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17SYD-8339

25 October 2018

Dear Kristin,

Bango Wind Farm – Comparison of biodiversity impacts for 71 versus 49 WTG layout

On 1 May 2018, the Independent Planning Commission of NSW (IPCN) approved the Bango Wind Farm (BWF) comprising up to 71 Wind Turbine Generators (WTGs) (of variable tower and rotor dimensions) up to a maximum tip height of 200 m (**71 WTG layout**).

The approval required that the applicant clear no more than 103.75 ha of Box Gum Woodland (BGW) (including derived native grassland) (Vegetation type LA103), undertake the removal of one Wedge-tailed Eagle (WTE) nest located in proximity to Turbine No. 81, and implement reasonable and feasible measures to minimise impacts to hollow-bearing trees (HBTs), threatened bird and bat populations and the clearing of native vegetation and key habitats.

The approval allowed the applicant to 'micro-site' turbines within the development corridor by no more than 100 m to assist in meeting these objectives.

In order to minimise impacts further, BWF is proposing a reduced layout comprising 49 of the **71 WTG layout**, incorporating WTGs with 121 m tower heights, 158 m rotor diameters, reaching to the same maximum tip height of 200 m (**49 WTG layout**).

Eco Logical Australia (ELA) have been commissioned by CWP Renewables (CWP) on behalf of BWF, to undertake a comparison of the biodiversity impacts of the **71** and **49 WTG layouts**.

Figure 1 shows the approved 71 WTG layout and the proposed 49 WTG locations.

A summary of the key changes resulting from this 22 WTG reduction is provided in **Table 1**, which in brief shows that the **49 WTG layout** will result in a 18.41 ha reduction in the on-ground development footprint and a 16.9 % reduction in the above-ground development footprint (rotor swept area). This reduction in overall project impacts is considered to have corresponding reductions in biodiversity impacts as outlined in this summary report.

Robert Humphries

Yours sincerely,

Robert Humphries, Manager, Biodiversity Offset Programs

Table 1: Comparison of major project components

Project Aspect	Approved project	Mitigation Response	Comparison with Approved Project
Development Footprint Area of all *Permanent* and *Temporary* Project infrastructure including temporary disturbances within the Study Area	118.95 ha	100.54 ha	Reduced by 18.41 ha
Permanent Project Infrastructure	**Approved project**	**Mitigation Response**	**Comparison with Approved Project**
Wind turbine generators	Up to 71	Up to 49	Reduced by 22
Tower height (min / max)	80 m to 128 m	121 m	Reduced by 7 m from the max
Rotor diameter (min / max)	72 to 144 m	158 m	Increase of 14 m from the max
Rotor radius (min / max)	36 m to 72 m	79 m	Increase of 7 m from the max
Tip height (max) above ground	200 m	200 m	No change
Tip height (min) above ground	34 m based on a MM92 WTG, comprising 80 m tower height, 46 m rotor radius	42 m	Increased by 8 m
Rotor Swept Area (per turbine)	16,288 m^2	19,609 m^2	Increase of 3,321 m² (20.4%)
Rotor Swept Area (whole Project)	1,156,457 m^2	960,841 m^2	Reduced by 195,616 m² (16.9%)
Hardstands (2,100 m^2 each)	149,100 m^2	102,900 m^2	Reduced by 46,200 m^2
Footings (625 m^2 each)	44,375 m^2	30,625 m^2	Reduced by 13,750 m^2
Road length	54 km	44 km	Reduced by 10 km
Road width	6 m	6 m	No change

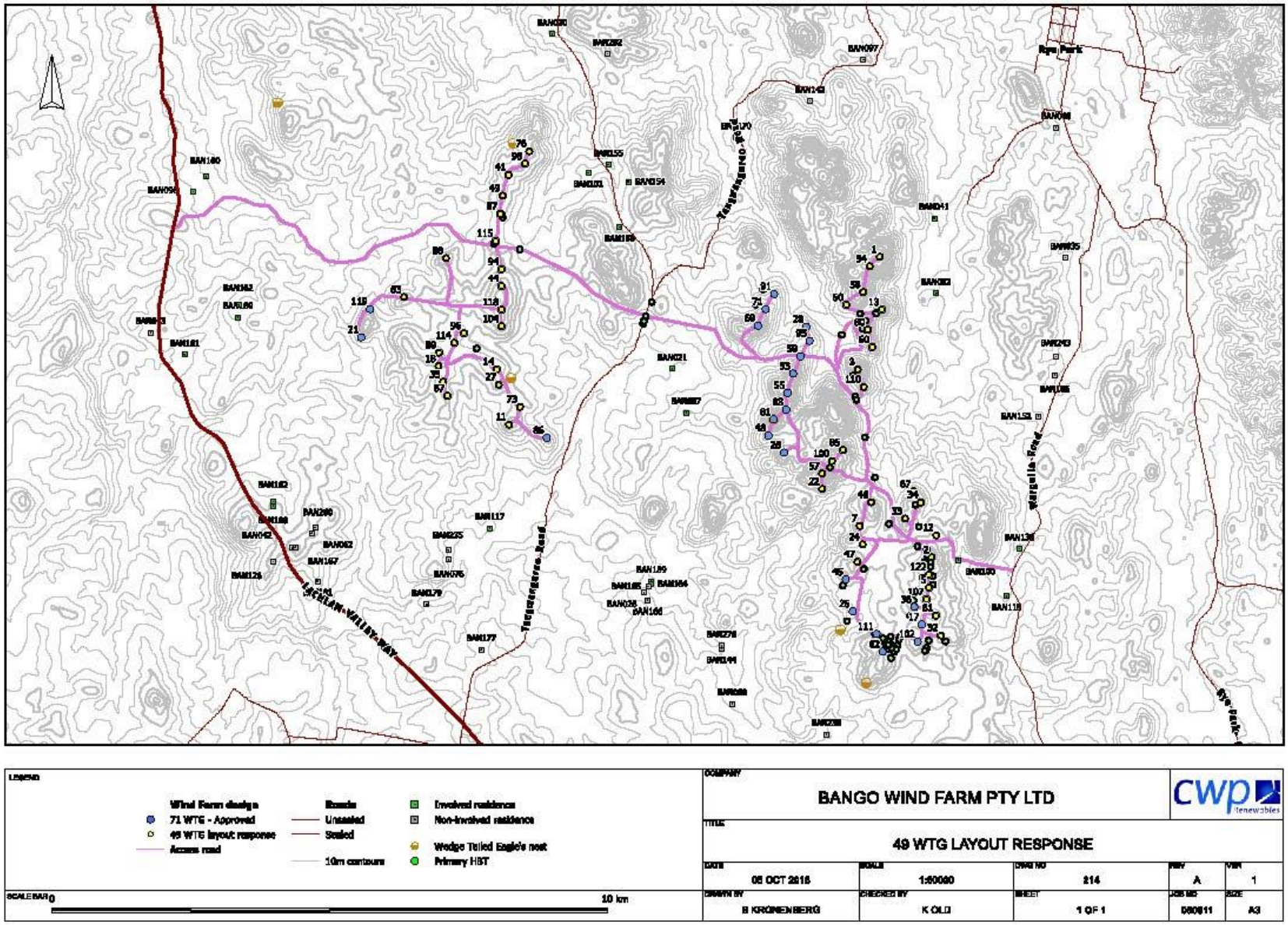

Figure 1: 71 versus 49 WTG layout

Assessment of Biodiversity Impacts

1 Impacts to Native Vegetation

CWP have provided ELA with the footprint of the **71 and 49 WTG layouts** to undertake this analysis (**Figure 1**). ELA has previously undertaken a review of the vegetation mapping included in the CWP EIS (CWP Renewables 2016) and updates/clarification by ERM (2017) as required by condition 18 of the approval. This revised vegetation layer (ELA 2018) has been used for this analysis.

Two Plant Community Types (PCTs) have been mapped in the project area:-

- LA103 (PCT 654) - *Apple Box - Yellow Box dry grassy woodland of the South-Eastern Highlands Bioregion.* Met the definition for Box-Gum Woodland when mapped in moderate to good condition.
- LA182 (PCT 290) - *Red Stringybark - Red Box - Long-leaved Box - Inland Scribbly Gum tussock grass - shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion.*

PCT 654 has been mapped in five condition states reflecting past clearing and current use. Four of these condition classes (Biometric Moderate to Good roadside (C), good (H), moderate (S) and poor (P) - derived native grassland) has a site value score, determined by biometric plot data, of > 17, and thus impacts require offsets in accordance with the Framework for Biodiversity Assessment (FBA).

The 5th condition state (Low- scattered Yellow Box), comprises scattered paddock trees over cropped, cultivated and/or pasture improved grazing land and have a site value score < 17. In accordance with the FBA, impacts to this vegetation zone does not require offsets, however, the individual remnant trees are considered as being representative of the listed endangered ecological community, Box Gum Woodland.

PCT 290 has been mapped in two condition states ('Moderate to good' and 'Low'- scattered Red Stringybark).

Impacts within the 'Low' condition PCT 654 and PCT 290 are restricted to the 'cleared' areas of this vegetation zone other than the occasional individual tree that will be able to be avoided by micro-siting. Accordingly, the area of cleared cropped/grazed paddocks has not been counted in vegetation impacts.

Table 2 provides a comparison of the area of vegetation to be impacted by the **71 and 49 WTG layouts**.

- The **71 WTG layout** impacts a total of 41.67 ha of native vegetation communities comprising 32.22 ha of PCT 654/LA103 (of which 28.37 ha is derived native grassland) and 9.45 ha of PCT 290/LA182.
- The **49 WTG layout** impacts a total of 38.79 ha comprising 30.52 ha of PCT 654/LA103 (of which 26.92 ha is derived native grassland) and 8.27 ha of PCT 290/LA182.

This is a 2.88 ha reduction in the area of native vegetation to be impacted.

2 Impacts to Key Habitat Features (Primary Hollow Bearing Trees)

A number of HBTs have been mapped in the project area. HBTs are an important habitat feature as they provide nesting sites for threatened fauna, including the Superb Parrot, and are disappearing from rural landscapes as old trees die and are not replaced due to limited regeneration. A subset of these HBTs have been classified as Primary HBTs where they provide conditions suitable for Superb Parrot nesting. The Commonwealth Department of the Environment and Energy's approval also required that no more than eight Primary HBTs are to be directly impacted and that no infrastructure is to be within 50 m of a known Primary HBT.

To evaluate the comparative impacts of the **71 and 49 WTG layouts** on HBTs, a worst-case WTG scenario comprising of an 80 m tower height and 46 m rotor radius was utilised in the **71 WTG layout.**

Figures 2-5 show the location of these mapped Primary HBTs inclusive of a 50 m buffer. The figures also show the **71 and 49 WTG layouts** with 46 m and 79 m buffers (the comparative rotor radius) from each tower location, to respectively assess:

- How many HBTs would be directly impacted by the layout (i.e. cleared);
- How many HBT 50 m buffers would be affected by any infrastructure (disturbance issues); and,
- How many rotor tips would come within 50 m of a HBT canopy (increased disturbance issues).

As summarised in **Table 3**, the **71 WTG layout** would result in:

- Eight Primary HBTs directly impacted (roads, hardstands, tower footings);
- 39 Primary HBTs within 50 m of any infrastructure; and,
- Two rotor tips were within 50 m of the canopy of a Primary HBT.

Comparatively, the **49 WTG layout** would result in:

- Seven Primary HBTs directly impacted (roads, hardstands, tower footings);
- 30 Primary HBTs within 50 m of any infrastructure; and,
- Four rotor tips were within 50 m of the canopy of a Primary HBT.

Noting these impacts could reduce further through micro-siting of WTGs.

3 Impacts to and distance to Wedge-tailed Eagle Nests

Six Wedge-tailed Eagle (WTE) nests were recorded within the study area (**Figures 6** and **7**) by ERM 2013/2017. One is directly impacted by the **71 WTG layout** (Turbine No. 81) but has been expressly granted permission to be removed. No WTE nests are directly impacted by the **49 WTG layout**.

Of note, Turbine No. 81 has been removed from the **49 WTG layout**, with the result that that previously impacted WTE Nest (nest 4) is now 1,290 m from the nearest WTG.

The distance to the nearest WTG from each WTE nest in the **71 WTG layout** ranged from 0 m (nest 4) to over 4,000 m (nest 1). With the removal of 22 WTGs, the distance to the nearest WTG from each WTE nest in the **49 WTG layout** ranges from 251 m and 323 m (nests 3 and 2 - no change) and increases from 0 m to 1,290 m (nest 4), 401 m to 1,259 m (nest 5), and 636 m to 1,595 m (nest 6).

4 Assessment of Bird and Bat Strike

To evaluate the comparative impacts of the **71 and 49 WTG layouts** on birds and bats, three worst-case WTG scenarios for the **71 WTG layout** have been utilised comprising of:

1. The same WTG dimensions discussed and utilised in the HBT assessment (an 80 m tower height and 46 m rotor radius) which considers the WTG with the lowest tip height (34 m), however the resultant Rotor Swept Area (RSA) of this comparative option is not be as suitably comparable;
2. The larger 144 m rotor (72 m rotor radius) WTG discussed in the EIS with a tower height of 112 m, resulting in a lower tip height of 40m; and,
3. The same WTG discussed above with a tower height of 128 m, resulting in a lower tip height of 56m and a tip height of 200 m.

The tower heights selected for the large 144 m rotor are applicable to that WTG and result in lower and upper tip heights comparable to the **49 WTG layout**.

The species considered to be at greatest risk from these WTGs considered for the 71 WTG layout (as outlined in the DPE Assessment Report (DPE 2018)) are:-

- Superb Parrot;
- Wedge-tailed Eagle;
- Little Eagle;
- Spotted Harrier;
- Square-tailed Kite;
- Eastern Bent-wing Bat; and,
- Yellow-bellied Sheathtail-bat.

The **49 WTG layout** comprises a tower height of 121 m with a rotor radius of 79 m providing a maximum tip height of 200 m above the ground and a minimum tip height of 42 m above the ground. Under the **49 WTG layout** the RSA for each turbine increases by 20.4% to 19,609 m², however the whole-of-project RSA is reduced by 16.9% (960,841 m²) when compared with the largest rotor under evaluation for the **71 WTG layout,** due to the reduction of 22 WTGs (**Table 1**).

In terms of changes to the risk of blade strike for the key species:-

- There is a reduction of 22 WTG across the project area;
- The removal of Turbine No. 81 has removed the direct impacts to one WTE nest;
- The number of Primary HBTs impacted has been reduced as has the number of WTGs within 50 m of a Primary HBT;
- There is an up to 16.9 % reduction in the combined RSA across the project as a whole leading to a significant reduction in the collision risk for raptors including the WTE; and,
- An overall reduction in the risk of blade collision for the **49 WTG layout** compared to the **71 WTG layout**.

Superb Parrot

The Superb Parrot was generally observed at the BWF site foraging and moving in the tree canopy between 0 and 20 m above ground level (ERM 2013; 2017). Only one individual out of 148 sightings was observed at RSA height (stated in 2013 as being between 20 and 150 m as a worst-case scenario and most likely would be greater than 30 m above ground). NGH (2018) made similar observations of Superb Parrot foraging behaviour at the Coppabella Wind Farm, approximately 20 km to the south west of Bango Wind Farm, with flight height generally being between 10-15 m above ground, occasional records above 20 m, few records up to 30 m and one record up to 40 m (NGH 2017, 2018).

The combined reduction of swept area and up to 8 m increased minimum tip height in the **49 WTG layout** is considered to reduce the risk of blade strike to this species given its observed foraging activity. Most importantly is the significant reduction in RSA at the 30-39 m and 40-49 m height interval above ground with the 121 m tower / 79 m blade in the **49 WTG layout** compared to the 80 m tower / 46 m blade and 112 m tower/ 72m blade combinations in the **71 WTG layout** (see **Tables 3a-3c** and **Figure 8**).

Wedge-tailed Eagle

Six WTE nest were recorded in the study area with one nest active (ERM 2013). The species has been recorded soaring at heights of up to 2,000 m and will forage. Similar to other raptors, the species is considered susceptible to collision with turbines due to its foraging behaviour (soaring in up drafts, gliding at and above RSA heights while detecting prey). The reduction of 22 WTGs (and a corresponding 16.9 % reduction in total RSA) reduces this risk further. Additionally, the removal of 22 turbines has increased the distance between nest sites and turbines from around 300-400 m to >1 km for three nests (reducing the likelihood of blade strike for fledglings and adults defending nests) and remains at around 300 m for two nests. The sixth nest is already >4 km from the nearest turbine (**Figures 6** and **7**).

Further there is a significant reduction in RSA above 30 m above ground with the 121 m tower / 79 m blade in the **49 WTG layout** compared to the 80 m tower / 46 m blade, 112 m tower/ 72 m blade and 128 m tower / 72 m blade combinations up to 200 m above ground reducing the risk of blade strike to soaring WTEs (see **Tables 3a-3c** and **Figure 8**).

Little Eagle, Spotted Harrier and Square-tailed Kite

These raptors all soar at heights in excess of the maximum blade tip height (200 m) and also exhibit low flight when targeting prey. These species are considered susceptible to collision with turbines due to their foraging behaviour (soaring in up drafts and hovering/gliding at RSA heights while detecting prey) (BLA 2018b). The 49 WTG layout has an overall 16.9 % reduction in RSA and this would reduce the risk of collision in the project area. These species generally occur at low densities and thus have a low risk of collision.

Further there is a significant reduction in RSA above 30 m above ground with the 121 m tower / 79 m blade in the **49 WTG layout** compared to the 80 m tower / 46 m blade, 112 m tower/ 72m blade and 128 m tower / 72 m blade combinations up to 200 m above ground reducing the risk of blade strike to soaring and hovering raptors (see **Tables 3a-3c** and **Figure 8**).

Threatened Woodland bird species (Brown Treecreeper, Diamond Fire-tail)

These species typically forage in the canopy and/or understory. This behaviour makes them very unlikely to fly at RSA height and collision with turbines is highly unlikely. The reduction of 22 WTGs and a 16.9 % reduction in RSA reduces this risk further.

Eastern Bent-wing Bat

The Eastern Bent-wing Bat was recorded foraging in the project area. The species breeds in caves with the closest recorded maternity site being at Wee Jasper, some 50 km to the south of the project area. The species generally forages at or above the canopy but may forage at lower heights in more open country (Churchill 2008). Blade mortality for the species has been recorded at low levels at Boco Rock Wind Farm indicating flights paths within the RSA (BLA 2018b), although BLA (2018a) reports that the majority of bat activity is recorded below 50 m (85 %) and below 25 m (75 %). As the minimum blade tip height is 42m, the majority of bat activity will not be within the RSA. Further the 16.9 % reduction in total RSA is likely to reduce the risk of blade strike for this species.

The combined reduction of swept area and up to 8 m increased minimum tip height in the **49 WTG layout** is considered to reduce the risk of blade strike to this species given its observed foraging activity at and above the woodland canopy. Most importantly is the significant reduction in RSA at the 30-39 m and 40-49 m height interval above ground with the 121 m tower / 79 m blade in the **49 WTG layout** compared to the 80 m tower / 46 m blade and 112 m tower/ 72m blade combinations (see **Tables 3a-3c** and **Figure 8**).

Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat typically flies above the forest canopy making it susceptible to turbine collision (BLA 2018. Churchill 2008). It was recorded within the BWF project area in low abundance. The 16.9 % reduction in total RSA is likely to reduce the risk of blade strike for this species.

References

BLA (2018a) Coppabella Wind Farm. Proposed Turbine Modification Impacts on Bird and Bats. Report prepared for Coppabella Wind Farm Pty Ltd, March 2018.

BLA (2018b) Boco Rock Wind Farm Stage 2. Modification Application Impacts on Bird and Bats. Report prepared for CWP Renewables Pty Ltd, September 2018.

Churchill, S (2008) Australian Bats (2nd Edition), Allen & Unwin, Crows Nets, NSW.

ERM (2013) Bango Wind Farm Ecological Impact Assessment. Report prepared for Wind Prospect CWP, May 2013.

ERM (2017) Bango Wind Farm – Biodiversity Response to submissions. Report prepared for CWP Renewables, May 2017.

NGH (2018) Coppabella Wind Farm. Response to biodiversity and heritage submissions. Report prepared for Coppabella Wind Farm Pty Ltd, March 2018

Table 2: Area of each vegetation type and zone to be impacted by 71 and 49 WTG layouts

			Impacts Approved 71 WTGs			Impacts Proposed modified 49 WTGs		
Vegetation	**BVT/PCT**	**Condition/Ancillary code**	**Temp**	**Permanent**	**Total**	**Temp**	**Permanent**	**Total**
LA103_MG_C	Apple Box-Yellow Box Grassy Woodland	Roadside	0.00	0.26	0.26	0.00	0.26	0.26
LA103_MG_H	Apple Box-Yellow Box Grassy Woodland	High	0.02	0.04	0.06	0.02	0.04	0.06
LA103_MG_S	Apple Box-Yellow Box Grassy Woodland	Medium	1.04	2.49	3.53	0.93	2.35	3.28
LA103_MG_P	Apple Box-Yellow Box Grassy Woodland	DNG Poor	2.29	26.08	28.37	1.86	25.06	26.92
LA182_MG	Red Stringybark-Red Box - Long-leaved Box - Inland Scribbly Gum	MG	3.15	6.30	9.45	2.79	5.48	8.27
Sub-total Impacted Vegetation			**6.50**	**35.17**	**41.67**	**5.60**	**33.19**	**38.79**
Planted Native Vegetation	N/A		0.00	0.01	0.01	0.00	0.00	0.00
LA103_L	Scattered Yellow Box over pasture, cropping	Low (Cleared, no offset required	6.89	26.64	33.53	5.57	25.50	31.07
LA182_L	Scattered Red Stringybark over pasture, cropping	Low (Cleared, no offset required	21.24	22.46	43.70	15.02	15.62	30.64
Residual (existing roads)			0.00	0.04	0.04	0.01	0.03	0.04
Sub-total Other			**28.13**	**49.15**	**77.28**	**20.60**	**41.15**	**61.75**
TOTAL AREA (development footprint)			**34.63**	**84.32**	**118.95**	**26.20**	**74.34**	**100.54**

Table 3: Comparison of impacts to Primary Hollow-bearing Trees

Refer to Figures 2-5

	71 WTG (46m radius rotor)	49 WTG (79m radius rotor)	Comparison
Minimum tip height above ground	34 m	42 m	Increased by 8 m
No. Primary HBT in Study Area	106	106	No Change
No. HBT directly impacted (cleared)	8	7	Reduced by 1
HBT 50m buffer Impacted by any infrastructure	39	30	Reduced by 9
HBT canopy impacted by rotor	2	4	Increased by 2

Table 3a: Individual and combined swept area for each 10m height interval for 71 WTG layout (80m tower/46 m blade) compared to proposed 49 WTG layout with 121 m tower and 79 m blade.

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	Swept Area 71 WTG - 46 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Swept Area 71 WTG - 46 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Key Bird and Bat Species
0 - 9.99	0	0	0	0.00%	0	0	0	0.00%	Superb Parrot Bent-wing Bat
10 - 19.99	0	0	0	0.00%	0	0	0	0.00%	
20 - 29.99	0	0	0	0.00%	0	0	0	0.00%	
30 - 39.99	181	0	-181	-100.00%	12,851	0	-12,851	-100.00%	
40 - 49.99	588	365	-223	-37.93%	41,748	17,885	-23,863	-57.16%	Little Eagle Wedge-tailed Eagle Yellow-bellied Sheath-tailed Bat
50 - 59.99	768	858	90	11.72%	54,528	42,042	-12,486	-22.90%	
60 - 69.99	866	1,109	243	28.06%	61,486	54,341	-7,145	-11.62%	
70 - 79.99	911	1,280	369	40.50%	64,681	62,720	-1,961	-3.03%	
80 - 89.99	911	1,403	492	54.01%	64,681	68,747	4,066	6.29%	
90 - 99.99	866	1,489	623	71.94%	61,486	72,961	11,475	18.66%	
100 - 109.99	768	1,544	776	101.04%	54,528	75,656	21,128	38.75%	
110 - 119.99	588	1,576	988	168.03%	41,748	77,224	35,476	84.98%	
120 - 129.99	181	1,573	1,392	769.06%	12,851	77,077	64,226	499.77%	

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	**Swept Area 71 WTG - 46 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Swept Area 71 WTG - 46 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Key Bird and Bat Species**
130 - 139.99	0	1,553	1,553		0	76,097	76,097		
140 - 149.99	0	1,503	1,503		0	73,647	73,647		
150 - 159.99	0	1,424	1,424		0	69,776	69,776		
160 - 169.99	0	1,309	1,309		0	64,141	64,141		
170 - 179.99	0	1,150	1,150		0	56,350	56,350		
180 - 189.99	0	920	920		0	45,080	45,080		
190 - 200	0	518	518		0	25,382	25,382		
TOTAL* **	**6,628**	**19,574**	**12,946**	**195.32%**	**470,588**	**959,126**	**488,538**	**103.81%**	

Table 3b: Individual and combined swept area for each 10m height interval for 71 WTG layout (112m tower/72 m blade) compared to proposed 49 WTG layout with 121 m tower and 79 m blade.

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	Swept Area 71 WTG - 72 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Swept Area 71 WTG - 72 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Key Bird and Bat Species
0 - 9.99	0	0	0	0.00%	0	0	0	0.00%	Superb Parrot Bent-wing Bat
10 - 19.99	0	0	0	0.00%	0	0	0	0.00%	
20 - 29.99	0	0	0	0.00%	0	0	0	0.00%	
30 - 39.99	0	0	0	0.00%	0	0	0	0.00%	
40 - 49.99	501	365	-136	-27.15%	35,571	17,885	-17,686	-49.72%	Little Eagle Wedge-tailed Eagle Yellow-bellied Sheath-tailed Bat
50 - 59.99	876	858	-18	-2.05%	62,196	42,042	-20,154	-32.40%	
60 - 69.99	1089	1,109	20	1.84%	77,319	54,341	-22,978	-29.72%	
70 - 79.99	1234	1,280	46	3.73%	87,614	62,720	-24,894	-28.41%	
80 - 89.99	1333	1,403	70	5.25%	94,643	68,747	-25,896	-27.36%	
90 - 99.99	1397	1,489	92	6.59%	99,187	72,961	-26,226	-26.44%	
100 - 109.99	1431	1,544	113	7.90%	101,601	75,656	-25,945	-25.54%	
110 - 119.99	1436	1,576	140	9.75%	101,956	77,224	-24,732	-24.26%	
120 - 129.99	1413	1,573	160	11.32%	100,323	77,077	-23,246	-23.17%	

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	**Swept Area 71 WTG - 72 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Swept Area 71 WTG - 72 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Key Bird and Bat Species**
130 - 139.99	1361	1,553	192	14.11%	96,631	76,097	-20,534	-21.25%	
140 - 149.99	1275	1,503	228	17.88%	90,525	73,647	-16,878	-18.64%	
150 - 159.99	1149	1,424	275	23.93%	81,579	69,776	-11,803	-14.47%	
160 - 169.99	966	1,309	343	35.51%	68,586	64,141	-4,445	-6.48%	
170 - 179.99	678	1,150	472	69.62%	48,138	56,350	8,212	17.06%	
180 - 189.99	117	920	803	686.32%	8,307	45,080	36,773	442.67%	
190 - 200	0	518	518		0	25,382	25,382		
TOTAL* **	**16,256**	**19,574**	**3,318**	**20.41%**	**947,566**	**959,126**	**-195,050**	**-20.58%**	

Table 3c: Individual and combined swept area for each 10m height interval for 71 WTG layout (128m tower/72 m blade) compared to proposed 49 WTG layout with 121 m tower and 79 m blade.

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	Swept Area 71 WTG - 72 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Swept Area 71 WTG - 46 m blade	Swept Area 49 WTG - 79 m blade	difference	% difference	Key Bird and Bat Species
0 - 9.99	0	0	0	0.00%	0	0	0	0.00%	Superb Parrot Bent-wing Bat
10 - 19.99	0	0	0	0.00%	0	0	0	0.00%	
20 - 29.99	0	0	0	0.00%	0	0	0	0.00%	
30 - 39.99	0	0	0	0.00%	0	0	0	0.00%	
40 - 49.99	0	365	365		0	17,885	17,885		Little Eagle Wedge-tailed Eagle Yellow-bellied Sheath-tailed Bat
50 - 59.99	124	858	734	591.94%	8,804	42,042	33,238	377.53%	
60 - 69.99	683	1,109	426	62.37%	48,493	54,341	5,848	12.06%	
70 - 79.99	969	1,280	311	32.09%	68,799	62,720	-6,079	-8.84%	
80 - 89.99	1151	1,403	252	21.89%	81,721	68,747	-12,974	-15.88%	
90 - 99.99	1277	1,489	212	16.60%	90,667	72,961	-17,706	-19.53%	
100 - 109.99	1362	1,544	182	13.36%	96,702	75,656	-21,046	-21.76%	
110 - 119.99	1414	1,576	162	11.46%	100,394	77,224	-23,170	-23.08%	
120 - 129.99	1436	1,573	137	9.54%	101,956	77,077	-24,879	-24.40%	

	Swept Area of Single Wind Turbine (approx m2)				Swept Area of Total No. of Wind Turbines (approx m2)				
Interval (m above ground)	**Swept Area 71 WTG - 72 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Swept Area 71 WTG - 46 m blade**	**Swept Area 49 WTG - 79 m blade**	**difference**	**% difference**	**Key Bird and Bat Species**
130 - 139.99	1431	1,553	122	8.53%	101,601	76,097	-25,504	-25.10%	
140 - 149.99	1397	1,503	106	7.59%	99,187	73,647	-25,540	-25.75%	
150 - 159.99	1332	1,424	92	6.91%	94,572	69,776	-24,796	-26.22%	
160 - 169.99	1232	1,309	77	6.25%	87,472	64,141	-23,331	-26.67%	
170 - 179.99	1086	1,150	64	5.89%	77,106	56,350	-20,756	-26.92%	
180 - 189.99	872	920	48	5.50%	61,912	45,080	-16,832	-27.19%	
190 - 200	490	518	28	5.71%	34,790	25,382	-9,408	-27.04%	
TOTAL	**16,256**	**19,574**	**3,318**	20.41%	**1,154,176**	**959,126**	**-195,050**	-16.90%	

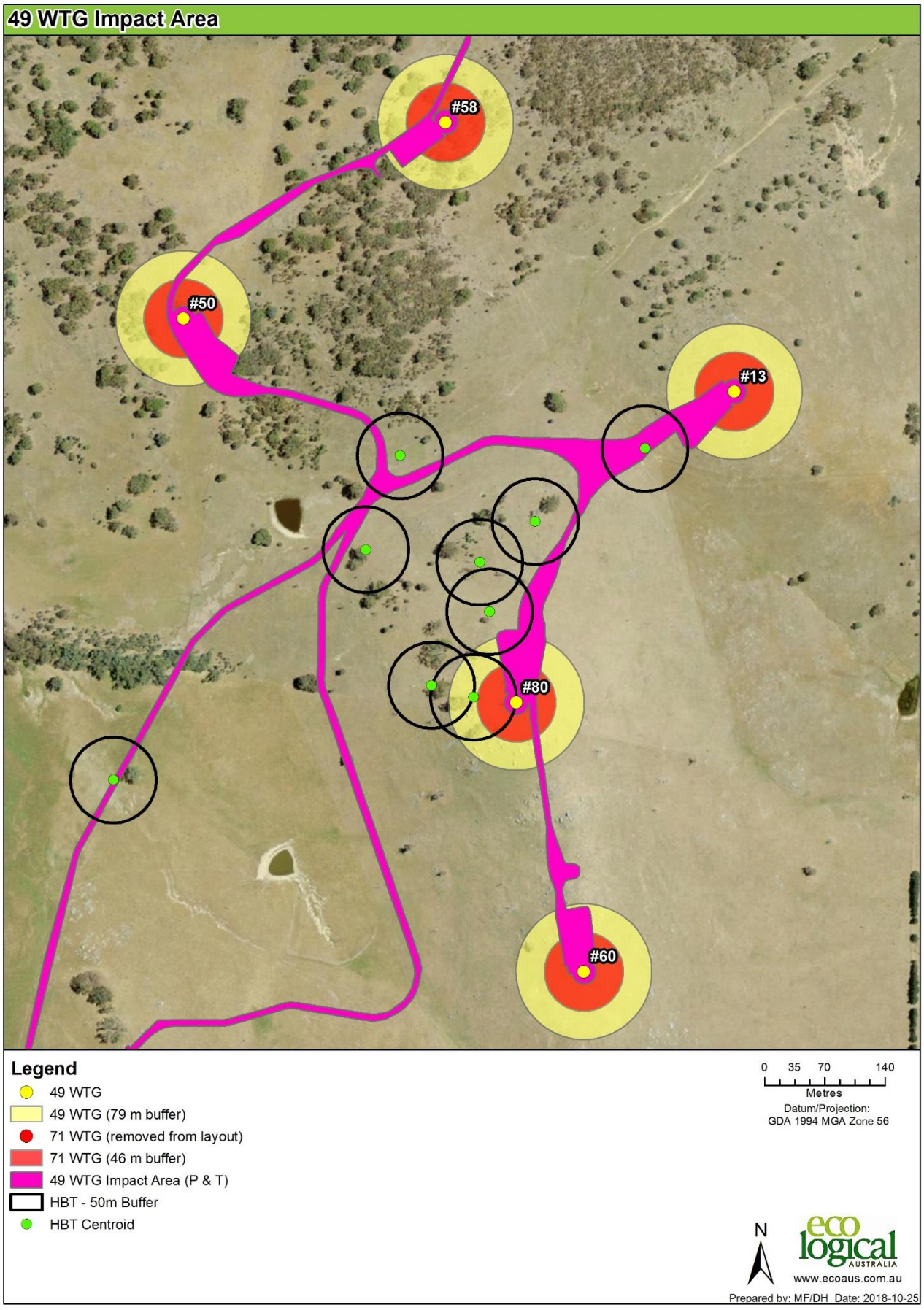

Figure 2: Potential impacts to Primary HBTs by 71 and 49 WTG layouts

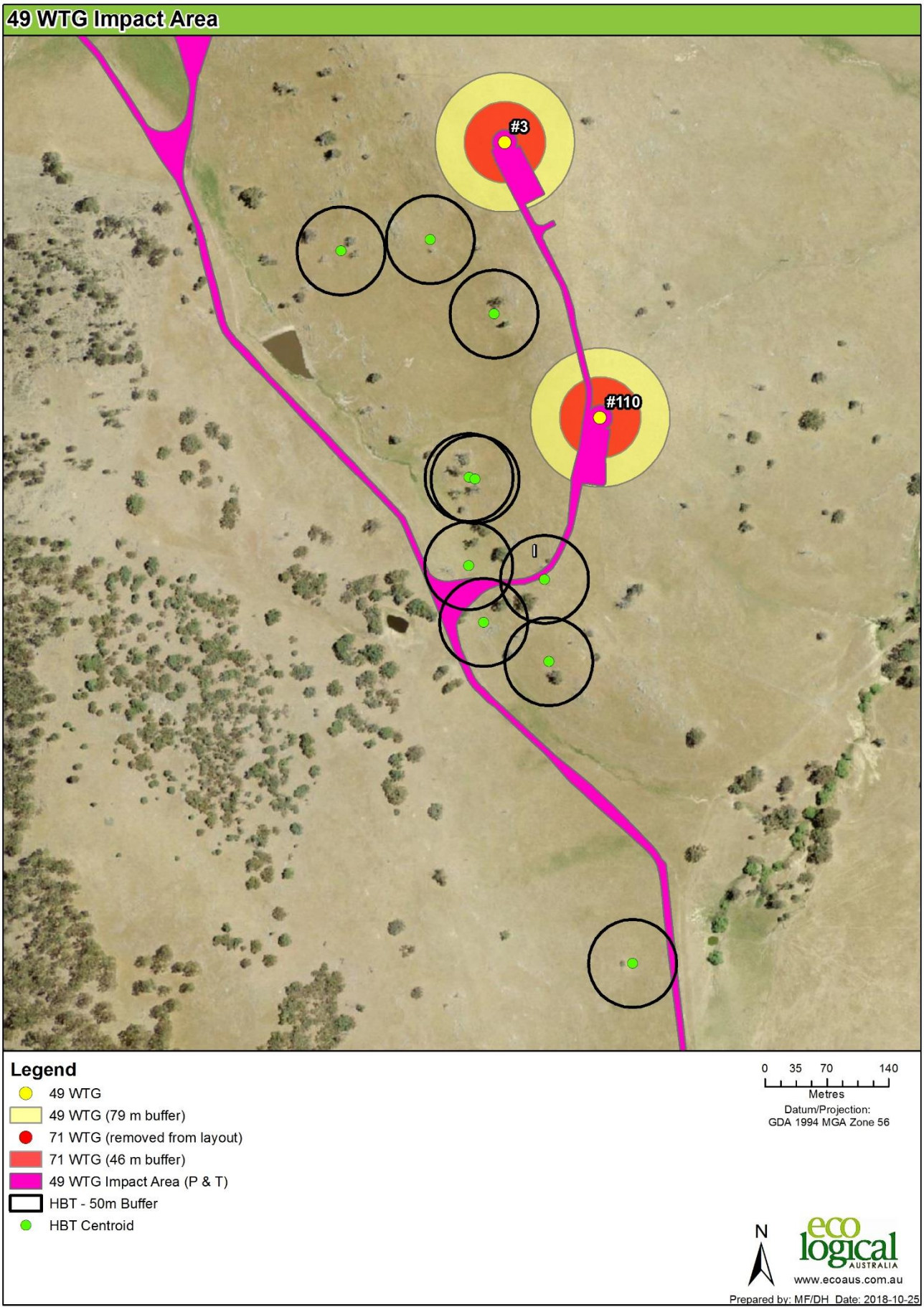

Figure 3: Potential impacts to Primary HBTs by 71 and 49 WTG layouts

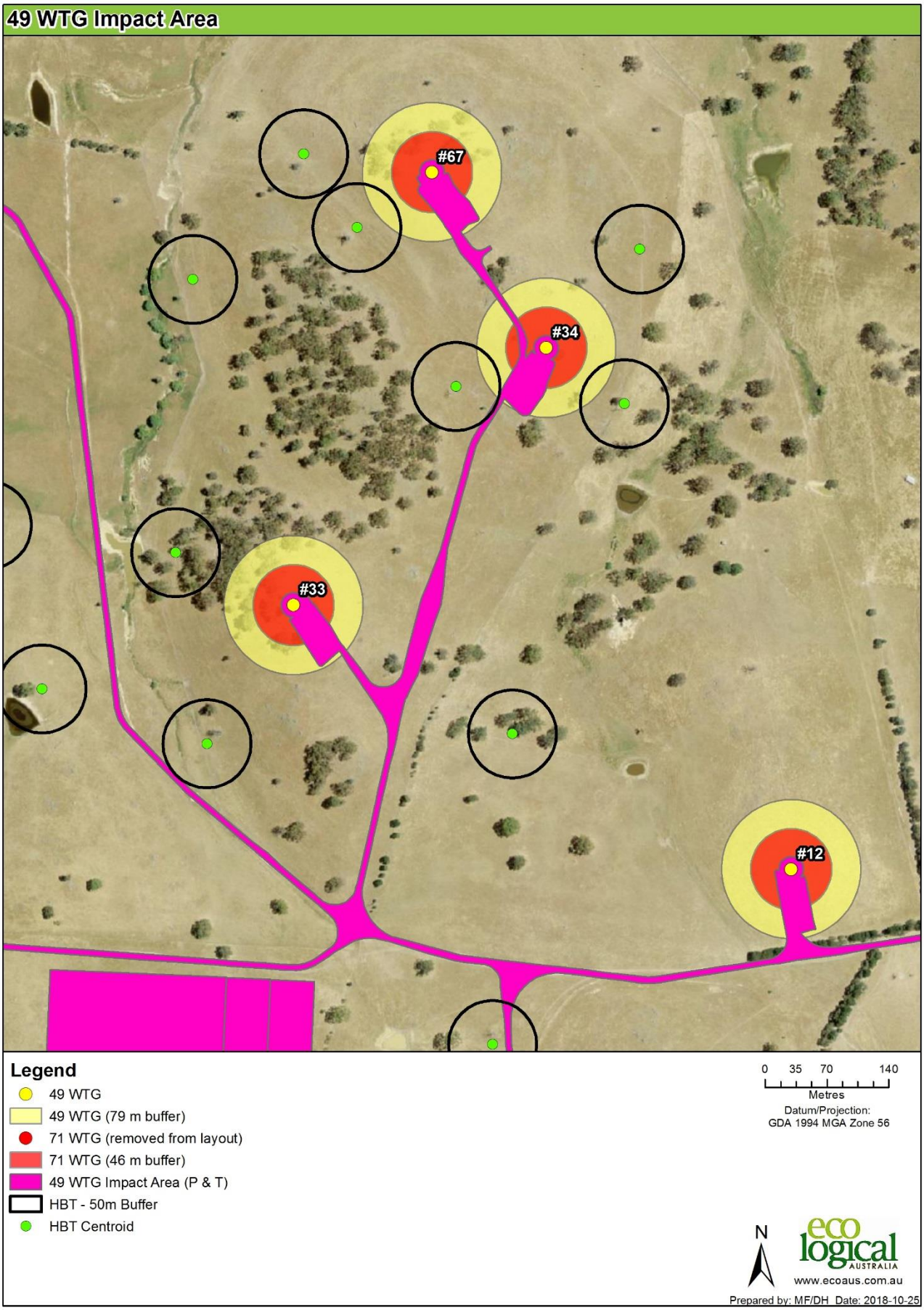

Figure 4: Potential impacts to Primary HBTs by 71 and 49 WTG layouts

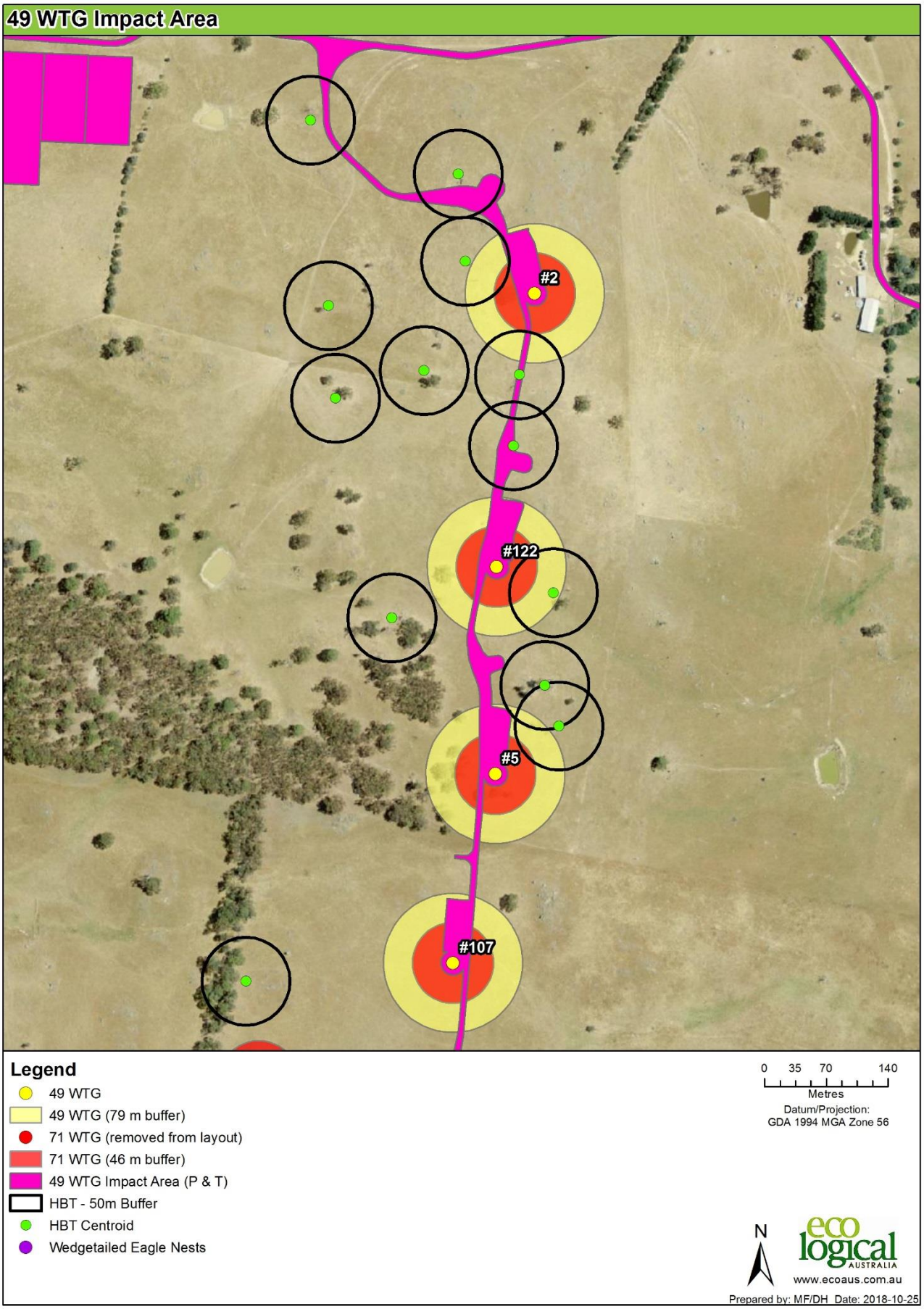

Figure 5: Potential impacts to Primary HBTs by 71 and 49 WTG layouts

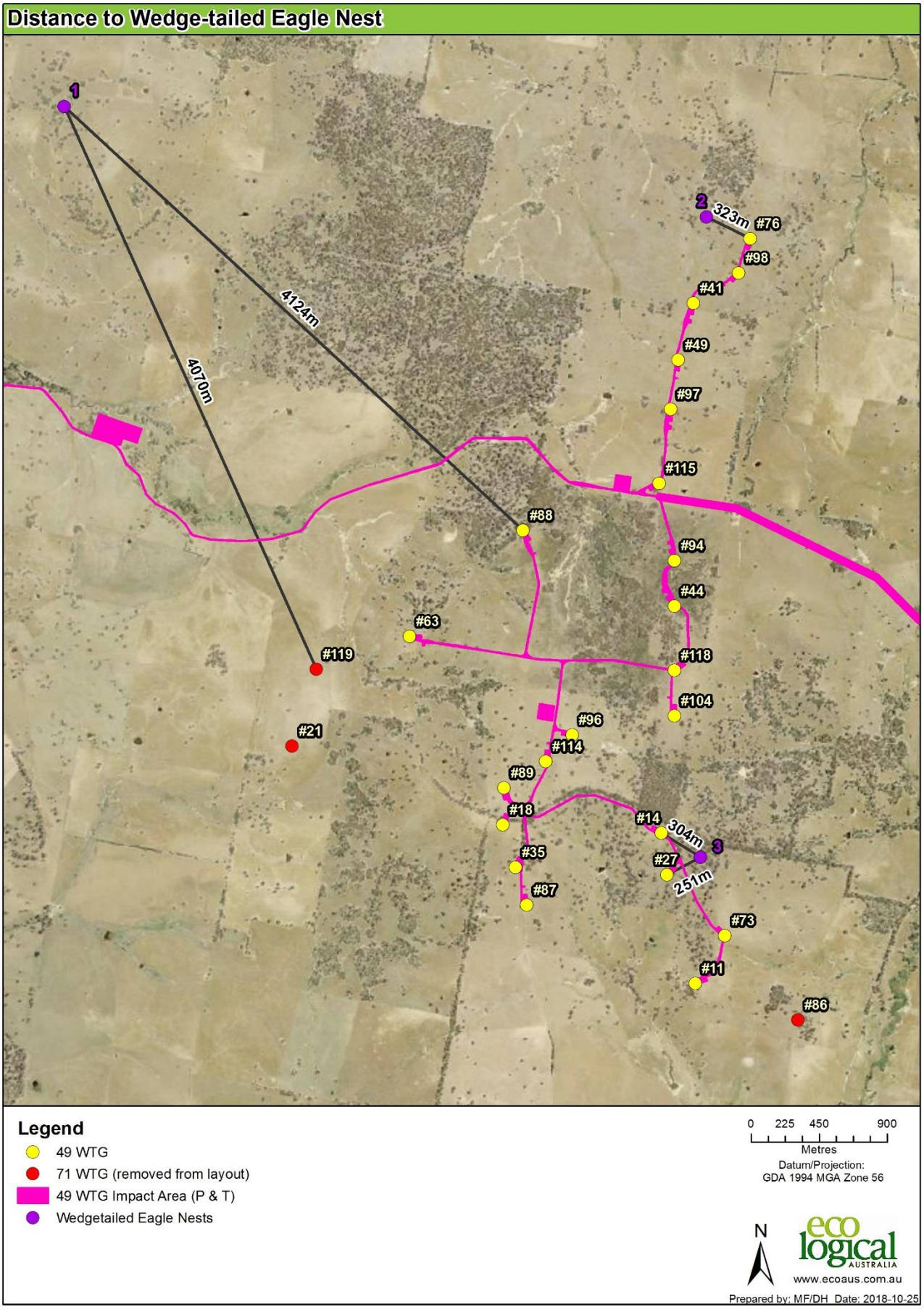

Figure 6: Distance from Wedge-tailed Eagle nests to nearest turbines (Nest 1-3)

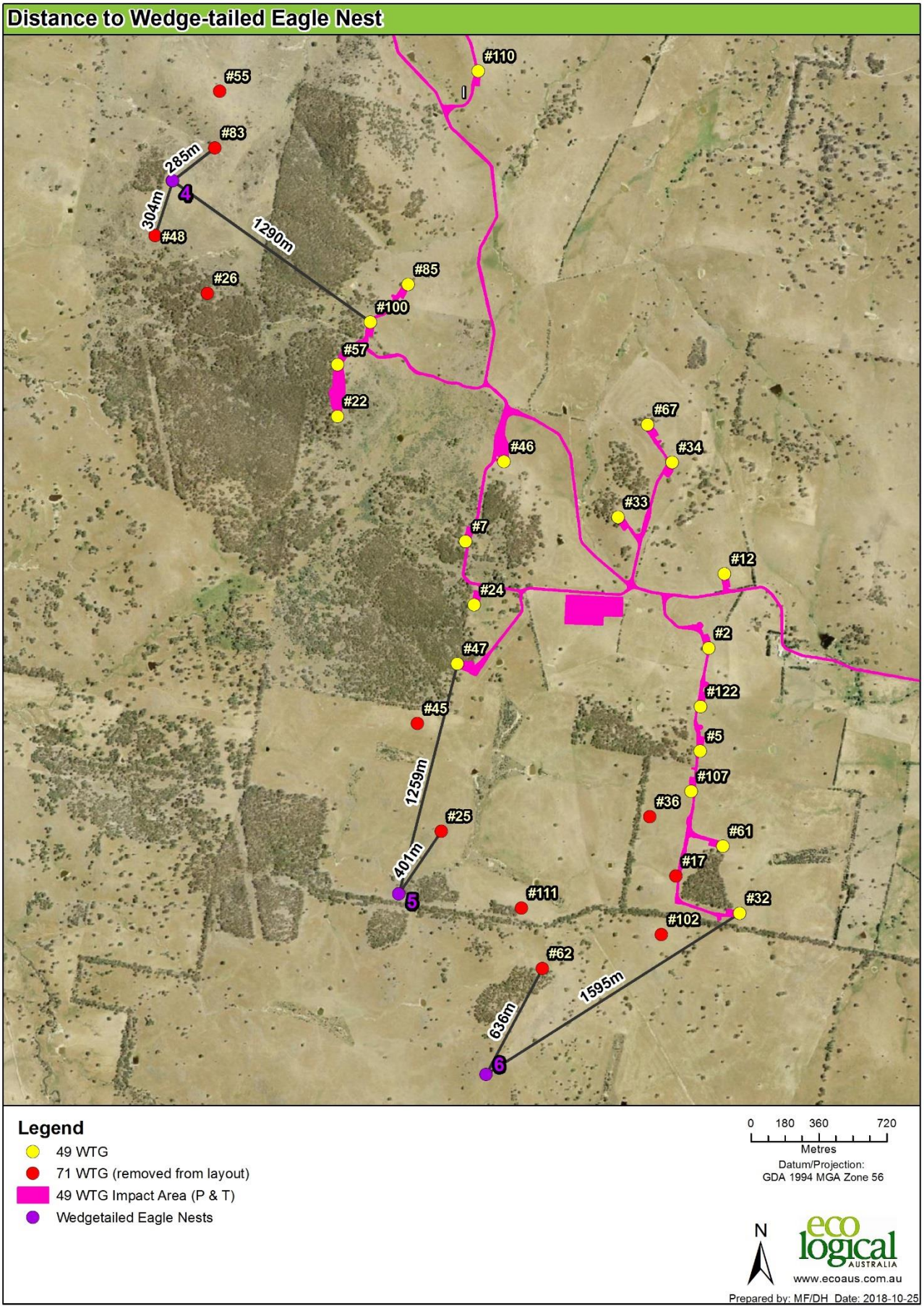

Figure 7: Distance from Wedge-tailed Eagle nests to nearest turbines (Nest 4-6)

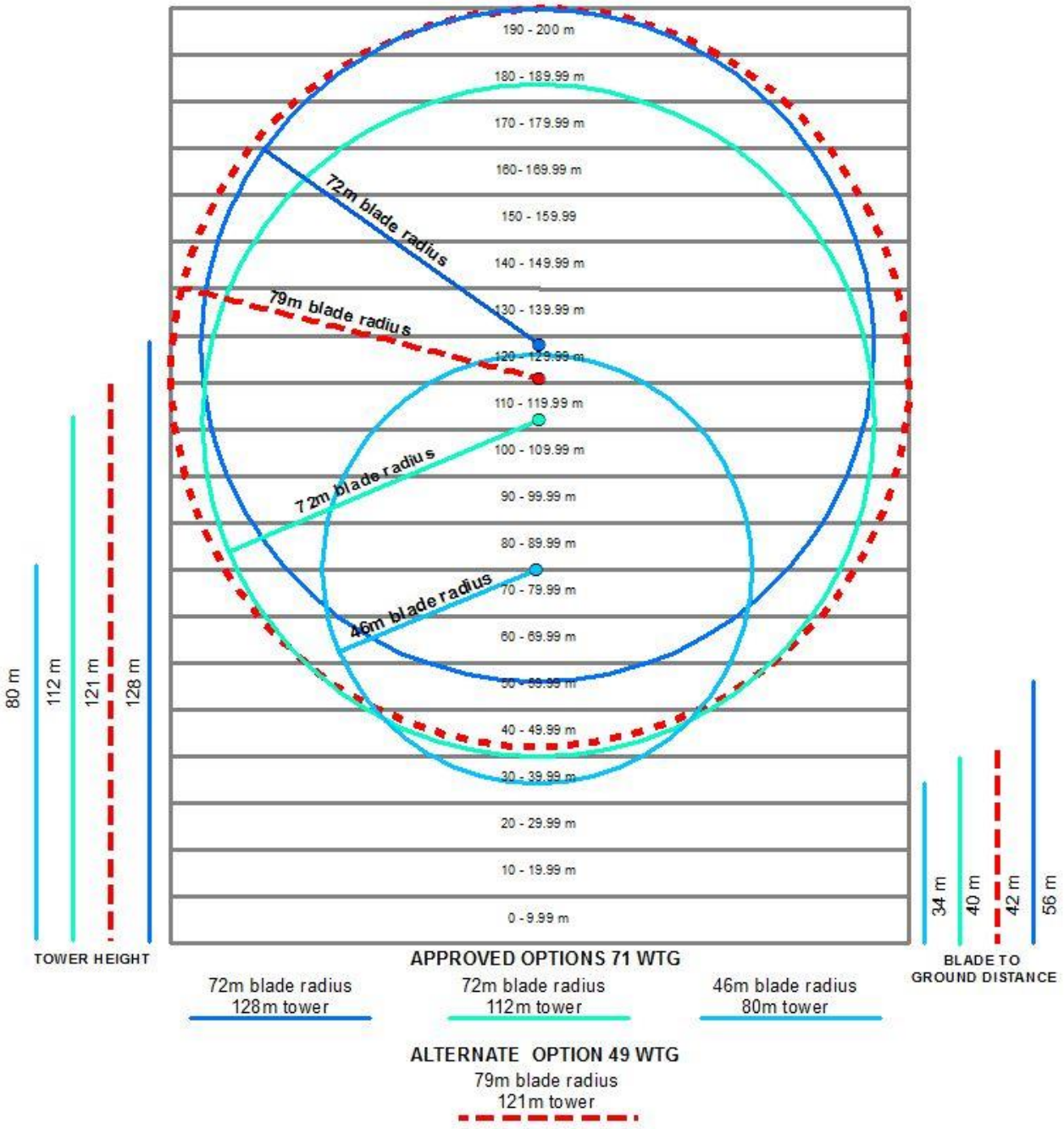

Figure 8: Comparison of minimum and maximum tip heights and rotor swept areas at 10m height intervals for approved 71 WTG layout options and alternate 49 WTG layout