G.5 BIODIVERSITY (BIRDS AND BATS)

umwelt
Environmental & Social Consultants

RYE PARK WIND FARM

Operational Bird and Bat Assessment -
Rye Park Wind Farm Modification

FINAL

March 2020

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FINAL

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

Project Director:	Allison Riley
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4	Allison Riley	18 March 2020	Allison Riley	18 March 2020

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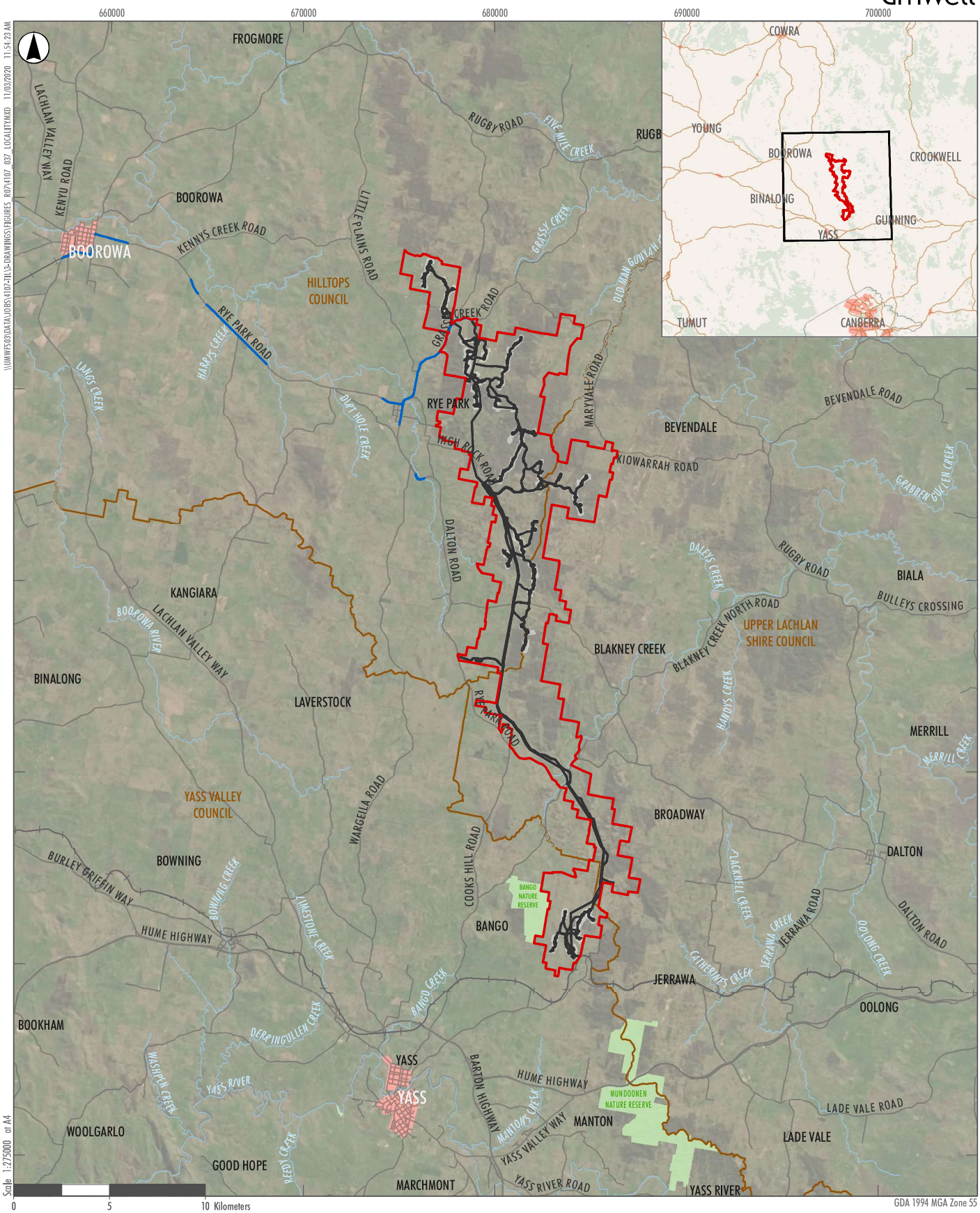
1.0 Introduction

Rye Park Renewable Energy Pty Ltd was granted State and Federal planning approval with conditions in May 2017 and December 2017 respectively to construct a wind farm comprising 92 wind turbines, on a site located in the Hilltops, Yass Valley and Upper Lachlan Local Government Areas in New South Wales. The site is located approximately 4 kilometres (km) east of the township of Rye Park and 250 km south west of Sydney, on the edge of the Southern Tablelands and the South West Slopes Bioregions.

The Rye Park Wind Farm site boundary (hereafter referred to as the Project Area) encompasses approximately 14,000 hectares (**Figure 1.1**). It spans approximately 37 km along a prominent NNW – SSE aligned ridge from a location 17 km east of Boorowa at its northern boundary to a location 11 km north-east of Yass at its southern boundary.

The proponent engaged Umwelt to undertake a comparative assessment of the risk that blade strike poses for birds and bats associated with the existing approved turbine layout versus a proposed modification to both the total number of turbines and turbine dimensions. The modification application would be submitted to the NSW Department of Planning, Industry and Environment (DPIE) for assessment and approval.



Legend

- Rye Park Wind Farm Site Boundary
- Rye Park Wind Farm Modified Indicative Development Footprint – External Roads
- Rye Park Wind Farm Modified Indicative Development Footprint – Wind Farm
- Rye Park Wind Farm Modified Development Corridor
- Watercourses
- Major Roads
- Railways
- Local Government Areas
- Built Up Areas
- NPWS Estate

FIGURE 1.1

Locality Plan

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

2.0 Proposed modification

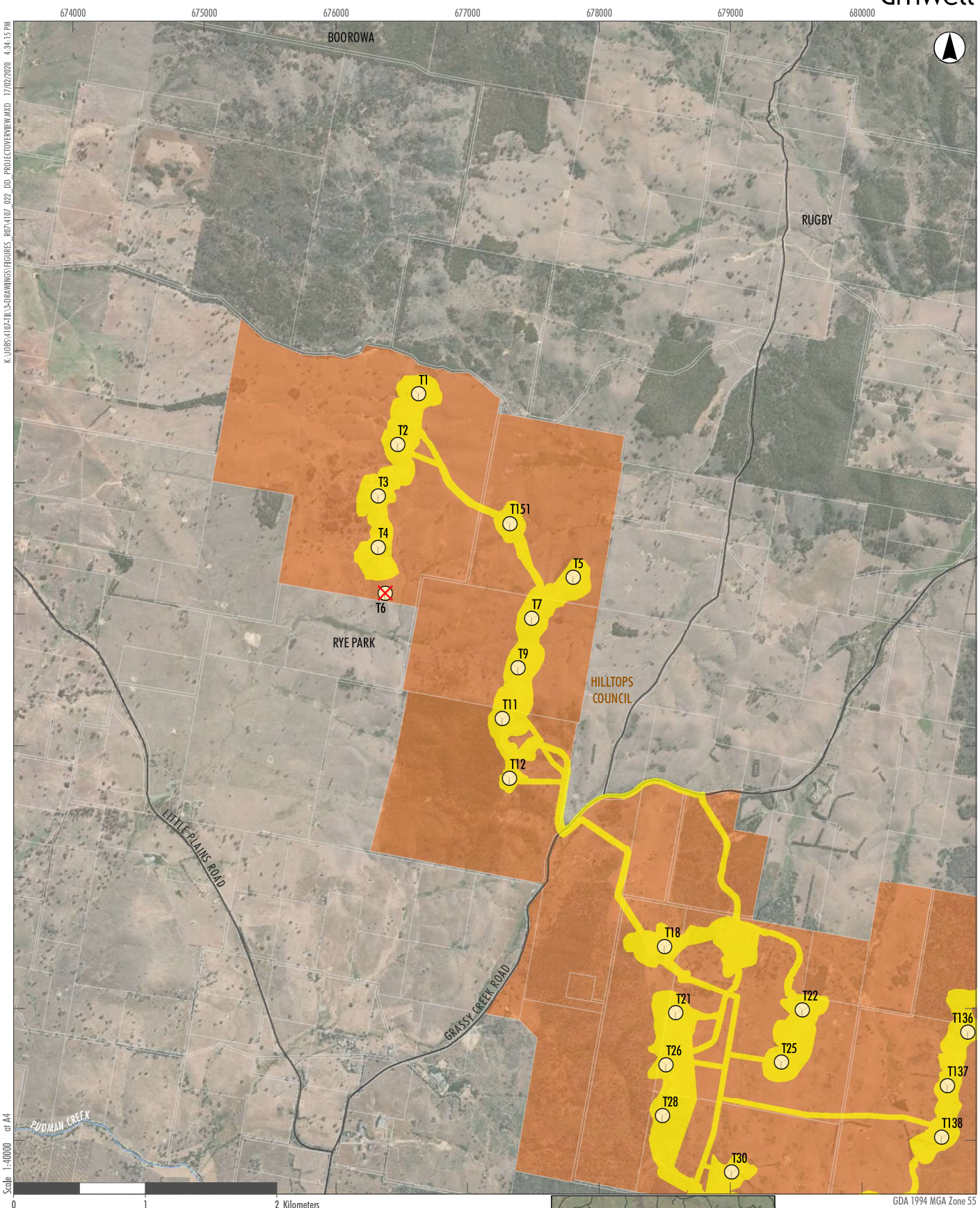
The proposed modification comprises a reduction in the approved number of turbines from 92 to 80 and an increase in maximum blade tip height.

The turbines to be removed were positioned in the northern section (6), north-eastern section (35, 38), central section (52, 53, 56, 77, 140 149) and the southern section (102, 103, 104) of the Project Area (**Figure 2.1**).

For the purpose of this assessment a worst-case maximum rotor swept area (RSA) has been assessed (which results in a slight increase in ground clearance compared with what was originally assessed). The indicative turbine specifications and total size of the rotor swept area (RSA) assessed, of each turbine and of the wind farm as a whole, is set out below (**Table 2.1**).

Table 2.1 Comparison between specifications of the approved design vs the proposed modification

	Approved Project	Modification	Total extent of change
Number of turbines	92	80	Reduction by 12 turbines (13%)
Rotor diameter	130m *(indicative)*	170m *(indicative)*	Increase by up to 40 metres (31%)
Maximum tip height	157m	200m	Increase maximum blade tip height by up to 43 metres (27%)
Ground clearance	27m *(indicative)*	30m *(indicative)*	Increase ground clearance by 3 metres (11%)
Rotor swept area / turbine (m^2)	13,267m^2 *(indicative)*	22,698m^2 *(indicative)*	Increase by 9,431m^2 (71%)
Total rotor swept area for wind farm (m^2)	1,220,564m^2 *(indicative)*	1,815,840m^2 *(indicative)*	Increase by 595,276m^2 (49%)



Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

Previously Approved Turbine Locations

- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses

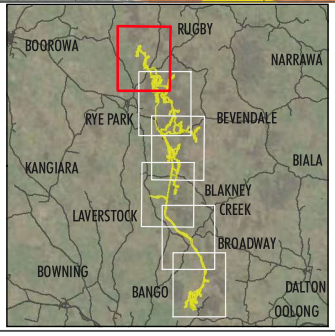
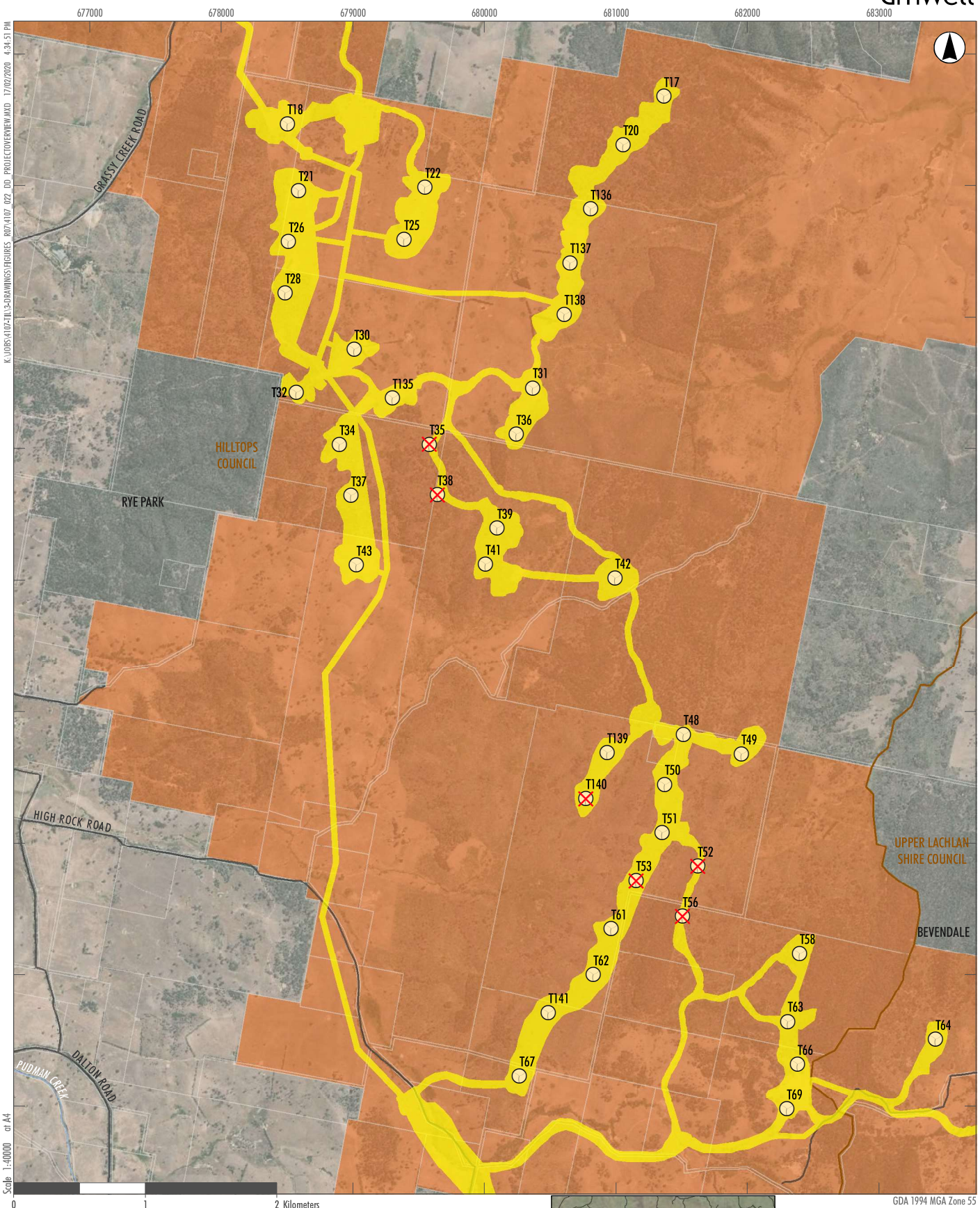
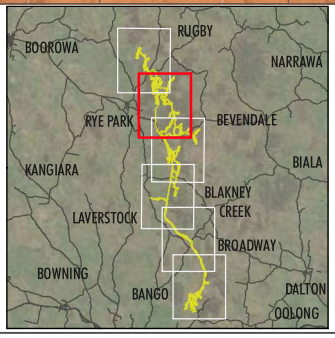


FIGURE 2.1.1

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;





Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

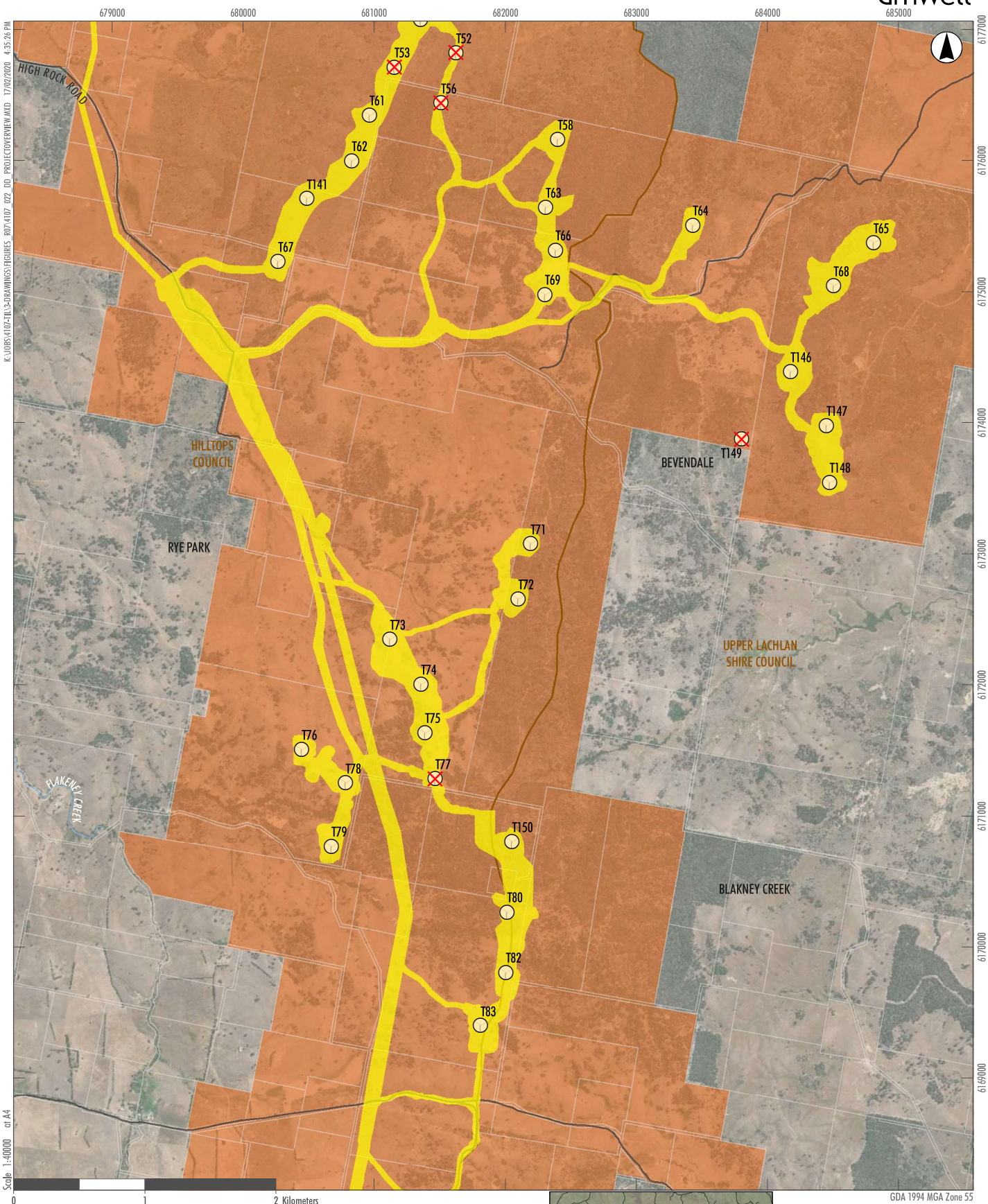
Previously Approved Turbine Locations

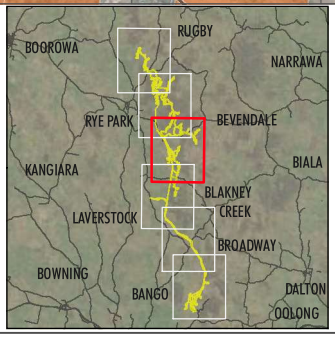
- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses

FIGURE 2.1.2

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;





Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

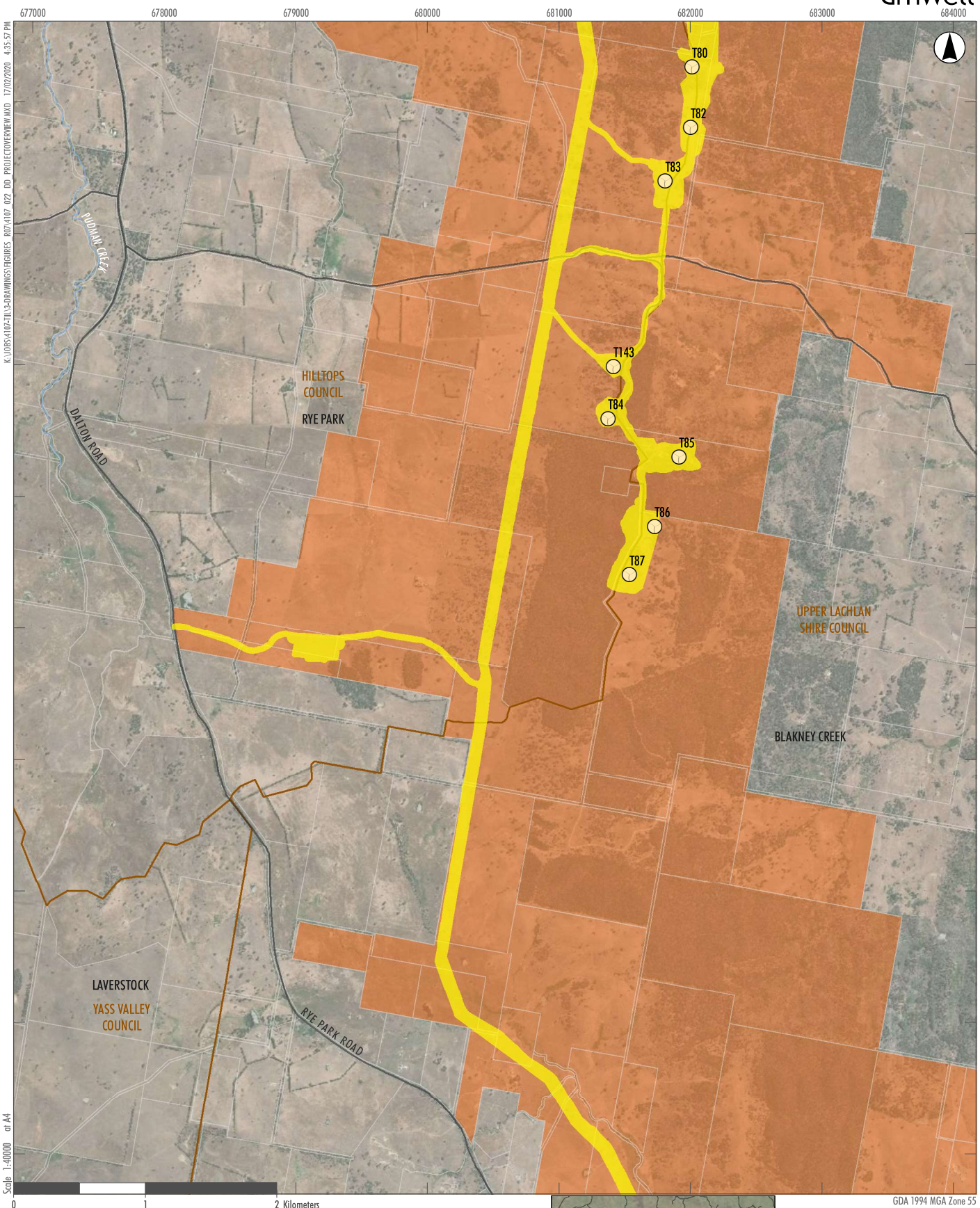
Previously Approved Turbine Locations

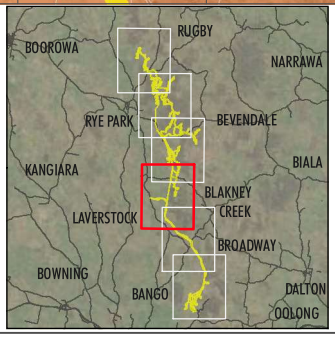
- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses

FIGURE 2.1.3

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;





Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

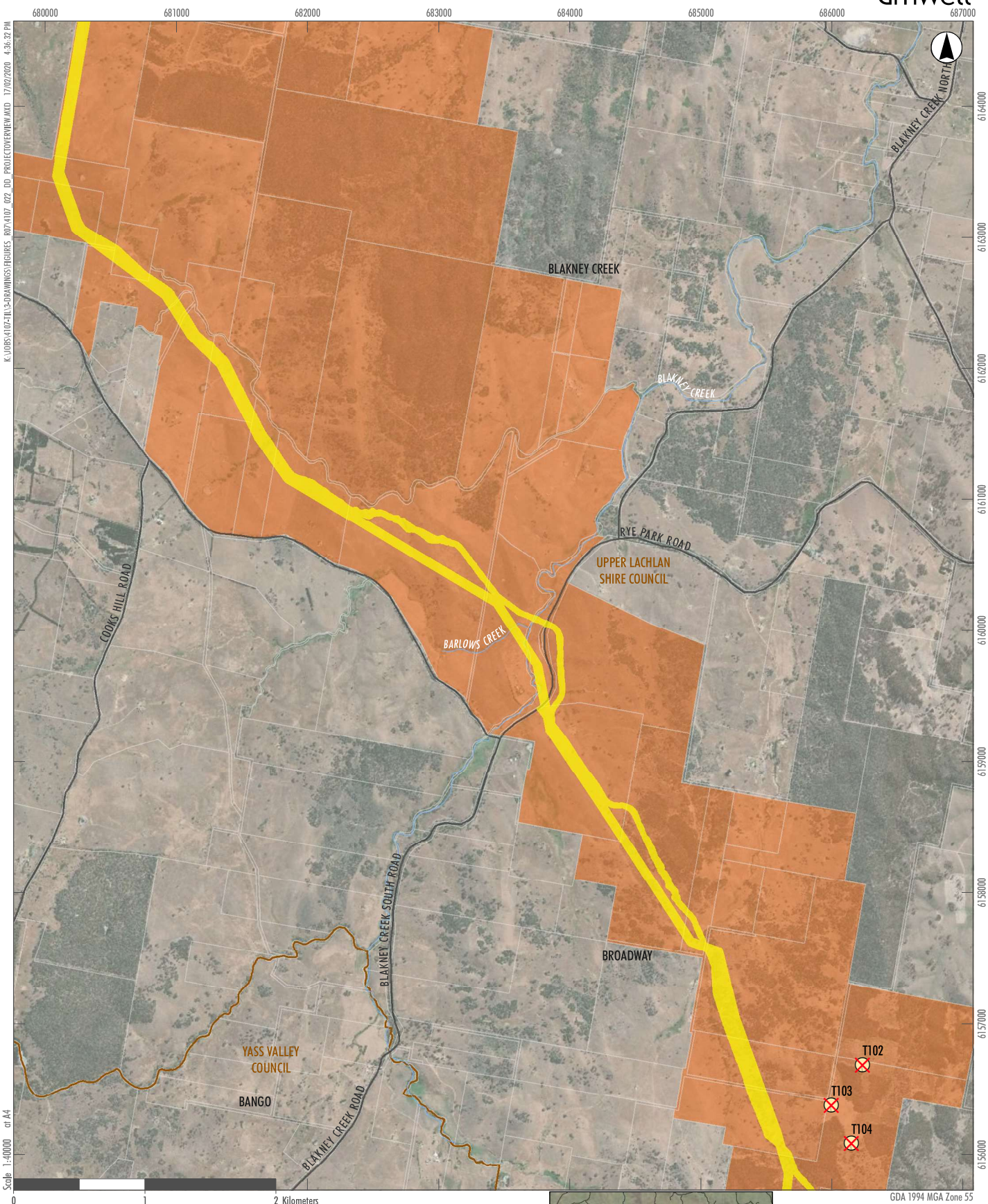
Previously Approved Turbine Locations

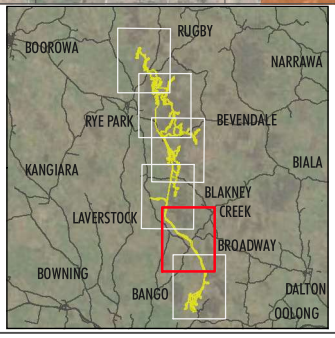
- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses

FIGURE 2.1.4

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;





Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

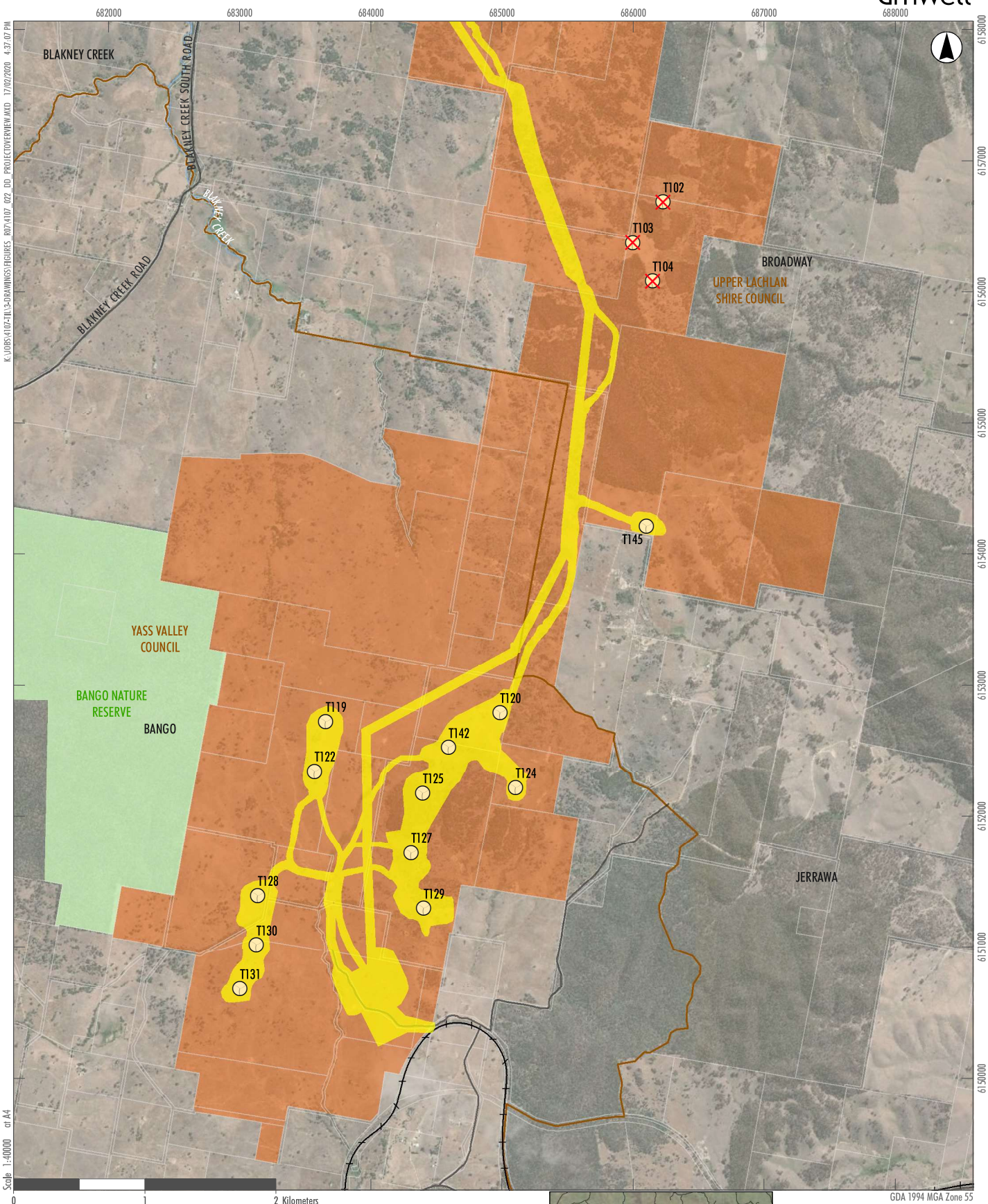
Previously Approved Turbine Locations

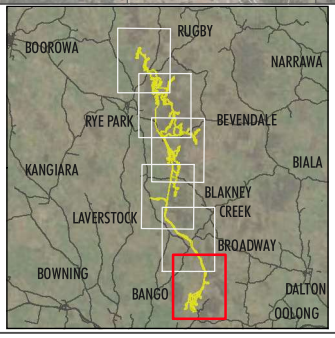
- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses

FIGURE 2.1.5

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;





Legend

- Rye Park Wind Farm Modified Development Corridor
- Project Site

Previously Approved Turbine Locations

- Included in Modified Layout
- Excluded from Modified Layout
- Property Boundaries
- Watercourses
- NPWS Estate

FIGURE 2.1.6

Location of Turbines to be Removed

Image Source: ESRI Basemap (2020) Data source: Geoscience Australia;

3.0 Bird data summary and risk assessment

A summary of flight observations of the threatened and/or migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the NSW *Biodiversity Conservation Act 2016* (BC Act) recorded during extensive surveys in the Project Area (**Table 3.1**) is presented in **Section 3.1.1**.

The risk of blade strike under the current design and the proposed modification for these 14 species is discussed in **Section 3.1.2**.

Flight observation data of selected non-listed species are presented in **Section 3.2.1** and the risk of blade strike for these non-listed species under the current design and the proposed modification is presented in **Section 3.2.2**.

Table 3.1 Threatened and/or migratory listed bird species recorded in the Project Area

Species name	Scientific name	EPBC Act Status	BC Act Status
dusky woodswallow	*Artamus cyanopterus*	-	Vulnerable
brown treecreeper	*Climactris picumnus victoriae*	-	Vulnerable
varied sittella	*Daphoenositta chrysoptera*	-	Vulnerable
white-fronted chat	*Epthianura albifrons*	-	Vulnerable
black falcon	*Falco subniger*	-	Vulnerable
painted honeyeater	*Grantiella picta*	-	Vulnerable
little eagle	*Hieraaetus morphnoides*	-	Vulnerable
white-throated needletail	*Hirundapus caudacutus*	Vulnerable Migratory	-
hooded robin	*Melanodryas cucullata*	-	Vulnerable
flame robin	*Petroica phoenicea*	-	Vulnerable
scarlet robin	*Petroica boodang*	-	Vulnerable
superb parrot	*Polytelis swainsonii*	Vulnerable	Vulnerable
speckled warbler	*Pyrrholaemus sagittatus*	-	Vulnerable
diamond firetail	*Stagonopleura guttata*	-	Vulnerable

3.1 Threatened Species

3.1.1 Summary of flight observations

Of the 14 threatened species recorded in the Project Area, nine were observed flying on at least one occasion during Umwelt's 2018/19 surveys, and six were recorded flying between 25m and 200m above ground level (AGL) (**Table 3.2**, **Table 3.3**, **Table 3.4**).

Table 3.2 Number of observations of threatened species by flight height

Species name	Not flying	<10	10-19	20-29	30-39	40-59	60-79	80-99	100-149	150-199	200-249	250-299	>300
dusky woodswallow	10	0	2	0	0	2	2	1	0	0	0	0	0
varied sittella	2	0	3	3	0	0	0	0	0	0	0	0	0
white-fronted chat	42	9	9	7	8	11	0	0	0	0	0	0	0
black falcon	0	0	1	0	0	1	0	1	0	0	0	0	0
little eagle	0	0	0	0	0	0	1	0	0	1	0	0	0
painted honeyeater	0	2	1	0	0	0	0	0	0	0	0	0	0
white-throated needletail	0	0	0	0	2	7	4	1	0	1	1	0	0
hooded robin	2	1	0	0	0	0	0	0	0	0	0	0	0
flame robin	2	0	0	0	0	0	0	0	0	0	0	0	0
scarlet robin	36	2	2	0	0	0	0	0	0	0	0	0	0
superb parrot	8	5	7	4	4	2	0	0	0	0	0	0	0
speckled warbler	4	0	0	0	0	0	0	0	0	0	0	0	0
brown treecreeper	Flight behaviour/height not recorded (NGH 2014). Brown treecreeper are likely to only very rarely fly above 20m AGL.												
diamond firetail	Flight behaviour/height not recorded (NGH 2014). Diamond firetail are likely to only very rarely fly above 20m AGL.												

Table 3.3 Frequency of recorded flights above and below minimum RSA height

Species	# of flights ≤25m (%)	# of flights >25m (%)
dusky woodswallow	2 (29%)	5 (71%)
brown treecreeper	No flights recorded	No flights recorded
varied sittella	6 (100%)	0
white-fronted chat	25 (57%)	19 (43%)
black falcon	1 (33%)	2 (67%)
painted honeyeater	3 (100%)	0
little eagle	0	2 (100%)
white-throated needletail	0	16 (100%)
hooded robin	1 (100%)	0
flame robin	No flights recorded	No flights recorded
scarlet robin	4 (100%)	0
superb parrot	16 (73%)	6 (27%)
speckled warbler	No flights recorded	No flights recorded
diamond firetail	No flights recorded	No flights recorded

Table 3.4 Frequency of recorded flights above and below maximum RSA – existing design vs modification

Species name	Existing (157m AGL)		Modification (200m AGL)		Difference
	# of flights <160m (%)	# of flights ≥160m (%)	# of flights ≤200m (%)	# of flights >200m (%)	
little eagle	2 (100%)	0	2 (100%)	0	0
black falcon	3 (100%)	0	3 (100%)	0	0
white-throated needletail	15 (94%)	1 (6%)	16 (100%)	0	+1 (6%)

3.1.2 Comparative risk assessment

Blade strike risk overview

The proposed modification is likely to increase the risk for bird species that regularly fly at and above 30m AGL. For species that regularly fly below and occasionally fly above minimum RSA height (of both the existing design and the proposed modification) changes in risk resulting from a slight increase in minimum RSA height, a reduction in the number of turbines and a considerable increase in total RSA may have a combined positive, negative or negligible impact on overall risk of blade strike. Such species may be subject to higher risk under the proposed modification due to an increase in the total RSA, however could be concurrently subject to lower risk as a result of the removal of 12 turbines. The influence of changes to each of the four relevant factors of the modification on risk of blade strike to threatened bird species is examined with consideration of flight observations from the Project Area and external information in the following sections.

Unlikely to regularly occur above 30m AGL

The risk of blade strike to species that are very unlikely to occur above 30m AGL such as **hooded robin, speckled warbler, brown treecreeper** and **diamond firetail** (**Table 3.3**) is likely to remain stable as the risk is already very low under the existing design (**Table 3.5**).

Scarlet robin and **flame robin,** although observed perched in the majority of instances in the Project Area (during 90% and 100% of observations respectively), are likely to occasionally fly above minimum RSA height (30m AGL) during altitudinal movements through the landscape.

Similarly, whilst not recorded above 25m AGL in the Project Area **painted honeyeater** and **varied sittella** may occasionally approach and exceed minimum RSA height during flight (30m AGL). Flocks of varied sittella were observed flying between paddock trees at 20m AGL on 3 occasions (50% of all observations) and are likely to fly above 30m AGL at times given that the canopy height of trees in the Project Area ranges between 25-30m AGL in areas of box-gum woodland in particular. Whilst painted honeyeater were not recorded flying above 15m AGL in the Project Area (NGH 2014) this species is known to occasionally fly above 30m AGL during display flights and whilst dispersing through the landscape elsewhere in the region (pers. obs. M. Allen).

Scarlet robin, flame robin, painted honeyeater and **varied sittella** could be at slightly higher risk of blade strike due to the 49% increase in total RSA, but will concurrently be subject to slightly lower level of risk owing to the removal of 12 turbines.

The difference in risk to these four species between the existing design and the proposed modification is likely to be negligible.

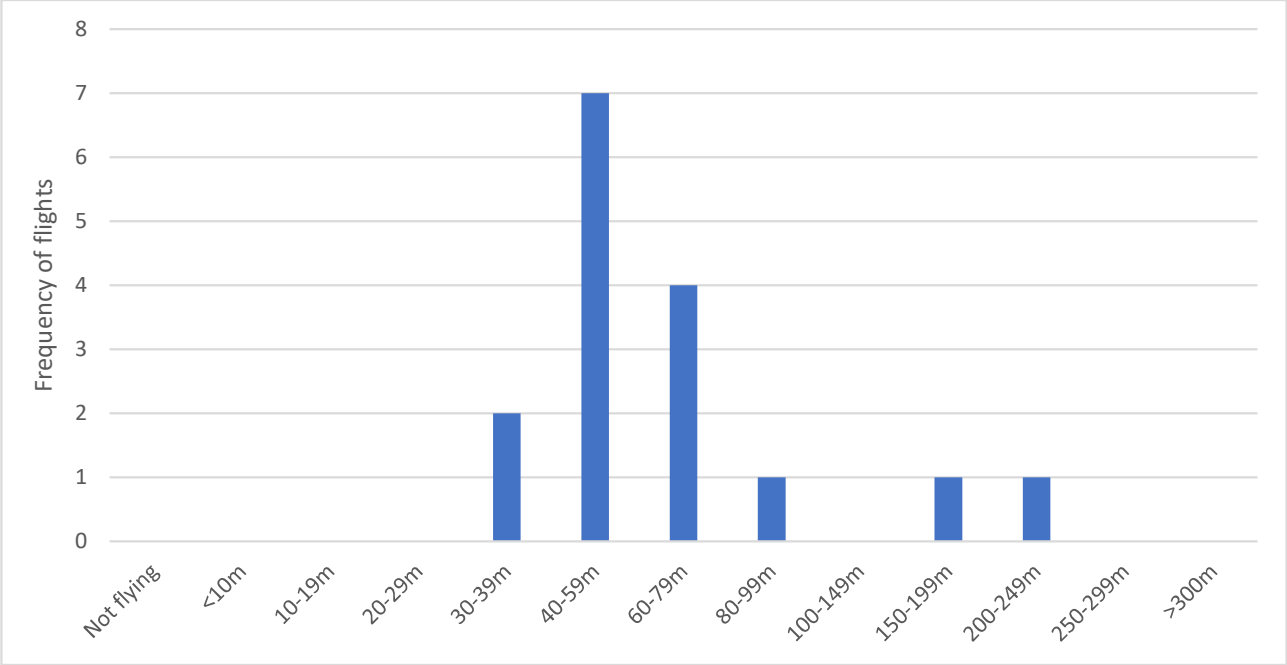
Frequently occur above 30m, occasionally occur below 30m

Species which fly far more frequently above 30m than below 30m such as **white-throated needletail, black falcon and little eagle** are likely to be placed at higher risk of blade strike under the proposed modification as a result of the 49% increase in the total RSA of the wind farm (**Table 3.5**).

In the case of **little eagle** and **black falcon,** both of which are uncommon visitors/residents which may occur overhead across any part of the Project Area, individuals utilising the airspace between 157-200m AGL are placed at risk of blade strike across a vertical zone 43m in width across a height band at which the risk of collision is not present under the existing design. The 3m increase in the minimum RSA height is likely to have a negligible on the level of risk to these two highly aerial raptors.

White-throated needletail were recorded on 16 occasions in the Project Area in flocks of up to 55 individuals flying between 30-200m AGL. The majority of white-throated needletail were observed between 40-80m AGL with 159/172 (92%) of individuals recorded in this height range (**Table 3.2**) (**Graph 3.1**).

The removal of the 12 turbines shown in **Figure 2.1** is likely to reduce risk of blade strike given that some of these turbines were located at higher elevation sites at or adjacent to the larger patches of woodland or forest in the Project Area, which corresponds to areas above which the majority of white-throated needletail were observed foraging or travelling N↔S through the landscape. Despite this the overall level of risk to this species is very likely to increase as a result of the modification due to the 49% increase in total RSA (**Table 3.5**). Furthermore, individuals utilising the airspace between 157-200m are placed at risk of blade strike as a result of the increase in maximum RSA height.



Graph 3.1 Frequency of white-throated needletail observations in each height class

<u>Regularly fly both above and below 30m</u>

The risk to species such as **superb parrot**, **dusky woodswallow** and **white-fronted chat** which regularly fly both below and above 30m AGL is likely to increase overall despite the removal of 12 turbines given the likely impact associated with a 49% increase in total RSA.

Superb parrot were recorded on 30 occasions during 2018/19 of which 22 observations were of birds in flight. A total of 4/22 (18%) of such observations were of individuals or flocks flying between 20-29m AGL, 4/22 (18%) at 30-39m AGL and 2/22 (9%) at 40-49m AGL whilst the remaining 12 flights (55%) were below 20m AGL (**Table 3.2**). The proposed removal of 12 turbines is unlikely to reduce risk to superb parrot given that this species was not recorded near such locations. The majority of turbines to be removed are located in the upper slopes and ridgetops of the Project Area. None are located in or near key foraging or breeding areas on the lower slopes of the Project Area.

The 3m increase in minimum RSA height is likely to have a negligible or minor influence on the risk to this species. The overall level of risk of blade strike to superb parrot is likely to increase as a result of the proposed modification (**Table 3.5**).

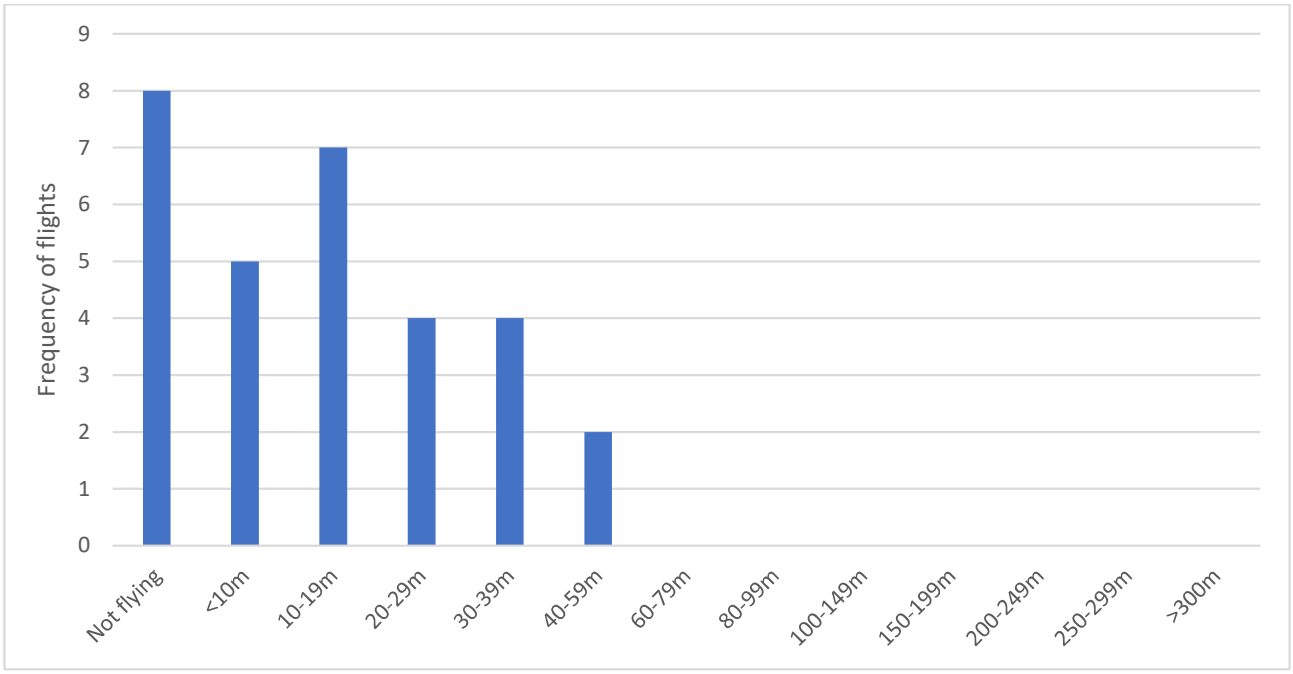
In the case of **dusky woodswallow**, a reduction in risk resulting from the removal of 12 turbines is unlikely to outweigh the risk associated with an increase in total RSA of 49% given that this species regularly utilises the airspace above 30m whilst dispersing and foraging. The majority of observations of dusky woodswallow flying in the Project Area (5/7 (71%)) were of flocks or individuals foraging between 40-100m AGL (**Table 3.2**) (**Graph 3.3**). The 3m increase in minimum RSA height is likely to have a negligible or minor influence on the risk to this species. The overall level of risk of blade strike to dusky woodswallow is likely to increase as a result of the proposed modification (**Table 3.5**).

Whilst **white-fronted chat** tend to spend a considerable amount of time foraging on the ground or in low shrubs (i.e. 42/86 (49%) observations) this species was regularly recorded flying at or above 30m AGL. On 8 occasions (18% of observed flights) individuals or flocks were recorded flying at between 30-39m AGL and on 11 occasions (25% of observed flights) they were recorded at between 40-49m AGL (**Table 3.2**) (**Graph 3.4**). The 3m increase in minimum RSA height is likely to have a negligible or minor influence on the risk to this species. Given the location of the 12 turbines proposed to be removed relative to the distribution of the white-fronted chat in the Project Area this aspect of the proposed modification is very likely to reduce the risk of blade strike to this species. However, the 49% increase in total RSA is likely to outweigh this factor resulting in an overall increase in the level of risk of blade strike to white-fronted chat.

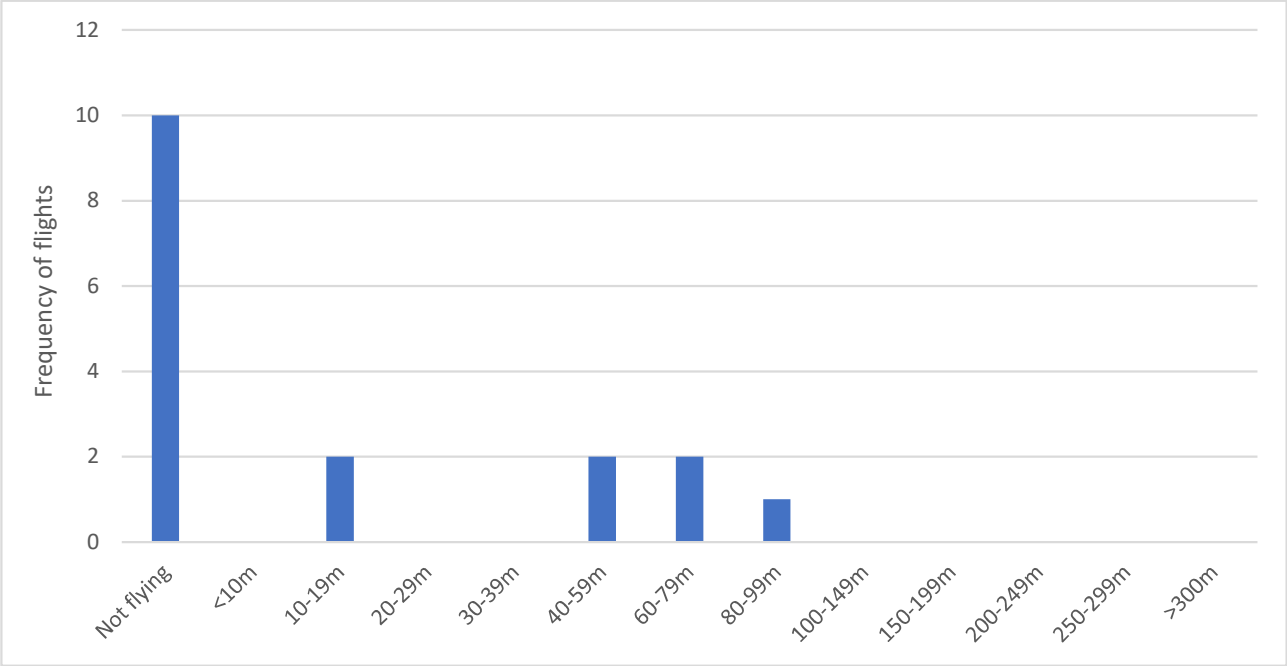
Summary

The proposed modification is likely to increase the risk of blade strike to white-throated needletail, little eagle, black falcon, superb parrot, dusky woodswallow and white-fronted chat and have little impact on the level of risk to hooded robin, speckled warbler, brown treecreeper, diamond firetail, scarlet robin, flame robin, painted honeyeater and varied sittella.

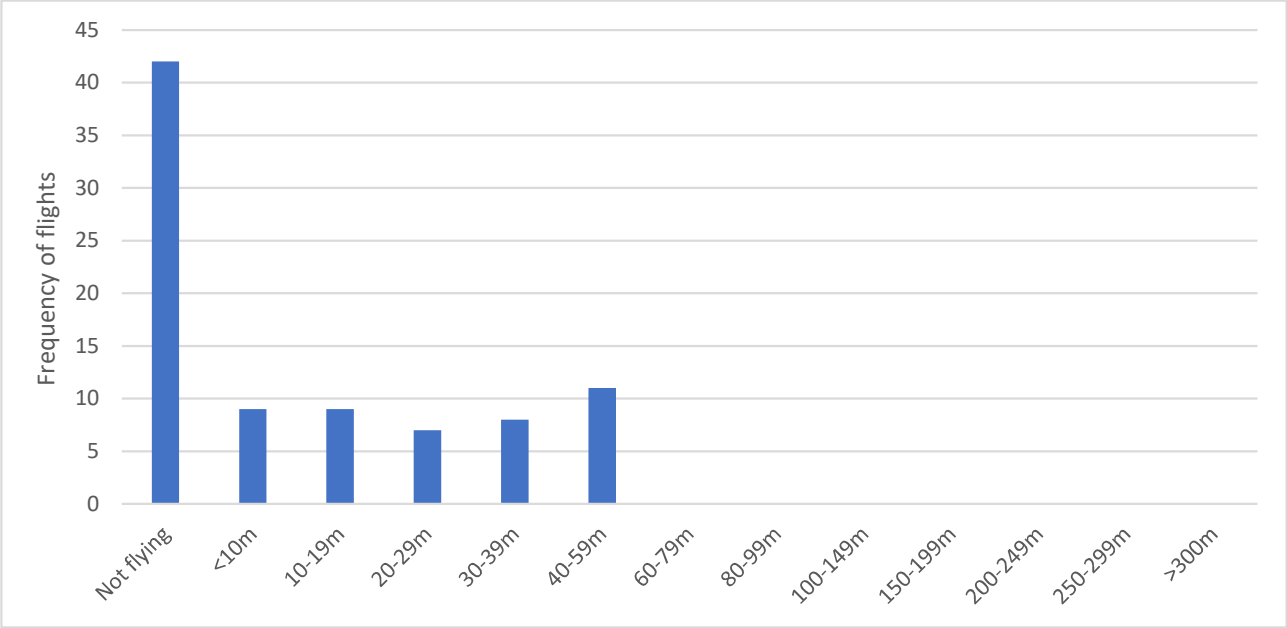
The proposed modification is unlikely to increase the level of risk to the extent that it would result in a significant adverse impact on any threatened birds listed under the EPBC Act and/or the BC Act based on the likely results of assessments of significance as presented in **Table 3.6** and **Table 3.7**.



Graph 3.2 Frequency of superb parrot observations in each height class.



Graph 3.3 Frequency of dusky woodswallow observations in each height class



Graph 3.4 Frequency of white-fronted chat observations in each height class

Table 3.5 Estimated relative risk trends relating to impact of changes to key factors of the proposed modification on risk of blade strike of threatened species
(↑ = increased risk, ↓ = decreased risk, ↔ = no change or highly uncertain)

Species name	Reduction of 12 turbines with a rotor diameter of 130m (RSA height of 27 to 157m AGL)	Increased maximum blade tip height by up to 43 metres from 157 to 200m AGL	Increased ground clearance by 3 metres from 27 to 30m AGL	An increase in total RSA by 595,276m^2 (49%)	Overall risk trend
dusky woodswallow	↓	↑	↔	↑	↑
varied sittella	↔	↔	↔	↔	↔
white-fronted chat	↓	↔	↔	↑	↑
black falcon	↓	↑	↔	↑	↑
painted honeyeater	↔	↔	↔	↔	↔
little eagle	↓	↑	↔	↑	↑
white-throated needletail	↓	↑	↔	↑	↑
hooded robin	↔	↔	↔	↔	↔
flame robin	↔	↔	↔	↔	↔
scarlet robin	↔	↔	↔	↔	↔
superb parrot	↔	↔	↔	↑	↑
speckled warbler	↔	↔	↔	↔	↔

Table 3.6 Test of significance summary - threatened bird species listed under the BC Act

	a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:		c. in relation to the habitat of a threatened species or ecological community:			d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
		i.is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction	ii.is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality		
dusky woodswallow	No	n/a	n/a	Negligible	No	Minor	No	No
white-fronted chat	No	n/a	n/a	Negligible	No	Minor	No	No
black falcon	Potential. Given the low density of this species in the landscape instances of blade strike may be significant at the local population scale.	n/a	n/a	Negligible	No	Uncertain	No	No
little eagle	Potential. As above.	n/a	n/a	Negligible	No	Uncertain	No	No
superb parrot	No	n/a	n/a	Negligible	No	Minor	No	No

Table 3.7 Test of significance summary - vulnerable bird species listed under the EPBC ACT

	a. lead to a long-term decrease in the size of an important population of a species	b. reduce the area of occupancy of an important population	c. fragment an existing important population into two or more populations	d. adversely affect habitat critical to the survival of a species	e. disrupt the breeding cycle of an important population	f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	h. introduce disease that may cause the species to decline	i. interfere substantially with the recovery of the species
superb parrot	No	No	No	No	No	No	No	No	No
white-throated needletail	No	No	No	No	No	No	No	No	No

3.2 Non-threatened bird species

3.2.1 Summary of flight observations

A summary of the number of observations of birds in flight above and below minimum RSA height for select raptors, waterbirds, other non-passerines and passerines recorded flying above 25m AGL in the Project Area is presented in **Table 3.8**.

A summary of the number of observations of wedge-tailed eagle below and above the maximum blade tip height of the existing design and the proposed modification is presented in **Table 3.9**.

Table 3.8 Frequency of recorded flights above and below minimum RSA (non-threatened species recorded at >25m AGL)

Species name	# of flights ≤25m (%)	# of flights >25m (%)
Raptors		
brown goshawk (*Accipiter fasciatus*)	2 (40%)	3 (60%)
wedge-tailed eagle (*Aquila audax*)	6 (5%)	115 (90%)
collared sparrowhawk (*Accipiter cirrocephalus*)	1 (33%)	2 (67%)
brown falcon (*Falco berigora*)	2 (40%)	3 (60%)
nankeen kestrel (*Falco cenchroides*)	18 (45%)	22 (55%)
Australian hobby (*Falco longipennis*)	0	1 (100%)
peregrine falcon (*Falco peregrinus*)	1 (33%)	2 (67%)
whistling kite (*Haliastur sphenurus*)	0	3 (100%)
black kite (*Milvus migrans*)	0	1 (100%)
Waterbirds		
Pacific black duck (*Anas superciliosa*)	0	1 (100%)
white-faced heron (*Egretta novaehollandiae*)	4 (57%)	3 (43%)
nankeen night-heron (*Nycticorax caledonicus*)	0	1 (100%)
straw-necked ibis (*Threskiornis spinicollis*)	0	2 (100%)
Other non-passerines		
sulphur-crested cockatoo (*Cacatua galerita*)	24 (37%)	41 (63%)
yellow-tailed black-cockatoo (*Calyptorhynchus funereus*)	0	1 (100%)
little corella (*Cacatua sanguinea*)	1 (50%)	1 (50%)
galah (*Eolophus roseicapilla*)	99 (68%)	46 (32%)
blue-winged parrot (*Neophema chrysostoma)*	0	1 (100%)
red-rumped parrot (*Psephotus haematonotus*)	1 (50%)	1 (50%)
Passerines		
rainbow bee-eater (*Merops ornatus*)	4 (33%)	8 (67%)
Australasian pipit (*Anthus novaseelandiae*)	11 (69%)	5 (31%)
spotted pardalote (*Pardalotus punctatus*)	4 (25%)	12 (75%)
striated pardalote (*Pardalotus striatus*)	5 (42%)	7 (58%)

Species name	# of flights ≤25m (%)	# of flights >25m (%)
yellow-faced honeyeater (*Caligavis chrysops*)	28 (78%)	8 (22%)
white-eared honeyeater (*Nesoptilotis leucotis*)	29 (97%)	1 (3%)
black-faced cuckoo-shrike (*Coracina novaehollandiae*)	21 (84%)	4 (16%)
red wattlebird (*Anthochaera carunculata*)	53 (95%)	3 (5%)
noisy friarbird (*Philemon corniculatus*)	14 (93%)	1 (7%)
silvereye (*Zosterops lateralis*)	7 (37%)	12 (63%)
white-browed woodswallow (*Artamus superciliosus*)	1 (14%)	6 (86%)
masked woodswallow (*Artamus personatus*)	2 (25%)	6 (75%)
Australian raven (*Corvus coronoides*)	16 (50%)	16 (50%)
little raven (*Corvus mellori*)	4 (40%)	6 (60%)
grey butcherbird (*Cracticus torquatus*)	6 (86%)	1 (14%)
Australian magpie (*Gymnorhina tibicen*)	73 (82%)	16 (18%)
pied currawong (*Strepera graculina*)	12 (92%)	1 (8%)
magpie-lark (*Grallina cyanoleuca*)	14 (88%)	2 (12%)
common starling (*Sturnus vulgaris*)	52 (84%)	10 (16%)
welcome swallow (*Hirundo neoxena*)	21 (68%)	10 (32%)

Table 3.9 Frequency of recorded wedge-tailed eagle flights above and below maximum RSA – existing design vs modification

Species name	Existing (157m)		Modification (200m)		Difference
	# of flights <160m (%)	# of flights ≥160m (%)	# of flights ≤200m (%)	# of flights >200m (%)	
wedge-tailed eagle	76 (63%)	45 (37%)	96 (79%)	25 (21%)	+20 (+17%)

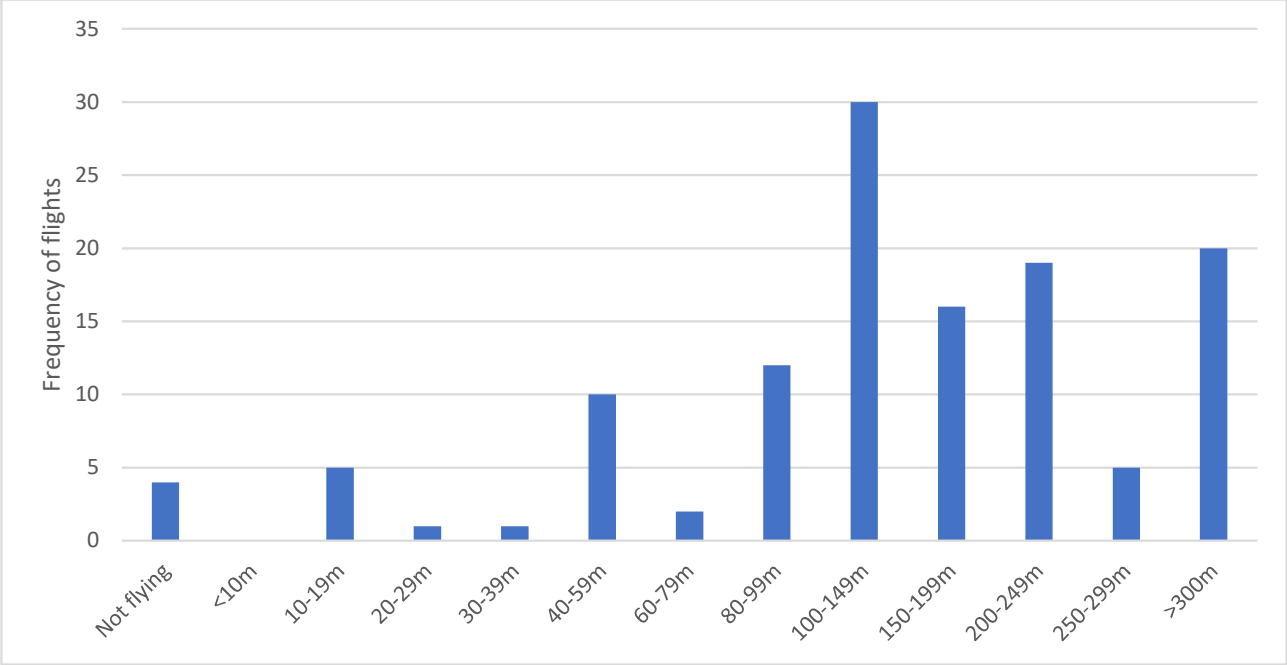
3.2.2 Comparative risk assessment

Wedge-tailed eagle

Wedge-tailed eagle were observed across the majority of the elevated areas of the Project Area and were recorded in flight on 121 occasions during the 2018/19 surveys. Observed flights were almost exclusively of individuals or pairs soaring, displaying or circling above 40m AGL (92% of observations). The proportion of flights recorded at RSA height varied between the existing design and the proposed modification. A total of 71 flights (58%) were recorded between 27-157m whilst a total of 90 flights (74%) were recorded between 30-200m (**Table 3.9**).

The increase in minimum RSA height from 27 to 30m AGL is likely to have little influence on risk of blade strike to this species whilst the increase in maximum RSA height from 157 to 200m AGL results in a greater number of flights being placed at risk. As a standalone factor the removal of 12 turbines would reduce risk of blade strike given that wedge-tailed eagle were either observed flying at RSA height at or are very likely to fly at these locations.

Overall, the level of risk of blade strike is very likely to increase due to the 49% increase in total RSA within a height range that wedge-tailed eagle frequently occur in (**Graph 3.5**) (**Table 3.10**). The majority of other raptors recorded in the Project Area are also likely to be at higher risk of blade strike under the modification due the 49% increase in the total RSA of the wind farm (**Table 3.10**).



Graph 3.5 Frequency of wedge-tailed eagle observations in each height class

Aerial nomads / migrants

The risk of blade strike to highly aerial nomads and migrants which often flock and move through the landscape above 50m AGL such as **masked woodswallow**, **white-browed woodswallow** and **rainbow bee-eater** is likely to increase due to the 49% increase in total RSA across a height range that these species frequently occur in. The majority of observations of masked woodswallow (6/8 (75%)), white-browed woodswallow (5/7 (71%)) and rainbow bee-eater (8/12 (67%)) in flight in the Project Area were of flocks flying between 30-150m AGL.

Other non-threatened species

Common resident species such as **sulphur-crested cockatoo, galah, Australian magpie** and **Australian raven** are also likely to be at higher risk under the modification due to the 49% in total RSA area (**Table 3.10**). Sulphur-crested cockatoo, galah, Australian magpie and Australian raven were recorded flying at or above 30m AGL during 41/65 (63%), 46/145 (32%),16/89 (18%) and 16/32 (50%) observed flights respectively (**Table 3.8**).

Common small passerines such as **striated pardalote**, **spotted pardalote** and **silvereye** were regularly recorded flying during migration below, above and very near to the height of the minimum RSA height of both the existing design and the modification (**Table 3.8**). The average observed flight height in the Project Area for striated pardalote, spotted pardalote and silvereye whilst migrating was 39.6m, 35.5m and 36.2m. For these migratory species an increase in the risk associated with a 49% increase in RSA is likely to outweigh the likely reduction in risk resulting from the removal of 12 turbines (**Table 3.10**). The risk of blade strike to **red wattlebird, yellow-faced honeyeater, magpie-lark, pied currawong** and **Australasian pipit** may potentially increase as a result of the 49% increase in total RSA (**Table 3.10**) whilst for **white-eared honeyeater** the overall risk may be reduced (**Table 3.10)**.

Summary

The majority of species which were recorded flying above 25m AGL in the Project Area are likely to be placed at higher risk of blade strike under the proposed modification largely due to the 49% increase in the total RSA of the project.

Table 3.10 Estimated relative risk trends relating to impact of changes to key factors of the proposed modification on risk of blade strike on selected non-threatened species recorded flying above 25m AGL (↑ = increased risk, ↓ = decreased risk, ↔ = no change or highly uncertain)

Species name	Reduction of 12 turbines with a rotor diameter of 130m (RSA height of 27 to 157m AGL)	Increased maximum blade tip height by up to 43 metres from 157 to 200m AGL	Increased ground clearance by 3 metres from 27 to 30m AGL	An increase in total RSA by 595,276m^2 (49%)	Overall risk trend
Raptors					
wedge-tailed eagle	↓	↑	↔	↑	↑
brown falcon	↓	↑	↔	↑	↑
nankeen kestrel	↓	↔	↔	↑	↑
brown goshawk	↓	↑	↔	↑	↑
collared sparrowhawk	↓	↔	↔	↑	↑
peregrine falcon	↓	↑	↔	↑	↑
Australian hobby	↓	↑	↔	↑	↑
Common resident species					
sulphur-crested cockatoo	↓	↔,↑	↔	↑	↑
galah	↓	↔	↔	↑	↑
Australian raven	↓	↔,↑	↔	↑	↑

Species name	Reduction of 12 turbines with a rotor diameter of 130m (RSA height of 27 to 157m AGL)	Increased maximum blade tip height by up to 43 metres from 157 to 200m AGL	Increased ground clearance by 3 metres from 27 to 30m AGL	An increase in total RSA by 595,276m^2 (49%)	Overall risk trend
Australian magpie	↓	↔	↔	↑	↑
pied currawong	↓	↔	↔	↔,↑	↔,↑
Australasian pipit	↓	↔	↔	↑	↑
magpie-lark	↓	↔	↔	↔, ↑	↔,↑
Migratory, partially migratory or nomadic passerines					
rainbow bee-eater	↓	↑	↔	↑	↑
yellow-faced honeyeater	↓	↔	↔	↑	↑
white-eared honeyeater	↓	↔	↔	↔	↔,↓
noisy friarbird	↓	↔	↔	↔, ↑	↔,↑
red wattlebird	↓	↔	↔	↔, ↑	↔,↑
silvereye	↓	↔	↔	↑	↑
striated pardalote	↓	↔	↔	↑	↑
spotted pardalote	↓	↔	↔	↑	↑
white-browed woodswallow	↓	↑	↔	↑	↑
masked woodswallow	↓	↑	↔	↑	↑

4.0 Bat data summary and risk assessment

A summary of records of threatened bat species listed under the EPBC Act and/or the BC Act and non-threatened species recorded in the Project Area (**Table 4.1**) is presented in **Sections 4.1.1** and **Section 4.2.1** respectively.

No microbats listed under the EPBC Act were recorded in the Project Area. The estimated risk of blade strike under the current design and the proposed modification for threatened species and non-threatened species is discussed in **Sections 4.1.2** and **4.2.2** respectively.

Table 4.1 Status of bat species recorded in the Project Area

Species name	Scientific name	EPBC Act Status	BC Act Status
large bent-winged bat	*Miniopterus orianae oceanensis*	-	Vulnerable
eastern false pipistrelle	*Falsistrellus tasmaniensis*	-	Vulnerable
yellow-bellied sheathtail bat	*Saccolaimus flaviventrus*	-	Vulnerable
southern myotis	*Myotis macropus*	-	Vulnerable

Microbat calls were monitored at a total of 29 locations in the Project Area, comprising 23 ground-based sites at which bat detectors were deployed at 2m AGL, and 6 elevated sites at which bat detectors were deployed at 45m AGL between November 2018 and April 2019. Maximum recording range of the microphones used is assumed to be 30m however recording range can be influenced by a range of variables such as weather conditions and varies markedly between certain microbat species.

4.1 Threatened bat species

4.1.1 Summary of records

The number of definite and probable calls of each threatened species recorded in the Project Area and the mean number of individual calls per unit per night are presented in **Table 4.2**.

Table 4.2 Summary of calls of threatened bat species recorded in the Project Area during 2018/19

Species name	Number of recorded calls at 2m AGL	Mean number of calls / unit / night recorded at 2m AGL	Number of recorded calls at 45m AGL	Mean number of calls / unit / night recorded at 45m AGL
large bent-winged bat	3	0.01	0	0
eastern false pipistrelle	1	<0.01	0	0
yellow-bellied sheathtail bat	10	0.02	4	<0.01
southern myotis	1	<0.01	0	0

Note that bat calls classified as either ‘definite’ or ‘probable’ by the microbat call expert are treated in this report as valid records whilst calls classified as ‘possible’ are not.

A high number of possible large bent-winged bat calls were not identified to species level due to difficulty in confidently differentiating their calls from that of *Vespadalus*. spp. (**Table 4.3**). Such calls should be treated as possibly being large bent-winged bat calls. The number of such calls recorded and the mean number of calls per bat detector per night during 5 November 2018 to 20 March 2019 and during the migration period (24 March to 10 April) is presented in **Table 4.4**.

Table 4.3 Summary of possible large bent-winged bat calls which could not be identified to species level with a high level of confidence

Species group	Number of recorded calls at 2m AGL	Mean number of calls / unit / night recorded at 2m AGL	Number of recorded calls at 45m AGL	Mean number of calls / unit / night recorded at 45m AGL
Miniopterus orianae oceanensis / Vespadelus darlingtoni / V. regulus / V. vulturnus	48997	11.21	46	0.12
Miniopterus o. oceanensis / V. regulus	11	0.02	0	0
Miniopterus o. oceanensis / V. regulus / V. vulturnus	10244	23.96	67	0.17
Miniopterus o. oceanensis / V. vulturnus	8775	24.85	36	0.09

Table 4.4 Summary of possible large bent-winged bat calls recorded prior to (9 November 2018 – 19 March 2019) and during the large bent-winged bat migration period (24 March – 10 April)

Species group	Number of recorded calls at 2m AGL	Mean number of calls / unit / night recorded at 2m AGL	Number of recorded calls at 45m AGL	Mean number of calls / unit / night recorded at 45m AGL
Pre large bent-winged bat migration period (9 November 2018 – 19 March 2019)				
Miniopterus orianae oceanensis / Vespadelus darlingtoni / V. regulus / V. vulturnus	3662	6.24	46	0.17
Miniopterus o. oceanensis / V. regulus	11	0.02	0	-
Miniopterus o. oceanensis / V. regulus / V. vulturnus	8731	14.87	67	0.24
Miniopterus o. oceanensis / V. vulturnus	7640	13.02	35	0.13
Large bent-winged bat migration period (24 March – 10 April 2019)				
Miniopterus orianae oceanensis / Vespadelus darlingtoni / V. regulus / V. vulturnus	1222	8.37	0	-
Miniopterus o. oceanensis / V. regulus	0	0	0	-
Miniopterus o. oceanensis / *V. regulus / V. vulturnus*	1481	10.14	0	-
Miniopterus o. oceanensis / V. vulturnus	1117	7.65	0	-

4.1.2 Comparative risk assessment

The difference in the level of risk of blade strike to **large bent-winged bat** under the existing design versus the proposed modification is uncertain. Only three definite large bent-winged bat calls were recorded during the 2019 migration period each of which were from ground level at a site in the far southern section (BGI02) of the Project Area. Additionally, no potential large bent-winged bat calls were recorded from 45m AGL during the migration period (**Table 4.4**) though over 100 were recorded prior to the migration period.

A 49% increase in total RSA would increase the risk to individuals flying above 30m AGL but the number of flights above this height appears to be low. The proposed modification may have a negligible effect or possibly increase the risk of blade strike to large bent-winged bat however there is a particularly high level of uncertainty associated with this estimate (**Table 4.7**).

A total of ten and four **yellow-bellied sheathtail bat** calls were recorded from 45m AGL and 2m AGL respectively. This species may be placed at higher risk of blade strike under the modification as a result of the 49% increase in total RSA. **Eastern false pipistrelle** was recorded once in the Project Area, from a ground-level site (BGIRP8) located in the central section of the Project Area. It is uncertain whether the proposed modification will increase, reduce or have a negligible effect on risk of blade strike on this species. A possible **southern myotis** call was recorded by a ground-based unit at BGIRP6 in the north-western section of the Project Area 150m from the nearest water body.

Summary

The proposed modification may increase the risk of blade strike to large bent-winged bat and yellow-bellied sheathtail bat. The proposed modification is unlikely to increase the level of risk to these species to the extent that it would result in a significant adverse impact based on the likely results of assessments of significance as presented in **Table 4.5**.

Table 4.5 Test of significance summary - threatened bat species listed under the BC Act

	a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:		c. in relation to the habitat of a threatened species or ecological community:			d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
		i.is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction	ii.is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality		
large bent-winged bat	No	n/a	n/a	n/a	No	n/a	No	No
yellow-bellied sheathtail bat	No	n/a	n/a	n/a	No	n/a	No	No

4.2 Non-threatened bat species

4.2.1 Summary of records

The number of calls of each non-threatened species and the mean number of calls per bat detector per night are presented in **Table 4.6**.

Table 4.6 Summary of calls of non-threatened bat species recorded in the Project Area during 2018/19

Species name	Number of recorded calls at 2m AGL	Mean number of calls / unit / night recorded at 2m AGL	Number of recorded calls at 45m AGL	Mean number of calls / unit / night recorded at 45m AGL
white-striped free-tailed bat (*Austronomus australis*)	27912	26.78	11740	29.06
Gould's wattled bat (*Chalinolobus gouldii*)	2487	4.68	76	0.19
chocolate wattled bat (*Chalinolobus morio*)	592	0.80	2	<0.01
inland free-tailed bat (*Mormopterus petersi*)	6	0.04	2	<0.01
southern free-tailed bat (*Mormopterus planiceps*)	2648	4.80	652	1.63
inland broad-nosed bat (*Scotorepens balstoni*)	40	0.05	17	0.04
little forest bat (*Vespadelus vulturnus*)	4836	10.96	46	0.12

4.2.2 Comparative risk assessment

White-striped free-tailed bat was the most commonly recorded species in the Project Area. It was detected at all 29 survey locations and was regularly recorded from 45m AGL. The level of risk of blade strike is very likely to increase as a result of the modification due to the 49% increase in total RSA within a height range that white-striped free-tailed bat frequently occur (**Table 4.7**).

Gould's wattled bat, inland free-tailed bat, southern free-tailed bat and **inland broad-nosed bat** may also be placed at higher risk of blade strike as a result of the 49% increase in total RSA whilst **chocolate wattled bat** and **little forest bat** may or may not be placed at higher risk of blade strike under the proposed modification than the existing design.

Table 4.7 Estimated relative risk trends relating to impact of changes to key factors of the proposed modification on risk of blade strike on all bat species recorded in the Project Area (↑ = increased risk, ↓ = decreased risk, ↔ = no change or highly uncertain)

Species name	Reduction of 12 turbines with a rotor diameter of 130m (RSA height of 27 to 157m AGL)	Increased maximum blade tip height by up to 43 metres from 157 to 200m AGL	Increased ground clearance by 3 metres from 27 to 30m AGL	An increase in total RSA by 595,276m^2 (49%)	Overall risk trend
Threatened species					
large bent-winged bat	↓	↔,↑	↔	↑	↔,↑
eastern false pipistrelle	↓	↔	↔	↔,↑	↔
yellow-bellied sheathtail bat	↓	↔	↔	↑	↔,↑
southern myotis	↓	↔	↔	↔	↔,↓
Non-threatened species					
white-striped free-tailed bat	↓	↔,↑	↔	↑	↑
Gould's wattled bat	↓	↔	↔	↑	↑
chocolate wattled bat	↓	↔	↔	↔,↑	↔,↑
inland free-tailed bat	↓	↔	↔	↑	↑
southern free-tailed bat	↓	↔	↔	↑	↑
inland broad-nosed bat	↓	↔	↔	↑	↑
little forest bat	↓	↔	↔	↑	↔,↑

5.0 Conclusion

Birds

The proposed modification is very likely to increase the risk of blade strike for certain species which regularly occur above 30m AGL in the Project Area.

Wedge-tailed eagle, little eagle, black falcon and white-throated needletail in particular are likely to be placed at greater risk of blade strike as a result of the 49% increase in the total RSA of the wind farm under the proposed modification. Other highly aerial species or groups of species such as white-browed woodswallow, masked woodswallow, rainbow bee-eater and all raptors present in the Project Area are also likely to be at higher risk of blade strike under the proposed modification.

Threatened species known to occasionally or regularly occur above 30m AGL in the Project Area such as superb parrot, dusky woodswallow and white-fronted chat are likely to be at higher risk of blade strike under the proposed modification. For threatened species which rarely occur above 20m AGL such as hooded robin, diamond firetail, brown treecreeper and speckled warbler or species that occasionally do such as varied sittella, flame robin, scarlet robin, painted honeyeater the difference in blade strike risk between the existing design and the proposed modification is likely to be negligible as there is a very low risk of blade strike under both scenarios.

The proposed modification is unlikely to increase the level of risk of blade strike to the extent that it would result in a significant adverse impact on any threatened birds listed under the EPBC Act and/or the BC Act.

A suite of non-threatened migrants, partial migrants and sedentary species including silvereye, spotted pardalote, striated pardalote, yellow-faced honeyeater, galah, sulphur-crested cockatoo, Australian magpie and Australian raven are also likely to be negatively impacted by the 49% increase in total RSA to the extent that this factor will likely outweigh the reduction in risk resulting from the removal of 12 turbines.

Bats

White-striped free-tailed bat is very likely to be placed at higher risk of blade strike as a result of the 49% increase in the total RSA of the wind farm under the proposed modification. Gould's wattled bat, inland free-tailed bat, southern free-tailed bat and inland broad-nosed bat are also likely to be at greater risk of blade strike under the proposed modification whilst the level of risk of blade strike to large bent-winged bat, yellow-bellied sheathtail-bat, chocolate wattled bat and little forest bat may be similar or slightly higher than the level of risk posed by the current design.

The proposed modification is unlikely to increase the level of risk of blade strike to the extent that it would result in a significant adverse impact on any threatened bats listed under the BC Act. No bats listed under the EPBC Act have been recorded in the Project Area.

Summary

Overall the changes in the components of the wind farm design and/or turbine specifications which differentiate the proposed modification from the existing design are likely to generally influence the risk of blade strike as follows:

- the reduction in the number of turbines will reduce the risk to species that occur at such locations and fly at RSA height

- the 3m increase in minimum RSA height is likely to have a negligible or minor effect on the risk of blade strike to species which occur both above and below this height

- the increase in maximum RSA height will increase the vertical range in which a few highly aerial species, particularly wedge-tailed eagle and white-throated needletail, are at risk of blade strike, and

- the 49% increase in the total RSA of the wind farm is likely to increase risk to a certain suite of species which either occur occasionally, regularly or almost exclusively above 30m AGL.

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