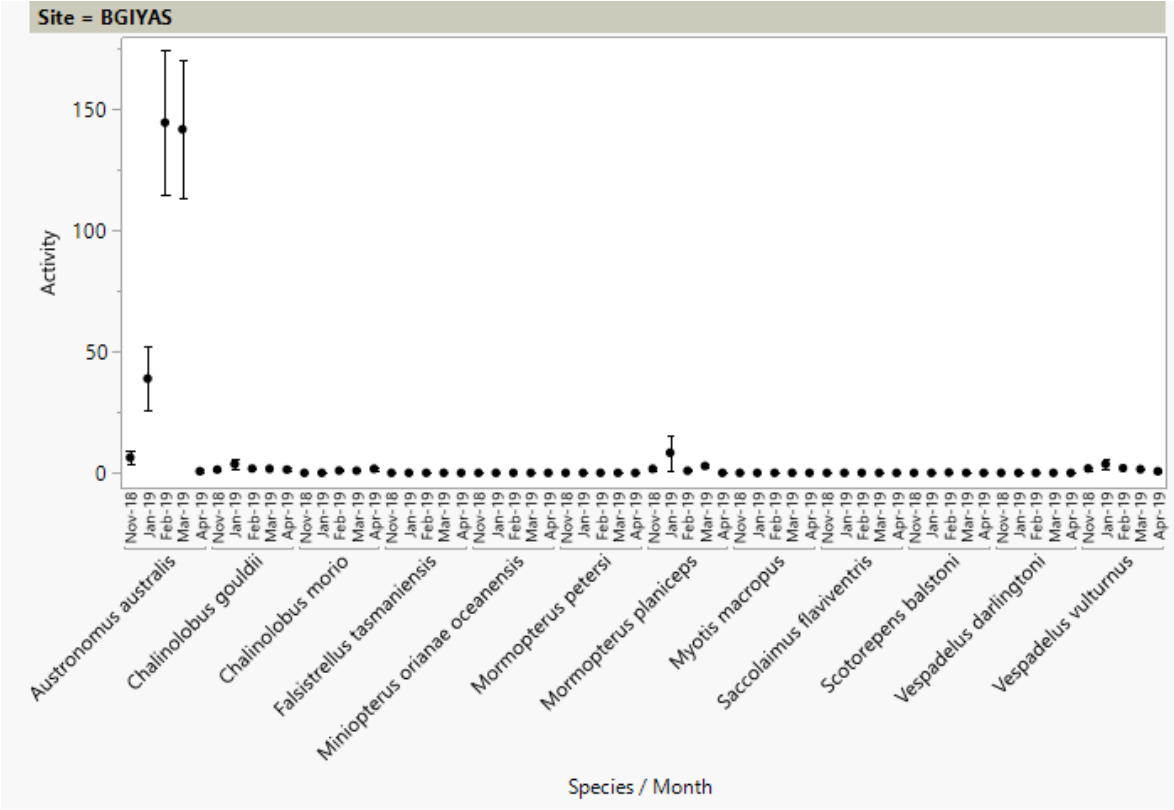
Vespadelus vulturnus
Species / Month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Mar-19
Apr-19
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Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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Scotorepens balstoni
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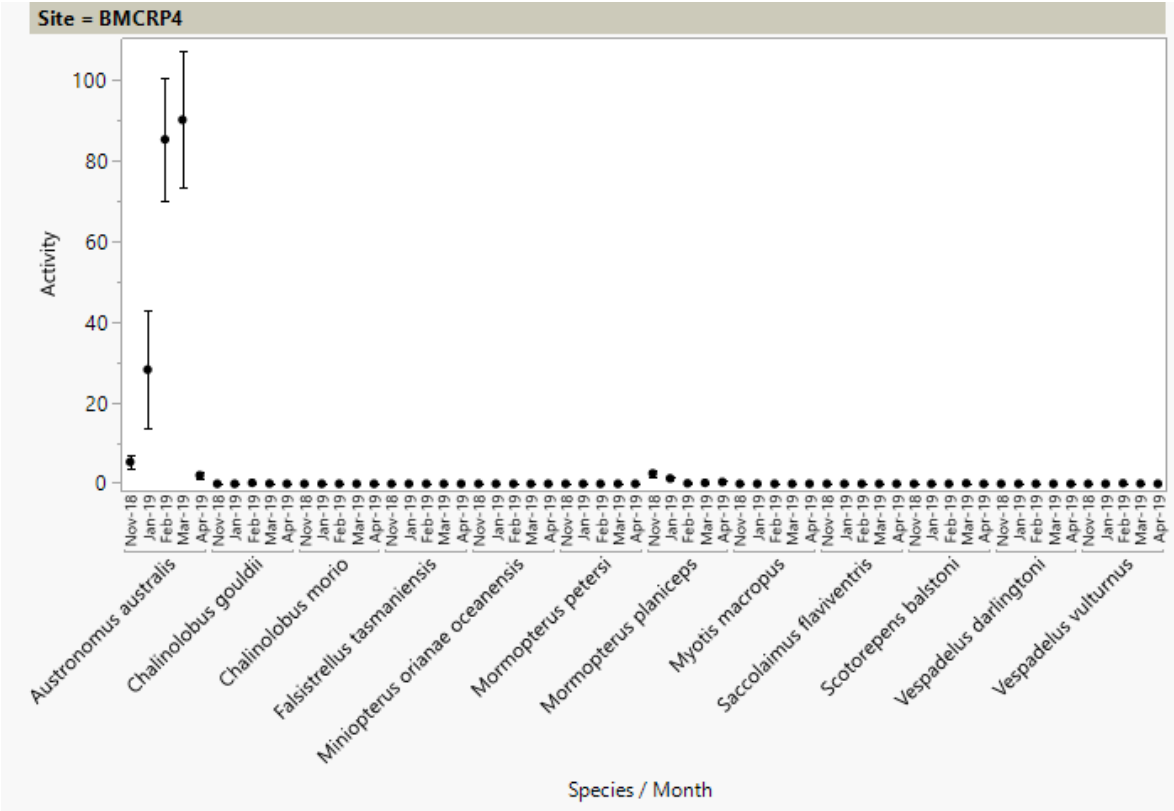
Species / Month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Mar-19
Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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Scotorepens balstoni
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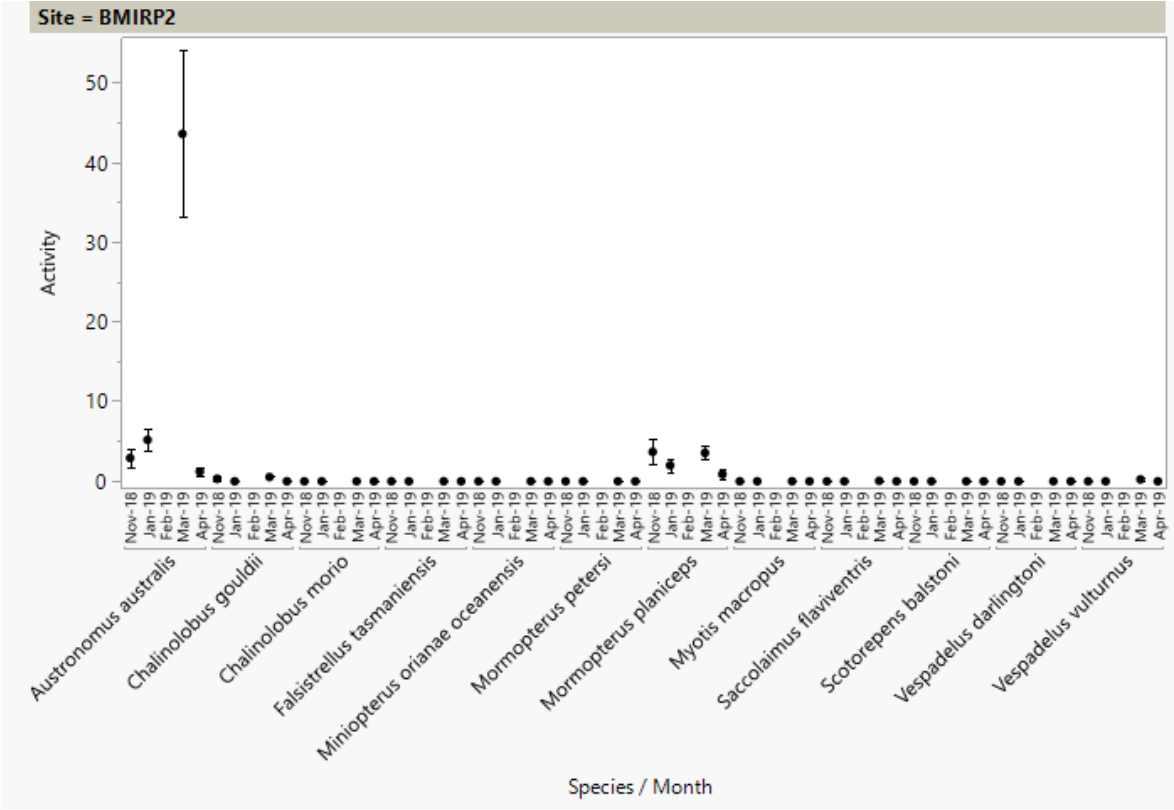
Vespadelus vulturnus
Species / Month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Jan-19
Feb-19
Mar-19
Apr-19
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Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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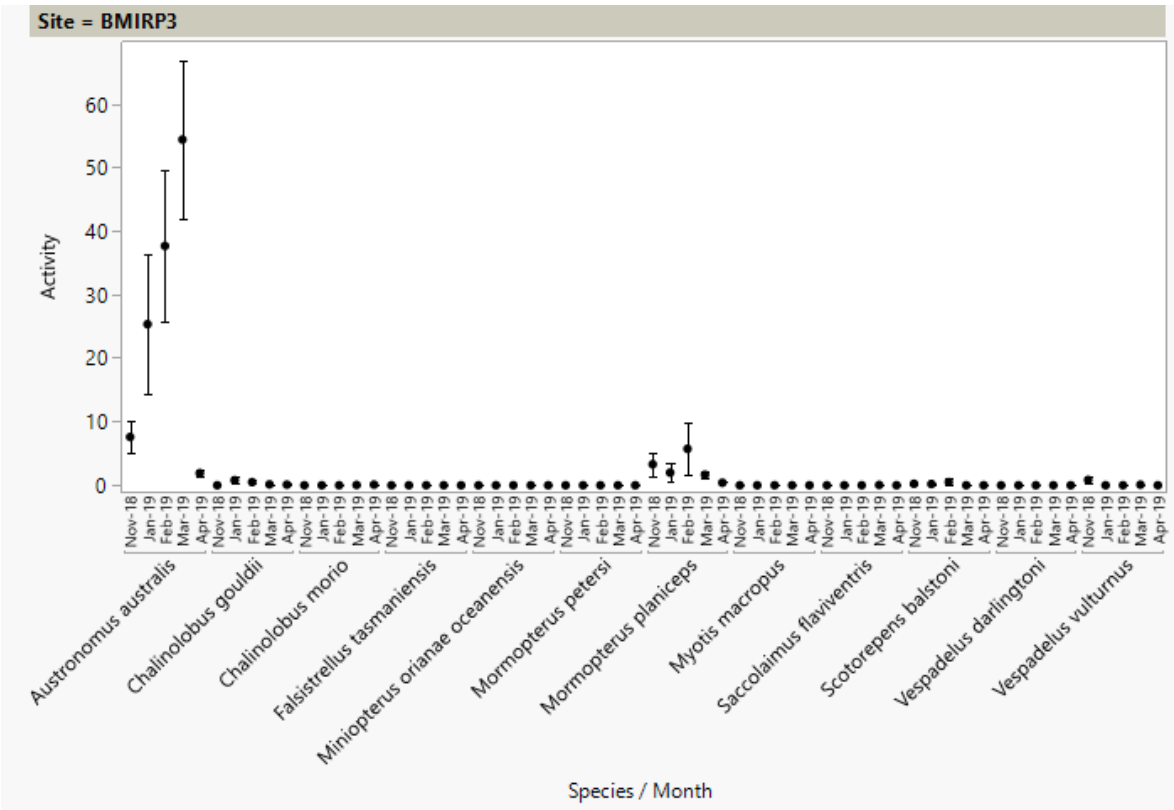
Vespadelus vulturnus
Species / Month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Apr-19
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Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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Saccolaimus flaviventris
Scotorepens balstoni
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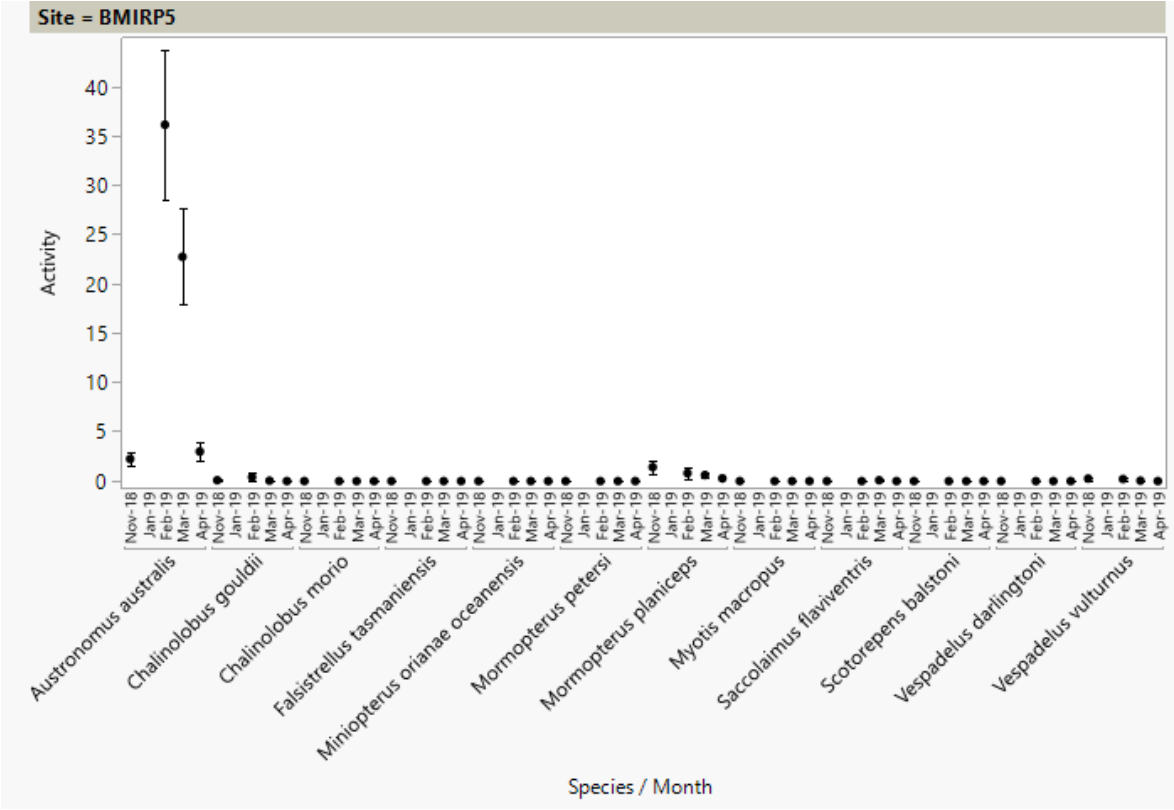
Vespadelus vulturnus
Species / Month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Mar-19
Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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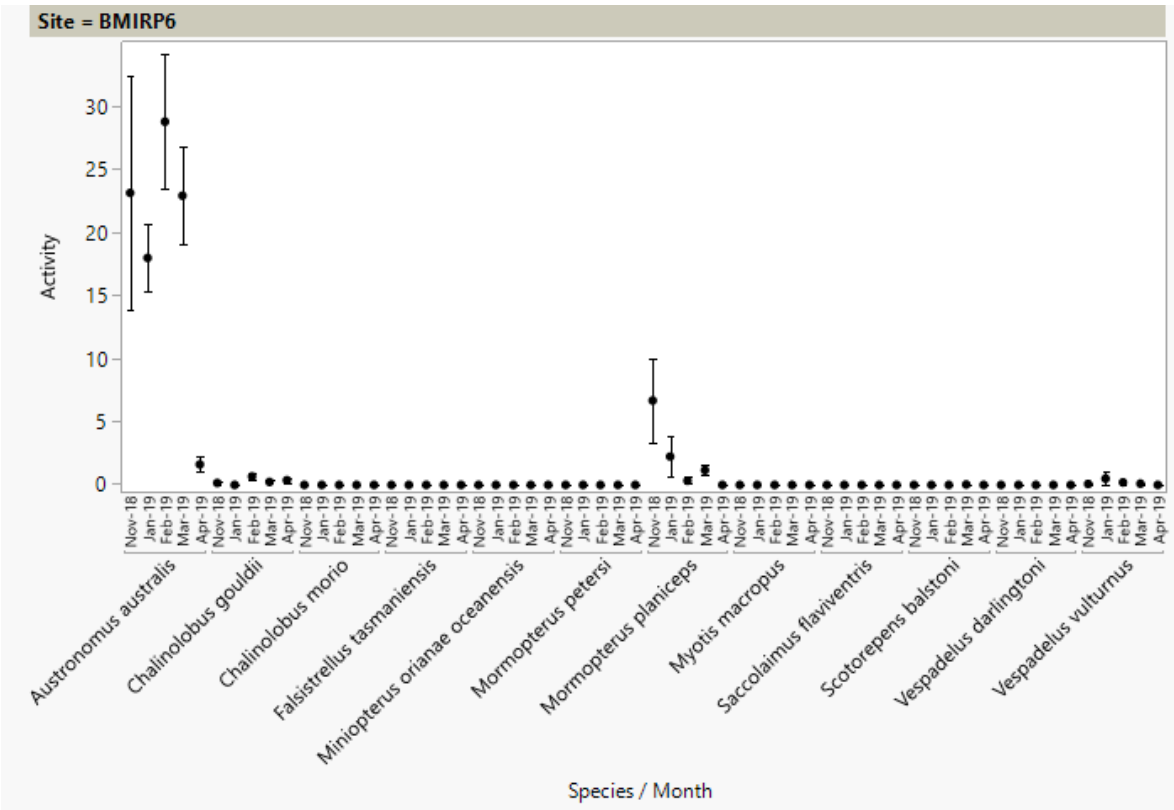
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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Apr-19
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Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
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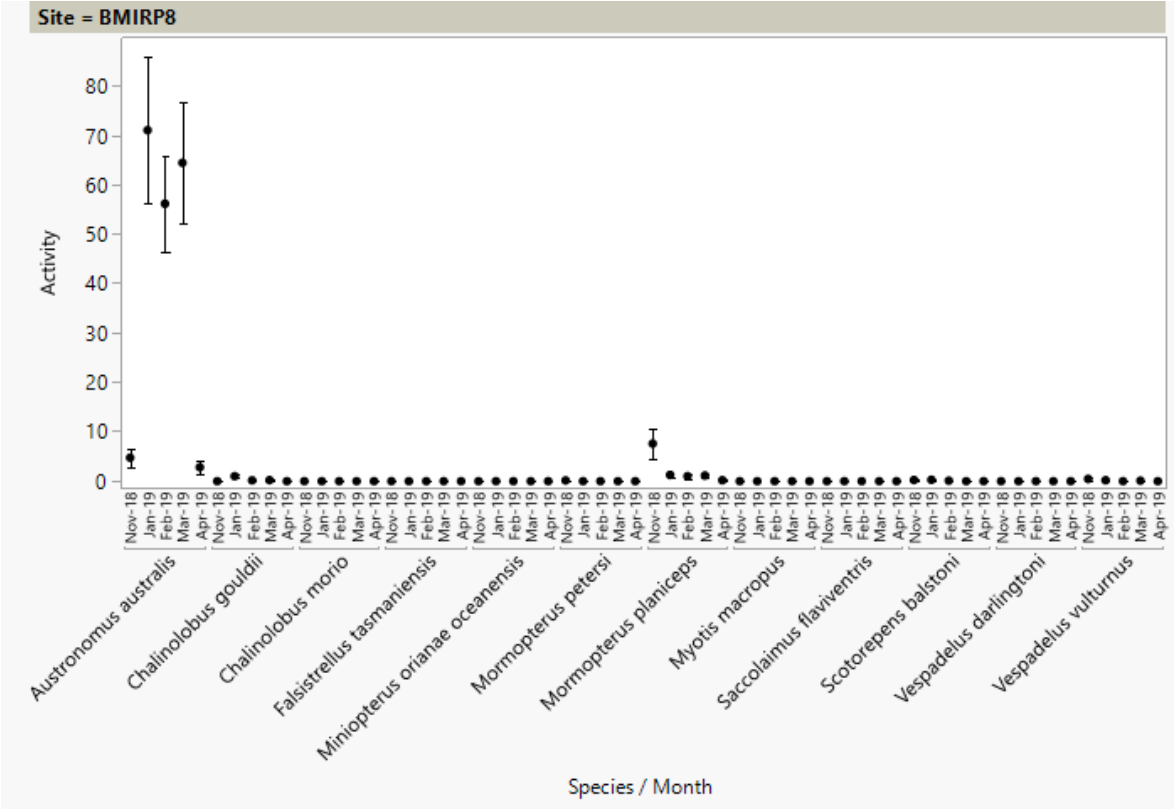
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month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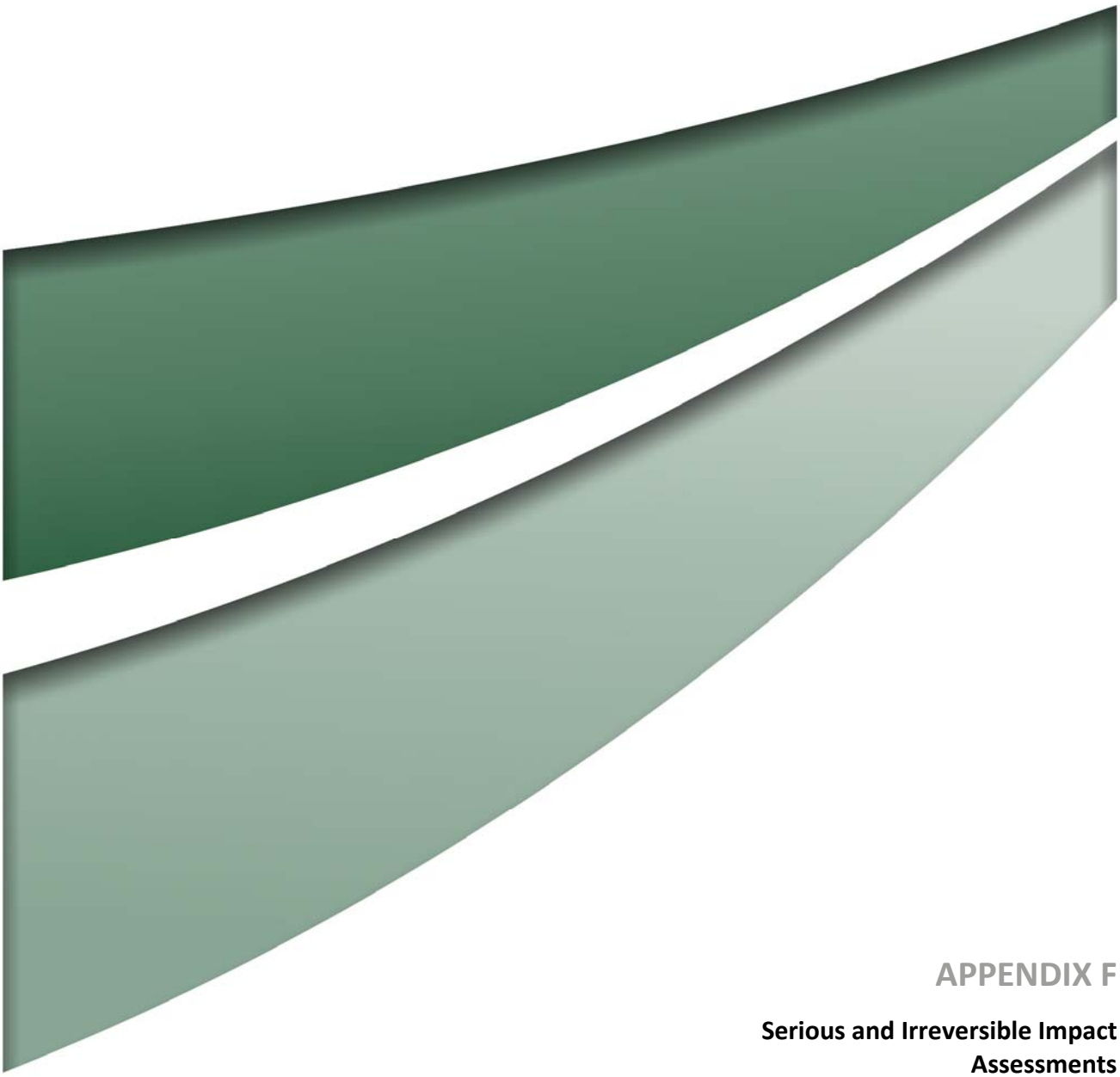
50
60
70
80
Nov-18
Jan-19
Feb-19
Mar-19
Apr-19
Austronomus australis
Chalinolobus gouldii
Chalinolobus morio
Falsistrellus tasmaniensis
Miniopterus orianae oceanensis
Mormopterus petersi
Mormopterus planiceps
Myotis macropus
Saccolaimus flaviventris
Scotorepens balstoni
Vespadelus darlingtoni
Vespadelus vulturnus
Species / Month

umwelt
Environmental & Social Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au



APPENDIX F

Serious and Irreversible Impact Assessments

Assessments have been conducted for three serious and irreversible impact (SAII) entities recorded within the Indicative Development Footprints, being:

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, BC Act
- large bent-winged bat (*Miniopterus orianae oceanensis*)
- golden sun moth (*Synemon plana*).

These assessments have been conducted in accordance with the impact assessment criteria provided in Subsection 10.2.2 (for ecological communities) and 10.2.3 (for threatened species or populations) of the BAM.

1. White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	
Criteria	**Assessment**
a) The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	The Project has gone through substantial avoidance (and minimisation) measures, through changes to the final design, in relation to the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act. A total of 31.54 hectares of the CEEC (BC Act) in the Development Corridors has been avoided by the Project through reductions in the number of wind turbines, operation/maintenance facilities, substations, and through changes to access tracks, cabling networks and the preferred transport route. In addition, several mitigation measures will be implemented to contribute to the maintenance of habitat quality adjacent to the final Development Footprint. These avoidance and minimisation measures are described in full within **Section 4.0**.
b) The area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone	The Indicative Development Footprints supports a total of 37.50 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act within Vegetation Zones 3 (20.08 hectares) and 4 (17.42 hectares). Impact to this CEEC (BC Act) is less (12.70 hectares) than the impact threshold of 50.2 hectares for this TEC as identified in Consent Condition 19(a) of the existing State Approval (SSD 6693). Umwelt note that 31.54 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act will persist within the wider Development Corridors, and considerable amounts of the CEEC (BC Act) occur beyond the Development Corridors in the local region. Applicable Vegetation Zones and their vegetation integrity score are presented below: • Vegetation Zone 3 (Moderate to Good): 76.2 (SWS IBRA)/65.0 (SHE IBRA) • Vegetation Zone 4 (Derived Native Grassland): 34.3 (SWS IBRA)/35.5 (SHE IBRA).
c) A description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*	No impact thresholds have been made publicly available for candidate SAII.

d) The extent and overall condition of the potential TEC within an area of 1,000ha, and then 10,000ha, surrounding the proposed development footprint	Umwelt used two regional vegetation mapping units to complete this analysis, being VIS Classification Map 1624 (Boorowa) and VIS Classification Map 3858 (Southern Forests). Within an approximate 1,000 hectares area surrounding the Indicative Development Footprints , approximately 100 hectares is likely to align with the CEEC (BC Act) in a similar condition to that recorded in the Indicative Development Footprints . This includes approximately 97 hectares within VIS Map 1624 and 3 hectares within VIS MAP 3858. Within an approximate 10,000 hectares area surrounding the Indicative Development Footprints , a total of 1,207 hectares is likely to align with the CEEC (BC Act) in a similar condition to that recorded in the Indicative Development Footprints . This includes approximately 1,188 hectares within VIS Map 1624 and 19 hectares within VIS MAP 3858.
e) An estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration	This CEEC (BC Act) is known to occur within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes IBRA Bioregions. There is no publicly available information to determine which IBRA subregions the CEEC (BC Act) occurs in. The similarly aligned CEEC listed under the EPBC Act was described as comprising 6,721 hectares within the Boorowa Shire and a further 55,798 hectares within the South West Slopes (TSSC 2006). It is likely that all of this extant would conform with the BC Act listed CEEC. There is no publicly available information to readily complete the task of calculating the extent of the CEEC (BC Act) that occurs within the IBRA Subregions applicable to the Project.
f) An estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion	Within the Project IBRA Subregions, this CEEC (BC Act) is known to occur in the Benambra National Park (NP), Brindabella NP, Conimbla NP, Dananbilla Nature Reserve (NR), Ellerslie NR, Flagstaff Memorial Nature Reserve, Goobang NP, Gungewalla NR, Illunie NR, Koorawatha NR, Livingstone NP, Minjary NP, Oak Creek NR, Queanbeyan NR, Tumblong State Conservation Area and Woomargama NP (DoECCW 2010). The National Recovery Plan for the similarly aligned CEEC listed under the EPBC Act (DoECCW 2010) estimates that approximately 8,000 hectares occurs within the South Western Slopes IBRA Subregion national parks and nature reserves. There is no public information readily available to estimate the area of the CEEC (BC Act) in these reserves.

g) The development clearing or biodiversity certification proposal's impact on: i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alternation of surface water patterns ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemical or pollutants which may harm or inhibit growth of species in the potential TEC	The Project is not considered likely to impact on abiotic factors critical to the long-term survival of the CEEC (BC Act) . While construction impacts may include localised instances of erosion, dust pollution, noise and vibration, these will be temporary in nature. Operational impacts will include changes to water runoff patterns, however it is not considered that these changes will be so substantial that the long-term survival of the CEEC (BC Act) will be adversely affected. The Project will impact on characteristic species of the CEEC (BC Act) through the direct impacts discussed above (i.e. clearing of vegetation), and in **Sections 5.1.1** and **5.2**. Indirect impacts to the CEEC (BC Act) are discussed in **Section 5.1.2**. They are considered to be manageable with appropriate management and mitigation measures that would be formalised through the required management plans. Furthermore, given the extensive spread of the project design (some 36 kilometres in length from the northern to southern tip) the indirect impacts are likely to be of low magnitude temporally and spatially.
h) Direct or indirect fragmentation and isolation of an important area of the potential TEC	The Indicative Development Footprints support a total of 37.50 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act within Vegetation Zones 3 (20.08 hectares) and 4 (17.42 hectares). Umwelt note that 31.54 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act will persist within the wider Development Corridors, and considerable amounts of the CEEC (BC Act) occur beyond the Development Corridors in the local region. Indirect impacts to the CEEC (BC Act) are discussed in **Section 5.1.2**.
i) The measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion	The biodiversity offset strategy for the Project will address measures of contributing to the recovery of this CEEC (BC Act) in the IBRA subregion through land-based offsets. Five potential offset sites within parcels of land adjacent to the Project have been identified for further investigation. These sites have, based on a range of preliminary surveys, the potential to generate ecosystem and species credits consistent with those impacted by the Project. This includes PCTs 298, 335, 350 and 351 ecosystem credits. This is discussed in full in **Section 8**.

2. Large bent-winged bat (*Miniopterus orianae oceanensis*)	
Criteria	**Assessment**
a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	The Project has gone through substantial avoidance (and minimisation) measures, through changes to the final design, in relation to foraging habitat for this species. Over 300 hectares of open forest habitat suitable for foraging within the Development Corridors has been avoided by the Project. This was done through reductions in the number of wind turbines, operation/maintenance facilities, substations, and through changes to access tracks, cabling networks and the preferred transport route. In addition, several mitigation measures will be implemented to contribute to the maintenance of habitat quality adjacent to the final Development Footprint. These avoidance and minimisation measures are described in full within **Section 4.0**. No breeding habitat for the species will be impacted by the Project. Direct impacts on the large bent-winged bat resulting from the Project will include turbine strikes during the operational phase. Umwelt prepared an updated operational bird and bat impact assessment to analyse the difference in impacts between the original assessment and the proposed relevant modifications to the Project, being less turbines and larger blade lengths. It was found that the level of risk of blade strike to large bent-winged bat may be similar or slightly higher than the level of risk posed by the current design. This impact will be addressed in a Bird and Bat Adaptive Management Plan (BBAMP) for the Project, which will include monitoring requirements, defined impact triggers for the species and a mitigation and management strategy. The strategy will encompass a range of management actions, including the deterrence of bats from turbines. Reporting of outcomes from implementation of the BBAMP will be used to inform ongoing operation of the Project and potentially develop further actions to reduce the extent of direct impacts on the species.
b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	The large bent-wing bat was recorded within the Development Corridors during echolocation surveys conducted by Umwelt. The closest historic record of the species occurs approximately 8.4 km west of the Development Corridors near Wargeila Road (DPIE 2020). The southern sections of the Indicative Development Footprints occur within 50 km of known roost caves at Wee Jasper (Church Cave and Dip Cave). DPIE recognises that discrete populations are centred around maternity caves, and that dispersals of up to 300 km occur at certain times of the year (DPIE 2020). It has been recorded that the species can forage long distances from the roost site, with some being known to travel up to 65 km in one night (Churchill 2008). While these sites are home to thousands of individuals during periods of roosting, it is unknown how many individuals utilise the Development Corridors for foraging, particularly when the roost migrates.

c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*	The threshold for the large bent-winged bat in the BioNet TBDC is listed as "breeding habitat to be identified by survey" (DPIE 2020). Breeding habitat for this species constitutes caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding. This includes species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500. No habitat conforming to these criteria has been recorded within the Indicative Development Footprints historically or through recent surveys conducted by NGH and Umwelt. The impact does not exceed the listed threshold for this species.
d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to: i. an estimate of the change in habitat available to the local population as a result of the proposed development ii. the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and iii. modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development. BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development	i. The Project will result in impacts to 106.29 hectares of foraging habitat for the local large bent-winged bat population. There are no recorded breeding habitat locations within the disturbance area. Impacts as a result of clearing and habitat modification are discussed in **Section 5.1**. ii. The modification of large bent-winged bat habitat through vegetation clearing is not likely to lead to a decline in the local population of the species within the Indicative Development Footprints. There are two known maternity roosts approximately 50 km away from the Project area. It is possible that individuals from this area may use habitat within the project area to forage. However as flying is the mode of transport for this species, it is not considered likely that will cause significant loss, modification, destruction, or isolation of the available foraging habitat of the local population. iii. Direct impacts are not likely to separate or fragment the large bent-winged bat habitat areas, within the Indicative Development Footprints, used in this species' life-cycle. Due to the species' high mobility throughout the surrounding landscape, there being no roosting habitat destroyed, and no substantial habitat fragmentation occurring due to the proposed development. A total of 57 BioNet Atlas records of the species occur in the Inland Slopes (NSW – South Western Slopes) IBRA subregion, and 121 in the Murrumbateman (South Eastern Highlands) IBRA subregion. Of these, 16 records occur within 25 km the Development Corridors, constituting 9% of the records in the relevant subregions. There are three confirmed large bent-winged bat calls were recorded during the 2018/19 survey, within the proposed development corridor. This constitutes 1.7 % of known records (if each record is assumed to be a separate individual). The survey method used cannot quantify abundance, only presence or absence. Due to the extensive nature of surveys within the Development Corridors compared to the surrounding region, it is considered likely that this is a reasonable reflection of the species utilisation of the surrounding area and within the Development Corridors.

	As the proposed development is not impacting any known roosting sites it is unlikely that there will be any direct impacts to the local populations. It is difficult to quantify the indirect impacts to the local populations, the most likely of which will be collision with turbines. The BBAMP will include monitoring requirements, defined impact triggers for the species and a mitigation and management strategy. The findings in the BBAMP are likely to provide quantifiable estimates of the indirect impacts.
e) the likely impact on the ecology of the local population. At a minimum, address the following: i. for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways ii. for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available: – pollination cycle – seedbanks – recruitment, and – interactions with other species (e.g. pollinators, host species, mycorrhizal associations)	The Project will not impact on any breeding or roosting activities of the large bent-wing bat due to an absence of suitable breeding habitat in the Indicative Development Footprints. Foraging activities of the local population may be affected by the removal of approximately 106.29 hectares of open forest/woodland habitat which comprises potential foraging habitat. It is noted that large amounts (over 300 hectares) of similar or higher quality foraging habitat occur for the species in the surrounding Development Corridors and wider region. It is unlikely that the Project will impact on foraging activities to such an extent that a local population of the species will decline. Movement pathways for the species through the Development Corridors will be impacted by the presence of 80 wind turbines which may change flight behaviour and patterns of individuals migrating through the area. It is considered unlikely that the Project will impact on dispersal activities to such an extent that a local population of the species will decline.
f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	Due to the highly dispersive nature of this species, it is considered unlikely that the Project will result in a local population becoming fragmented or isolated.
g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	The local population of the species likely interacts with individuals from other populations (the species is known to disperse up to 300 km from the maternity roost (DPE 2020; Churchill 2008)). The local population likely provides valuable genetic diversity to the metapopulation along the east coast. The local population is not at the limit of the species range (the species occurs along the entire east coast of Australia (Churchill 2008)). Due to the highly dispersive nature of the species, it is considered unlikely that the proposed development will impact interactions between the local population and surrounding populations.

h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The Saving Our Species report for the large bent-winged bat lists three threats to the species. these are: 1. Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances. 2. Predation by feral cat. 3. Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding. As there are no known roosting sites within the Development Corridors. As such, the proposed development will not lead to an increase in threats 1 and 3. Impacts by feral cats are recognised to occur mostly in modified, fragmented environments and where alternative prey (rabbit and house mouse) fluctuate in abundance (DPIE 2019c). Woodland habitat will be cleared as part of the proposed development. Bionet Atlas records show this species occurring throughout an already fragmented landscape. Due to there being no known roosts within the Indicative Development Footprints and the small amount of vegetation to be cleared, the proposed development will not lead to a decrease in the viability of the local population.
i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	A total of 57 BioNet Atlas records of the species occur in the Inland Slopes (NSW – South Western Slopes) IBRA subregion, and 121 in the Murrumbateman (South Eastern Highlands) IBRA subregion. Of these, 16 records occur within 25 km the Development Corridors, constituting 9% of the records in the relevant subregions. There are three confirmed records within the Development Corridors, constituting 1.7 % of known records (if each record is assumed to be a separate individual). There are two known roost caves approximately 50 km from the Development Corridors. Generally, roosts are known to support thousands of individuals of one species. No information is known about the exact size of these local populations.
j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	The Saving Our Species report for the large bent-winged bat lists seven priority management sites, two of which (Church Cave and Dip Cave) are located in Wee Jasper approximately 50 km from the Development Corridors. Management activities listed for these sites area heavily focused on ensuring access to maternity caves is maintained and the impacts of pest species are reduced. As there are no known maternity caves within the Development Corridors, there is nothing that can be proposed to contribute to their management. Predation by feral cat is a recognised threat to the species. As part of regular monitoring feral cat populations will be monitored. If there is a recorded increase in feral cat records within the site, this will trigger pest control

	works.

3. Golden sun moth (*Synemon plana*)	
Criteria	**Assessment**
a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	The Project has gone through substantial avoidance (and minimisation) measures, through changes to the final design, in relation to the removal of known habitat for the golden sun moth. 70.69 hectares of known habitat for the species within the Indicative Development Corridors has been avoided by the Project through reductions in the number operation/maintenance facilities and substations, and through changes to the preferred transport route. In addition, several mitigation measures will be implemented to contribute to the maintenance of habitat quality adjacent to the final Development Footprint. These avoidance and minimisation measures are described in full in **Section 4.0**.
b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	The limited dispersal ability of the golden sun moth means habitat areas that are separated by >200 m are effectively isolated and should be considered as separate habitat areas (DEWHA, 2009). The Project will result in impacts to 43.20 hectares of golden sun moth habitat across ten main habitat areas within the Indicative Development Footprints. This comprises four habitat areas >10 ha and six habitat areas <10 ha. There will be permanent habitat loss >0.5 ha in all four habitat areas >10 ha, and habitat loss in the remaining six habitat areas <10 ha.
c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*	The threshold listed in the BioNet TBDC for the golden sun moth is clearing of >10% of identified habitat on site. The Project will impact 43.20 hectares of golden sun moth habitat, which constitutes 38% of the 113.89 hectares of golden sun moth habitat identified within the Development Corridors. This impact exceeds the threshold by 28% , however it falls below the Federal Conditions of Approval for the Project which allows for impacts to a maximum of 66.94 hectares. It is noted that 70.69 hectares will persist beyond the extent of the Indicative Development Footprints within the Development Corridor.
d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to: i. an estimate of the change in habitat available to the local population as a result of the proposed development ii. the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and iii. modification of habitat required for the maintenance of processes	i. The Project will result in impacts to 43.20 hectares of habitat for local golden sun moth populations across ten main habitat areas within the Indicative Development Footprints. This comprises four habitat areas >10 ha and six habitat areas <10 ha. There will be permanent habitat loss >0.5 ha in all four habitat areas >10 ha, and habitat loss in the remaining six habitat areas <10 ha. Impacts as a result of clearing and habitat modification are discussed in **Section 5.1**. ii. The modification of golden sun moth habitat through vegetation clearing is likely to lead to a decline in the local population of the species within the Indicative Development

important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development. BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development	Footprints The species is not known to travel more than 200 metres, and removal of habitat areas will likely result in a direct loss of both adults and larvae during construction. Given the context of several thousand hectares of similar golden sun moth habitat being present in the broader landscape (Gellie 2005) the anticipated loss is only expected to affect local populations, and will result in negligible change to habitat availability for the wider regional population. iii. Direct impacts are likely to separate or fragment the golden sun moth habitat areas within the Indicative Development Footprints, but are unlikely to cause large barriers or isolate populations such as breaks of 200 m or more that will restrict dispersal and long-term evolutionary development. A total of 49 BioNet Atlas records of the species occur in the Inland Slopes (NSW – South Western Slopes) IBRA subregion, and 230 in the Murrumbateman (South Eastern Highlands) IBRA subregion. Of these, eight records occur within the Development Corridors, constituting 2.9% of the records in the relevant subregions. Due to the extensive nature of surveys within the Development Corridors compared to the surrounding region, this percentage is considered likely to be a reasonable estimate, if not over-estimate, of the proportion of golden sun moth population to be impacted by the Project.
e) the likely impact on the ecology of the local population. At a minimum, address the following: i. for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways ii. for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available: – pollination cycle – seedbanks – recruitment, and – interactions with other species (e.g. pollinators, host species, mycorrhizal associations)	Project impacts are likely to lead to a decline in a small percentage (up to 2.9%) of the known population recorded in the surrounding region. This is associated with a direct loss of individuals (including mortality during the construction phase of both adults and underground larvae) and removal of habitat. Areas of habitat within the Indicative Development Footprints will be fragmented during construction and operation, but are unlikely to cause large barriers or isolate populations such as breaks of 200 metres or more that will restrict dispersal and movement pathways. There are extensive areas (i.e. several thousand hectares) of suitable habitat for the species mapped as Yellow Box-Apple Box Grassy Woodlands, which have groundcovers dominated by wallaby grass (*Rytidosperma racemosum* var. *racemosum*), kangaroo grass (*Themeda australis*), weeping grass (*Microlaena stipoides* var. *stipoides*) and speargrass (*Austrostipa scabra*) (Gellie 2005) in the surrounding landscape. These are likely to be similar to golden sun moth habitat areas found in the Development Corridors, and would continue to facilitate the maintenance of important life cycle processes for the species including both foraging and breeding for the species in the wider region.

f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	The Project will result in impacts to 43.20 hectares of known habitat for golden sun moth habitat across ten main habitat areas within the Development Corridors. Direct impacts likely to separate or fragment these areas, but are unlikely to cause large barriers or isolate populations such as breaks of 200 metres or more that will restrict dispersal. The quality of similar adjacent habitat areas which may be utilised have potential to change due to edge effects such as shading, wind, altered hydrology and weed invasion. However, given the already disturbed nature of the Indicative Development Footprints, edge effects are unlikely to cause a decline in remaining habitats.
g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	Studies of golden sun moth across the species' range show genetic variation increasing with the geographic distance between populations (CPR 2017). Five key genetic clusters have been identified, one encompassing the populations from the ACT and nearby NSW and the remainder in Victoria. Populations in the ACT/NSW cluster are likely to have recently undergone further genetic differentiation as a result of habitat fragmentation associated with the introduction of agriculture. Due to limited information of the distribution of the species in the immediately surrounding landscape, however, it is difficult to draw strong conclusions regarding relationships to other populations. The Development Corridors is located in the approximate centre of the distribution of the NSW/ACT population, and is unlikely to have any specific importance for maintaining genetic viability or represent a distinct genetic unit. The Development Corridors is not at the limit of the species' range, however on the whole the ACT/NSW local population is the northernmost population of the species.
h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	A principal threat to golden sun moth is weed invasion, particularly introduced pasture grasses that compete with native *Austrostipa* spp. and *Rytidosperma* spp., grasses. This excludes the exotic Chilean needlegrass (*Nassella nessiana*) which provides habitat for the golden sun moth. The associated indirect impacts of this are well documented and include increased potential for the proliferation of invasive species. Most of the Development Corridors is exposed to historical and ongoing disturbances from grazing and other agricultural pressures. Given the occurrence of existing weeds in habitat areas, the Project is unlikely to introduce invasive species such as weeds that are harmful to the golden sun moth or its habitat. Measures to minimise invasion of weeds during construction and operation would be implemented to mitigate increases of weed invasion into golden sun moth habitat, and are described in full within **Section 4.0**.
i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	A total of 49 BioNet Atlas records of golden sun moth occur in the Inland Slopes (NSW – South Western Slopes) IBRA subregion, and 230 in the Murrumbateman (South Eastern Highlands) IBRA subregion. Criteria for dividing golden sun moths into distinct populations is unclear, however species records within the wider NSW – South Western Slopes IBRA bioregion are grouped into approximately 24 distinct localities, and South Eastern Highlands IBRA bioregion are grouped into

	approximately 26 distinct localities (BCD 2020a). Data is not available on the population areas protected in reserves in NSW; however, golden sun moth are found, or considered likely to occur, in Goorooyarroo Nature Reserve, Bango Nature Reserve, McLeod's Creek Nature Reserve, Oakdale Nature Reserve (OEH 2015) and the Yass River Gorge Council reserve (Yass Valley Council 2017).
j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	There is currently no specific recovery plan for the golden sun moth, but the following regional priority recovery and threat abatement actions relevant to the Project are recommended in the conservation advice (DoE, 2013) for the species: • Minimise disturbance in areas where the golden sun moth occurs, excluding necessary actions to manage the conservation of the species. Retain and protect natural grassland remnants within the known distribution of the species. • Ensure remnant populations remain connected or linked to each other; in cases where remnants have become isolated, consider revegetation to re-establish links and aid dispersal. • Manage any changes to hydrology that may result in changes to water table levels and/or increased run-off, salinity, or pollution. • Identify populations of high conservation priority. Search for the species in suitable habitat in areas that are proposed for development. • Control invasions of weeds and pasture species, and consider the impact of herbicide use in habitat; where possible use methods that directly target weeds such as spot spraying and hand removal to minimise the adverse impact on the golden sun moth. The Proponent is committed to implementing the hierarchy of avoidance measures through the final design phase of the Indicative Development Footprints. It is expected that additional avoidance and disturbance minimisation will be possible for the Project. Environmental management during construction will include weed control and hygiene protocols to minimise weed dispersal, and will be designed to minimise risks associated with herbicide use. The offset package for the Project may provide opportunities for linking, enhancing or establishing additional populations, and are discussed in **Section 8.0**.

APPENDIX G

Biodiversity Credit Report

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00010359/BAAS17068/18/00012903	Rye Park Development SEH IBRA	18/06/2020
Assessor Name	Assessor Number	BAM Data version *
Bill Wallach	BAAS17068	29
Proponent Name(s)	Report Created	BAM Case Status
Tilt Renewables	12/08/2020	Open
Assessment Revision	Assessment Type	Date Finalised
6	Major Projects	To be finalised

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species
Synemon plana / Golden Sun Moth
Synemon plana / Golden Sun Moth

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	0.7	11.00
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	15.8	371.00
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	Not a TEC	134.7	1700.00

335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Inland Floodplain Swamps This includes PCT's: 66, 204, 205, 335, 360, 447, 465, 1291	Inland Floodplain Swamps >=70% and <90%	No	Murrumbateman,Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Freshwater Wetlands	Tier 4 or higher	No	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Murrumbateman,Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 3 or higher	Yes (including artificial)	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	Yes	Murrumbateman,Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Petaurus norfolcensis / Squirrel Glider	40.8	1365.00
Polytelis swainsonii / Superb Parrot	10.2	271.00
Synemon plana / Golden Sun Moth	21.6	381.00

Petaurus norfolcensis/ Squirrel Glider	350_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	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	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	351_ModerateGood_ Remnant	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Polytelis swainsonii/ Superb Parrot	350_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Polytelis swainsonii/Superb Parrot	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	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Synemon plana/ Golden Sun Moth	350_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Synemon plana/Golden Sun Moth	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	Endangered	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Synemon plana/ Golden Sun Moth	351_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Synemon plana/Golden Sun Moth	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	Endangered	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00010359/BAAS17068/18/00012903	Proposal Name Rye Park Development SEH IBRA	BAM data last updated * 18/06/2020
Assessor Name Bill Wallach	Assessor Number BAAS17068	BAM Data version * 29
Proponent Names Tilt Renewables	Report Created 12/08/2020	BAM Case Status Open
Assessment Revision 6	Assessment Type Major Projects	Date Finalised To be finalised

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species
Synemon plana / Golden Sun Moth
Synemon plana / Golden Sun Moth

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	0.7	11.00
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	15.8	371.00
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	Not a TEC	134.7	1700.00

335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Inland Floodplain Swamps This includes PCT's: 66, 204, 205, 335, 360, 447, 465, 1291	Inland Floodplain Swamps >=70% and <90%	No	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	Yes	Murrumbateman, Bondo, Crookwell, Inland Slopes, Monaro, Murrumbateman and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Petaurus norfolcensis / Squirrel Glider	40.8	1365.00
Polytelis swainsonii / Superb Parrot	10.2	271.00
Synemon plana / Golden Sun Moth	21.6	381.00

Petaurus norfolcensis/ Squirrel Glider	350_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	350_Moderate	
	351_ModerateGood_ Remnant	**Like-for-like credit retirement options**
		Spp / IBRA region
		Petaurus norfolcensis/Squirrel Glider / Any in NSW
Polytelis swainsonii/ Superb Parrot	350_Moderate	**Like-for-like credit retirement options**
		Spp / IBRA region
		Polytelis swainsonii/Superb Parrot / Any in NSW
Synemon plana/ Golden Sun Moth	350_DNG	**Like-for-like credit retirement options**
		Spp / IBRA region
		Synemon plana/Golden Sun Moth / Any in NSW
	351_DNG	**Like-for-like credit retirement options**

		Spp	IBRA region
		Synemon plana/Golden Sun Moth	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00010359/BAAS17068/18/00012902	Rye Park SWS IBRA	18/06/2020
Assessor Name	Assessor Number	BAM Data version *
Bill Wallach	BAAS17068	29
Proponent Name(s)	Report Created	BAM Case Status
Tilt Renewables	12/08/2020	Open
Assessment Revision	Assessment Type	Date Finalised
6	Major Projects	To be finalised

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species
Synemon plana / Golden Sun Moth
Synemon plana / Golden Sun Moth

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	0.8	26.00
335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	4.8	114.00
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	21.8	512.00
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	Not a TEC	322.6	3653.00

289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Upper Riverina Dry Sclerophyll Forests This includes PCT's: 269, 285, 289, 290, 298, 302, 304, 314, 338, 340, 342, 353, 1088, 1094, 1095	Upper Riverina Dry Sclerophyll Forests >=50% and <70%	Yes	Inland Slopes,Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: NSW South Western Slopes, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Inland Floodplain Swamps This includes PCT's: 66, 204, 205, 335, 360, 447, 465, 1291	Inland Floodplain Swamps >=70% and <90%	No	Inland Slopes,Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	HBT	IBRA region

	Freshwater Wetlands	Tier 4 or higher	No	IBRA Region: NSW South Western Slopes, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region
	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Inland Slopes,Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 3 or higher	Yes (including artificial)	IBRA Region: NSW South Western Slopes, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	Yes	Inland Slopes,Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: NSW South Western Slopes, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Delma impar / Striped Legless Lizard	3.6	27.00
Myotis macropus / Southern Myotis	0.0	1.00
Petaurus norfolcensis / Squirrel Glider	62.2	2270.00
Polytelis swainsonii / Superb Parrot	9.9	308.00
Synemon plana / Golden Sun Moth	21.6	335.00

Delma impar/ Striped Legless Lizard	351_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Delma impar/Striped Legless Lizard	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Myotis macropus/ Southern Myotis	350_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	289_ModerateGood	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	350_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	351_ModerateGood_Remnant	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Polytelis swainsonii/ Superb Parrot	350_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Polytelis swainsonii/Superb Parrot	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	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Synemon plana/ Golden Sun Moth	350_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Synemon plana/Golden Sun Moth	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	Endangered	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	351_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Synemon plana/Golden Sun Moth	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	Endangered	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00010359/BAAS17068/18/00012902

Proposal Name
Rye Park SWS IBRA

BAM data last updated *
18/06/2020

Assessor Name
Bill Wallach

Assessor Number
BAAS17068

BAM Data version *
29

Proponent Names
Tilt Renewables

Report Created
12/08/2020

BAM Case Status
Open

Assessment Revision
6

Assessment Type
Major Projects

Date Finalised
To be finalised

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion

Species
Synemon plana / Golden Sun Moth
Synemon plana / Golden Sun Moth

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	0.8	26.00
335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Not a TEC	4.8	114.00
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	21.8	512.00
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	Not a TEC	322.6	3653.00

289-Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Upper Riverina Dry Sclerophyll Forests This includes PCT's: 269, 285, 289, 290, 298, 302, 304, 314, 338, 340, 342, 353, 1088, 1094, 1095	Upper Riverina Dry Sclerophyll Forests >=50% and <70%	Yes	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

335-Tussock grass - sedgeland fen - rushland - reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Inland Floodplain Swamps This includes PCT's: 66, 204, 205, 335, 360, 447, 465, 1291	Inland Floodplain Swamps >=70% and <90%	No	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
350-Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	Yes	Inland Slopes, Bogan-Macquarie, Bondo, Capertee Uplands, Capertee Valley, Crookwell, Hill End, Kerrabee, Lower Slopes, Murray Fans, Murrumbateman, Orange, Pilliga, Talbragar Valley and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Delma impar / Striped Legless Lizard	3.6	27.00
Myotis macropus / Southern Myotis	0.0	1.00
Petaurus norfolcensis / Squirrel Glider	62.2	2270.00
Polytelis swainsonii / Superb Parrot	9.9	308.00
Synemon plana / Golden Sun Moth	21.6	335.00

Delma impar/ Striped Legless Lizard	351_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Delma impar/Striped Legless Lizard	Any in NSW
Myotis macropus/ Southern Myotis	350_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	289_ModerateGood	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	350_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	350_Moderate	
	351_ModerateGood_ Remnant	**Like-for-like credit retirement options**
		Spp / IBRA region
		Petaurus norfolcensis/Squirrel Glider / Any in NSW
Polytelis swainsonii/ Superb Parrot	350_Moderate	**Like-for-like credit retirement options**
		Spp / IBRA region
		Polytelis swainsonii/Superb Parrot / Any in NSW
Synemon plana/ Golden Sun Moth	350_DNG	**Like-for-like credit retirement options**
		Spp / IBRA region
		Synemon plana/Golden Sun Moth / Any in NSW

Synemon plana/ Golden Sun Moth	351_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Synemon plana/Golden Sun Moth	Any in NSW

umwelt
Environmental & Social
Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au