Avifauna Comparative Assessment for the ZEN Wind Energy Facility – Amendment Application

Republic of South Africa

Gouda, Western Cape

Avifauna Comparative Assessment report – 2019

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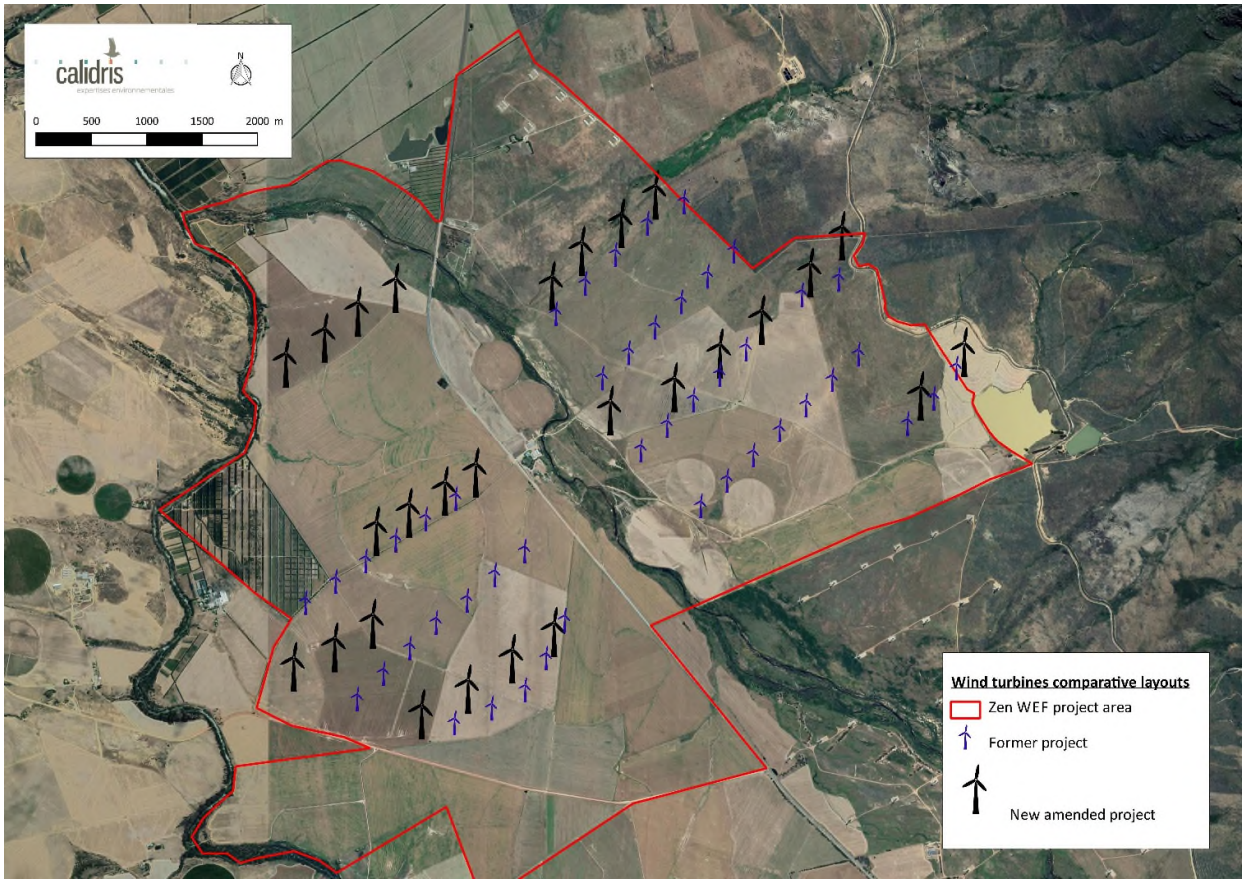
INTRODUCTION

Savannah Environmental is submitting, to the Department of Environment, Forestry & Fisheries (DEFF), an amendment to the Environmental Authorisation (EA) for the Zen Wind Energy Facility (WEF), to change the turbine specification and layout as previously assessed in the EIA. The project led by Zenaphan Trading (Pty) Ltd and already known as Zen Wind Energy Facility had already received the Environmental Authorisation in terms of the National Environmental Management Act (act 107 of 1998) on 03 November 2016 (DEA ref: 14/12/16/3/3/2/322, as subsequently amended on 11 February 2019). Of the list of proposed amendments, only the following are relevant to this report and need to be assessed:

- Reduction in the number of turbines from **46** to **27**;
- Increase rotor diameter from **122 m** to up to **165 m**;
- Increase hub height from **110 m** to up to **140 m**;
- Potential increase to dimensions of the crane pad and laydown area (storage area per turbine) from 2400 m² to 5500 m²;
- Increase in the concrete foundation from **20m** x **20m** x **4m** to **25m** x **25m** x **6m**.

The proposed amended project is based on 27 turbines split in two groups on each side of the R44 for a total capacity of 147 MW. 15 turbines will be located on the west side of the road, arrayed in 4 strings and the other 12 turbines will be set on the east side in 3 strings. The hub height of these turbines will be up to 140 m with a rotor diameter of 165 m which means that the blade arcs will extend from 57.5 m above ground up to 222.5 meters high.



Map 1: Comparison between the authorized project layout and the amended project layout

The landscape is composed of agricultural lands mainly comprised of crops like wheat west of R44 and pastures and wheat crops east of the road. This road follows more or less the Kleinberg River which is surrounded by a thick riparian forest of an average 20 m in extent on both sides.

The present report provides a comparative assessment between the impacts identified during the EIA led for the authorised project and the one associated with the proposed amendments and enlightened during the the amendment process led in 2019 for the new layout.

METHODOLOGY & RESULTS

1. AFRICAN INSIGHTS, 2015

1.1. METHODOLOGY

A pre-construction programme of bird monitoring was conducted across a 27 months period from September 2012 to December 2014, and for a total observation period of > 400 hours. The monitoring followed BirdLife South Africa's guidelines (version 2, JENKINS *et al.*, 2014). Field techniques employed in 2012-2013 were: observations from 6 vantage points; 8 walked linear transects (3 of them controls); 2 driven transects; inspection of identified focal sites; and incidental observations made by observers while traversing the study area. In 2014, 3 key vantage points, from which all proposed turbine areas were covered, and were each monitored for a total of 12 h in five seasons.

1.2. RESULTS

A total of 214 bird species may occur in the Zen region (Jenkins 2012). Of these 161 species were recorded during the field surveys of which ten species in the 2014 national red-data list (Taylor, 2014) were recorded during the two years of observations. Only three red-listed species were resident in the Zen area. These were: Black Harrier – rated Endangered; Southern Black Korhaan – Vulnerable; and Blue Crane – Near Threatened. The other 7 red-listed species, were seldom seen and/or occurred in very small numbers. These were five birds of prey and two water birds.

2. CALIDRIS, 2019

2.1. METHODOLOGY

12 monitoring sessions have been planned all year long, starting in January 2019. Each session lasts 4 days split between 2 days of vantage points (for a total a 16 hoours) and 2 days of observation transects.

Depending on the season and on the biological cycle of birds we also added point counts following the International Bird Census Committee (IBCC) recognized method first described by BLONDEL *et al.* (1970). 12 walked linear transects split in the four typical habitats within the study area were performed additionally.

The observations are set for the entire biological cycle of birds (i.e. across one year: breeding, migration (for migrating species), moulting and off season) inside the project area and in the vicinity. The monitoring followed BirdLife South Africa's best practice guidelines (third edition, JENKINS *ET AL.*, 2014).

2.2. CALIDRIS, 2019

During the on-going 2019 survey, 178 species have been recorded on the study area for now, among which 10 are considered as priority species on the current BLSA checklist of birds in South Africa (Lotz, 2019).

2019 fieldwork	J	F	M	A	M	J	J	A	S	O	N	D
African Marsh Harrier								x	x		//	//
Black Harrier	x	x	x		x	x	x	x	x	x	//	//
Black Stork			x								//	//
Blue Crane	x	x	x	x	x	x	x	x	x	x	//	//
Denham's Bustard		x		x	x		x	x	x	x	//	//
Lanner Falcon				x					x		//	//
Ludwig's Bustard									x	x	//	//
Secretarybird				x	x		x				//	//
Southern Black Korhaan			x					x		x	//	//
Verreaux's Eagle				x	x						//	//

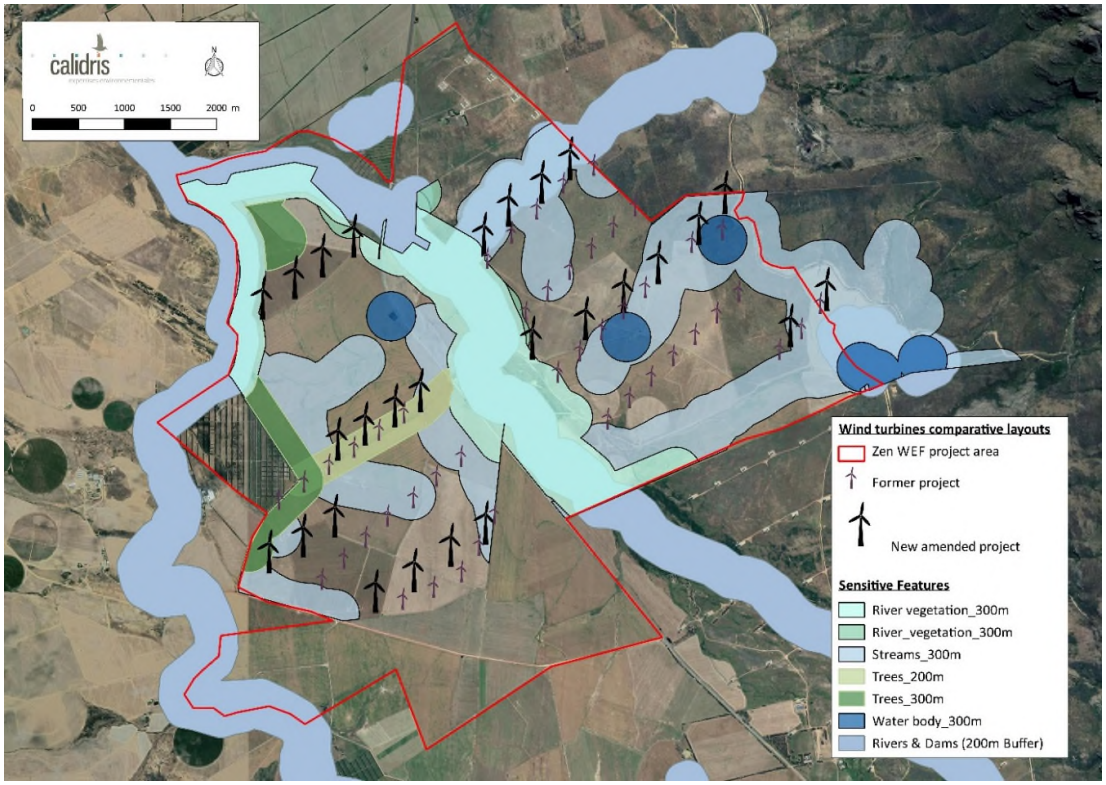
4 of these species (in bold type) can be considered as resident (or probable local breeders), which means that they have been seen during every season and the 6 others have only been spotted a few times.

SENSITIVITIES

1. SENSITIVE FEATURES

Map 2 targets the main sensitive features onsite such as waterbodies, streams, rivers and tree lines. This map shows that globally, with the new layout, turbines are farther from sensitive zones or in smaller number. The minimisation and mitigation measures for the authorized layout are still applicable as follows:

- No wind turbines should be implemented within the 200 m buffer surrounding riparian vegetation and tree lines.



Map 2: Comparative wind turbines layouts above sensitive features mapping

2. WINDFARM-RELATED SENSITIVITIES OF TARGET BIRD SPECIES

During the construction phase, all birds will be affected by the noise and the increased presence of human on the site, nevertheless, some species are more sensitive and/or less habituated to humance presence. Similarly, the habitat loss will affect birds differently depending on their habitat preferences and their habits. Finally, because of their behaviour, some species will be more at risk of mortality through collision with turbines than others.

2.1. AFRICAN MARSH HARRIER (REGIONAL THREATENED STATUS: VU)

Like most harriers, the African Marsh Harrier hunts by flying 1-3 meters above vegetation whether it is wetlands, croplands, grasslands or fynbos for example; this makes this species quite safe from collision with turbine blades. The risk is greater during displaying flights for territorial purposes or for attracting females. This species can also occasionally soar above its breeding grounds and be at risk at this occasion too (HOCKEY, 2005).

Globally, harriers are not of big concern when it comes to collision risk with wind turbines (WHITFIELD, 2006).

2.2. BLACK HARRIER (RTS: EN)

Black Harrier is rated sixth on the South African Birds and Renewable Energy Specialist Group's priority list (RALSTON-PATON, 2017). Its low-flying behaviour, typical of harriers, implies that this species is not usually considered as at risk with collision during the EIAs. The post-construction studies undertaken for this BLSA report shows that a third of flight duration are at the height of the rotor swept area. Black Harrier's main habitat in Western Cape is fynbos but this species is also adapted to live agricultural landscapes which matches with most of wind farms' establishment and explains than, even with a low-risk behavior, leaving in the vicinity of WEF increase the risk of collision with blades.

2.3. BLACK STORK (RTS: VU)

Black Stork were seldom seen on the study area and are globally uncommon in southern Africa. Despite its tenth ranking on the Birdlife list no Black Stork have been noted as being killed through colliding with a wind turbine in South Africa to date. Like all soaring birds, Black Stork utilises ascending thermal current to soar without spending to much energy. To do so, they gain altitude on these rising air currents and then slide and great distances. Hence, the risk for these soaring birds, such as the Black Stork, is between two updrafts while sliding and losing altitude, entering the rotor swept area. These windy areas are also sought by windfarm developers.

Altogether, this is why its habitat preference, wide ranging and soaring habits however makes this species quite sensitive to the presence of windfarms.

2.4. Blue Crane (RTS: NT)

Because of its wide and numerous presences on the study site, its endemism and at risk-habits (e.g. soaring, open habitats preference overlapping with windfarms, flocking and ranging behaviour) Blue Crane is one of the main, if not the first, concern for this WEF project. However, its affinity to agricultural areas makes this species apparently quite tolerant to disturbance. For instance, in Ralston-Paton *et al.* (2017) report, their study found a nest at 120 m from a wind turbine and at least three other pairs successfully raised chicks within a 500 m radius.

Blue Crane is the only target species which have been seen breeding on the study site. Two eggs and the breeding pair have been seen incubating near the road R44 close to a small pond 800 m from the closest turbine (following the new layout).

2.5. Denham's Bustard (RTS: VU)

Denham's Bustard is well represented on the WEF project area with displaying males recorded on the northern limit of the site. This is a large terrestrial bird that spends most of its time foraging on the ground. Displaying males do so on the ground too so their behaviour largely prevents them from colliding with blades. The only mortality reported by Birdlife's report (Ralston-Paton *et al.*,op. cit.) was probably due to a collision with the supporting cables of a guyed mast (used for wind monitoring).

The main risk for this prone-to-disturbance species is more the loss of habitat and displacement during construction phase than mortality through collision.

2.6. Lanner Falcon (RTS: VU)

Lanner Falcon is uncommon in the Zen WEF site; its presence seems occasional. Its habitat preferences for open grasslands and agricultural areas (among others) can present a risk of living close to wind energy facilities. Because of that and its predatory and soaring behaviour, it is ranked 24th on Birdlife's list. According to Birdlife's report, a single individual has been found dead after colliding with a turbine in South Africa.

2.7. Ludwig's Bustard (RTS: EN)

Because of its Red List Status (Endangered both regionally and globally), Ludwig's Bustard is ranked 14th on Birdlife's list.

This species, endemic to southern Africa, is quite similar to Denham's Bustard concerning its morphology but also its ground-related behaviour. Nevertheless, Ludwig's Bustard is usually found in dryier habitats.

Like Denham's Bustard, the risk of colliding with turbines is low

2.8. SECRETARYBIRD (RTS: VU)

During the EIA of Zen project, the Secretarybird was considered of high collision mortality risk. Despite no collision being reported in Birdlife's report, the risk of mortality through collision cannot be excluded as this species roosts on top of trees. However, this species forages while walking in order to hunt reptiles, small mammals and big insects.

2.9. SOUTHERN BLACK KORHAAN (RTS: VU)

This species depends on natural vegetation such as renosterveld and fynbos for both foraging and breeding. These two habitats can be found on the study site borders and the Southern Black Korhaan has been found here during the 2019 survey. No turbines are planned to be implemented in this habitat type. With the higher turbines being proposed as part of the amendment, the distance from the lower tip of the blades is also raised so the risk of these birds colliding with the blades during a displaying flight (circling at around 15 m above ground) is reduced.

2.10. VERREAUX'S EAGLE (RTS: VU)

This species is considered as particularly at risk of mortality through colliding with wind turbines and ranked 3rd on BLSA's list (RALSTON-PATON *ET AL.*, 2017). Verreaux's Eagle has only been recorded twice on Zen WEF study site outside the protocol and it has not been seen since May 2019. Both recordings of this species have been in the mountainous area, and not in the project area gliding 300 m above ground in average. For this reason we don't deem further studies necessary ("Verreauxs' Eagle and Wind Farms" guidelines; BIRDLIFE SOUTH AFRICA, 2017).

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IMPACTS

1. IDENTIFICATION OF IMPACTS ASSOCIATED WITH THE PROJECT

The different type of impacts upon birds mentioned during the EIA are the same as that predicted with the proposed amendments, i.e.: temporary displacement, habitat loss, electrocution and mortality through collision with power lines and collision with wind turbines.

During the pre-construction monitoring undertaken in support of the EIA, the wind farm located southward from this project (hereafter Gouda 1) was in construction. The 46 wind turbines are now fully operating. With Zen WEF, there will be a total of 73 turbines in the Zen region (against 92 before this amendment); it is safe to say that there will be cumulative impact on the local avifauna.

1.1. TEMPORARY DISPLACEMENT

During the construction phase, birds using the site will suffer of a temporary displacement because of the noise and the increase of human presence on the lands. These lands consist of already transformed habitat in crops or pastures, the animals who succeed in living in these human habitats are used to adapt themselves in changing condition due to human intervention. Disturbance occurs during the mechanical work such as ploughing, sowing, harvesting but also due to vegetation growth depending on the seasons.

For these reasons, and because other areas with the same characteristics are available in the vicinity of the WEF project area, the temporary displacement is not considered as a major impact.

1.2. PERMANENT HABITAT LOSS

Zen WEF project is located on agricultural lands which means that all natural or semi-natural habitats within the project development have already been transformed for human purposes. Birds living in such conditions are used to habitat loss and to adapt themselves to changing conditions.

1.3. ELECTROCUTION AND COLLISION WITH POWERLINES

Where practical, the powerlines will be buried along the existing gravel roads; some of which will be improved for the passage of the building site machinery.

With a few new powerlines created where it is not deemed possible to bury them, the risk of collision for birds will be a lot lowered.

1.4. MORTALITY THROUGH COLLISION WITH WIND TURBINES

The major impact that threatens local birds will be the collision with blades.

The 27 wind turbines associated with the amended layout will have hub heights of 140 m with a rotor diameter of up to 165m i.e. the rotor blade arc will be from 57.5 m to 222.5 m above ground (for a surface of a little bit more than 2 hectares per turbine).

With smaller population and lower density, the risk is greater for large birds such as cranes, bustards, raptors which are, usually, priority species. The risk will also be for birds that fly in flocks at night. For this issue, a radar survey was undertaken during the monitoring completed as part of the EIA. This showed that most night movements concerned water-birds like geese roosting by day at Voelvlei dam (up to 10 km southward) and using the study area for foraging at night. The average height of this mainly NW-SE flight track was 93 m above ground which would lead them directly to the blade arcs. However, most of the tracks were outside the Zen WEF area.

Bird movements are usually at the beginning and the end of the night, a curtailment plan can be implemented if fatality rates are deemed too high. By stopping the blades 3hours at dawn and dusk, especially during bad wether conditions (i.e. heavy rain, mist, fog…) and during the peak of the breeding season and fledgling leaving the nest for the target species (i.e. September-January).

1.5. CUMULATIVE IMPACTS

As mentioned at the beginning of this chapter, another wind farm of 46 operating turbines are located in the vicinity of this project.

The cumulative impacts of these two WEFs lead to a rise of almost all the detected impacts; indeed, the temporary displacement is only due to the construction phase and becomes a permanent habitat loss when the turbines are operating. The Zen WEF site footprint is already transformed in agricultural lands (crops and pastures), so birds living there are adapted to this ever-changing environment and will find other suitable habitats if needed in the vicinity. The risks of colliding and

or being electrocuted by power lines has already been studied for the operating WEF known in this report as Gouda 1. Because a fair part of the power lines will be buried for the current project, there will be a small additionnal impact from that aspect.

Concerning the risk of collision with rotor blades, adding wind turbines enhance the risk of mortality. But the increase of the number and density of turbines also enhance the deterring effect on birds which might more easily avoid this artificial barrier. Moreover, the radar survey indicated that the main flight route is NW-SE to and from Voelvlei dam which is situated after Gouda 1 so if birds succeed in avoiding the first windfarm, they will also avoid Zen WEF.

2. COMPARATIVE ASSESSMENT OF THE IMPACTS BEFORE AND AFTER THE AMENDMENTS

2.1. AVIFAUNA

2.1.1. TEMPORARY DISPLACEMENT

As mentioned in part 2 above, the construction phase will induce a disturbance for resident birds which will result in a temporary displacement of the concerned species regardless of the amendment of the layout from that of the authorized layout. The only difference in impact may be associated with the duration of the work which should be shorter for the proposed amended layout (score 1 in criteria duration in any case). The other difference is that, with fewer turbines, the work area will be limited and the turbines located (map 3) in less sensitive habitats.

Nature of impact: **During construction phase, workers movements and noise are likely to have an impact on resident species and induce a temporary displacement**				
	Authorised		**Proposed amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short (1)	Short (1)	Short (1)	Short (1)
Magnitude	Small (2)	Small (2)	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)	Definite (5)	Definite (5)
Significance	**20 (Low)**	**20 (Low)**	**20 (Low)**	**20 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Medium	High	Medium	High
Irreplaceable loss of resources?		Unlikely		Unlikely
Can impacts be mitigated?	To a limited extent		To a limited extent	

Mitigation: Not deemed necessary. The priority bird species affected are accustomed to substantial disturbance from agricultural activities and will merely move to similar habitat in nearby undisturbed areas.
Cumulative impacts: Considering that the other windfarm in the vicinity is already operating, there are no cumulative impacts expected.
Residual Risks: The construction phase is only temporary as the impacts should be if the affected birds come back after the end of the construction work.

2.1.2. PERMANENT HABITAT LOSS

With fewer turbines, the surface of the area needed for the amended layout is reduced. Moreover, fewer turbines are planned on the west side of R44 where habitats are better for a good bird diversity (pastures, meadows and fallow lands) so the impact should be quantitatively and qualitatively (impacting less species) lowered.

Nature of impact: **Permanent habitat loss concerns all artificialized areas that won't be usable by resident species anymore. It is a main concern for large species and especially the Blue Crane that will endure permanent destruction of part of its habitat**				
	Authorised		**Proposed amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)	Low (1)	Low (1)
Probability	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)
Significance	**28 (Low)**	**21 (Low)**	**28 (Low)**	**21 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Low	Medium
Irreplaceable loss of resources?	Possible	Probably not	Possible	Probably not
Can impacts be mitigated?	Yes		Yes	
Mitigation: Minimising the development area by clustering turbines. If artificial water points need to be destroyed, other can be created elsewhere with a stream connecting the waterbodies.				
Cumulative impacts: With the other windfarm already constructed the surface of lost habitat, especially for the Blue Crane and Harriers, will be increased.				
Residual Risks: Recreating natural habitat on agricultural land nearby for these target species will compensate for the loss of habitat and can also move individuals away from the windfarm and reduce the risk of collision.				

2.1.3. ELECTROCUTION AND COLLISION WITH POWERLINES

For this new project, the plan is to bury powerlines where deemed practical which will reduce (should all powerlines are buried) this impact.

Nature of impact: **Collision and/or electrocution (possibly leading to bad or fatal injuries) with powerlines. This will vary with the location and the type of powerlines.**				
	Authorised		**Proposed amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Regional (3)	Local (1)	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (3)	Small (0)	Small (0)
Probability	Definite (5)	Highly probable (4)	Very improbable (1)	Very improbable (1)
Significance	**50 (Medium)**	**24 (Low)**	**6 (Low)**	**6 (Low)**
Status (positive or negative)	Negative	Negative	Neutral	Neutral
Reversibility	Low	Very low	High	High
Irreplaceable loss of resources?	Yes	Possible	No	No
Can impacts be mitigated?	Yes		Yes	
Mitigation: With buried powerlines, there will be no impact on birds. However, to do so, they will need to dig into the soil. The mitigation will be to assist the developer and guide them to follow the roads and cross rivers at the good spots to minimise the impact of the work.				
Cumulative impacts: With no collision risks, no cumulative impacts are expected.				
Residual Risks: After the recommended measures being undertaken, no residuals risks are expected.				

2.1.4. MORTALITY THROUGH COLLISION WITH WIND TURBINES

Mortality through collision with wind turbines is the main impact expected. With fewer turbines and better location (i.e. avoiding more sensitive habitats), the risk should be lowered, but with higher turbines, the risk should be increased. With bigger blades and higher hub, the blades will spin less quickly so the risk of colliding for birds and especially night flying water birds should be reduced. Moreover, distance between the ground and the lower tip of the blades is raised which will decrease the risk of collision for ground birds such as bustards and Secretary birds but also, displaying Blue Cranes and hunting harriers.

Nature of impact: **Collision with wind turbines. Some species are more vulnerable than others hence more at risk.**				
	Authorised		**Proposed amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local to regional (3)	Local (2)	Local to regional (3)	Local (2)
Duration	Lifetime of facility (5)	Lifetime of facility (5)	Long-term (5)	Long-term (5)
Magnitude	High (8)	Medium-high (7)	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)
Significance	**64 (Medium)**	**42 (Medium)**	**56 (Medium)**	**33 (Medium)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Low	Low
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes		Yes	
Mitigation: (Not currently permitted by the CAA) Painting turbine towers dark and one blade a different colour from the other two. Nocturnal illumination of rotor blades using green or blue light if CAA regulations will allow this. Closure of turbines during periods of agricultural activities likely to attract raptors. Implementing curtailment at dawn and dusk for limiting the risk for night-flyers water birds and roosting Blue Crane and Secretarybird during breeding season. (It is also efficient to decrease the number of collisions for bats).				
Cumulative impacts: A 46 turbines windfarm is currently running south of this project.				
Residual Risks: Some mortalities will occur regardless of mitigation.				

3. ADVANTAGES AND DISADVANTAGES ASSOCIATED WITH THE CHANGES

Because the layouts are different, the intensity of the impacts may differ due to the location of the machines, the number and density of the turbines, the hub height and the radius of the blades hence the lower and higher rotor arc limits.

3.1. NUMBER OF TURBINES

The number of turbines will decrease from 46 to 27.

For the authorised project, the concrete foundation was 20 m x 20 m which creates a platform of 400 m², resulting in a total of 18 400 m² of transformed surfaces. The amended project layout requires 25 m x 25 m of concrete foundation because of the bigger turbines proposed. Each platform will be 625 m² in extent, with a total of 16 875 m² being required for the full facility. In comparison, the overall transformed surface for the turbines is reduced. In addition, the number of roads created or upgraded will also be reduced. During construction (because of the disturbance: noise, humand presence…), however, the temporary displacement impact will be similar to what associated with the construction of the authorised project.

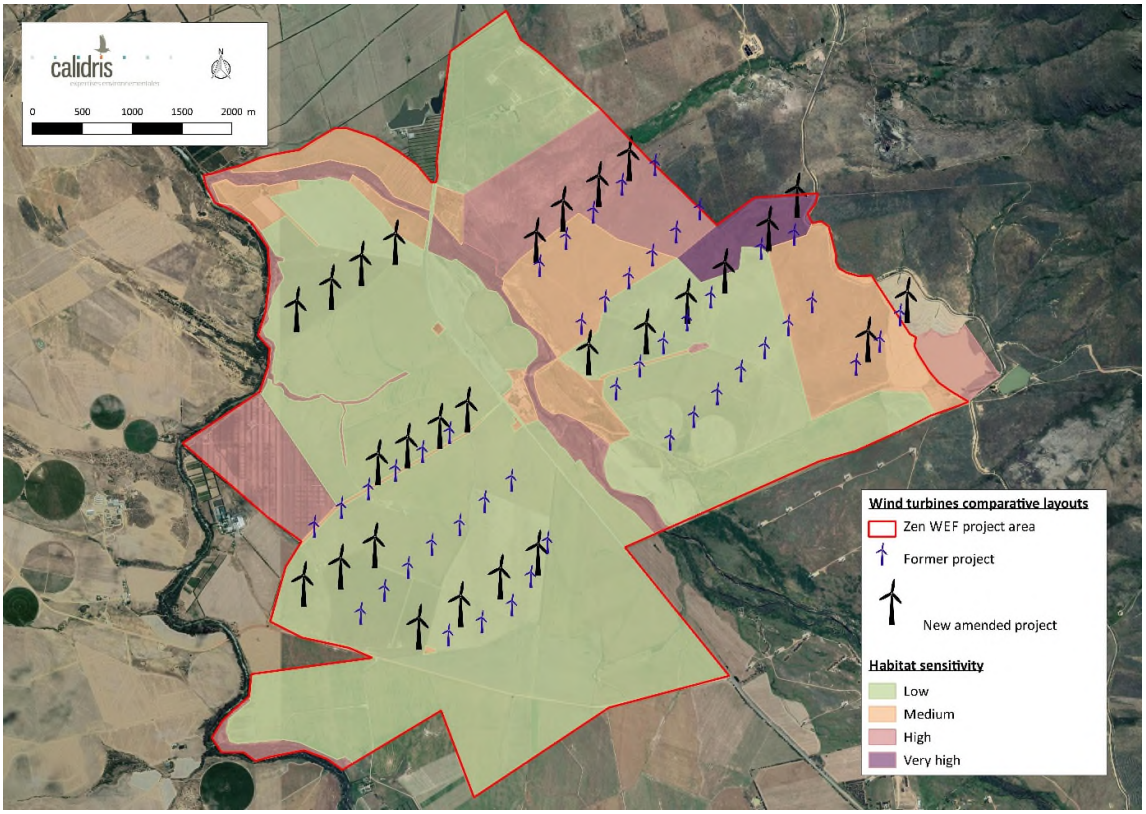
3.2. HUB HEIGHT AND ROTOR RADIUS

In order to double the rated power of the turbines (from 3MW to 6MW) the rotor and hub height will increase too. The result is that the vertical surface used per rotor blades is increased. The authorised project proposed turbines with a rotor surface of almost 11 700m² per turbine (for a total of close 538 000 m² for the full WEF). The proposed amended turbine results in a rotor surface of 21 400 m² (with a total of 577 000 m² for the full WEF). Even with a reduced number of turbines the space used "in the air" with turning blades is increased by almost 40 000 m2 which potentially increases the risk of collision for birds. Larger blades also mean that the blades will spin less quickly which will permit birds to avoid it easier.

3.3. LOCATION OF THE TURBINES

In order to reduce the impact of a windfarm, one of the main factor to take into account is the location (BIRDLIFE INTERNATIONAL, 2018). The footprint of the site used for the authorised project and the amended layout are the same, with the difference being the layout i.e. the density of turbines and the location of each of these turbines. When considering the habitat sensitivity mapping (map 3) complied by Calidris, and based on our 2019 spring surveys, we can see that west of the R44, habitats are mainly occupied by crops like wheat, resulting in a Low sensitivity rating.

The major concerns are east of the road where the number of turbines has been drastically reduced (from 28 to 11 WT).



Map 3 : Wind turbines comparative layouts above sensitivity habitat mapping (Source: Calidris)

CONCLUSION

Following the results of the 2019 bird monitoring, the proposed amendment is deemed acceptable. It is unlikely that the amendments to the turbine dimensions, number and layout proposed at Zen Wind Energy Facility would result in a significant change in impacts. The main amendments being proposed are:

- Reduced number of turbines;
- Increase of hub height and rotor diameter;
- Increase of the concrete foundation;
- Increase of the crane pad and laydown areas;
- Modified spatial location of wind turbines.

These amendments will impact species differently, depending on their ecology and behaviour. The advantages and disadvantages have been detailed in part 3 of the impacts chapter considering the results of 2019 surveys, the overall impact is expected to be reduced.

All the mitigation measures previously included within the EIA and the EMPr remain applicable and are to be implemented. If fatality rates are deemed not acceptable, a curtailment plan can be undertaken by stopping the wind turbines during the most critical periods for the most vulnerable species of the Zen WEF.

Layouts design should take sensitive areas for birds into consideration and respect buffer distances indicated in order to reduce at most the impacts on bird communities. The implementation of mitigation measures should reduce the identified impacts and result in acceptable residual impacts.

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