Appendix C

SPECIALIST STUDIES

Appendix C1

AVIFAUNA IMPACT ASSESMENT

ADDENDUM TO THE AVIFAUNAL IMPACT ASSESSMENT CONDUCTED FOR THE PROPOSED DWARSRUG WIND ENERGY FACILTY (WEF) NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

APPLICATION FOR AMENDMENT OF ENVIRONMENTAL AUTHORISATION

Addendum report compiled by:

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EXECUTIVE SUMMARY

The purpose of this addendum report is to revisit the avifaunal impact assessment for the proposed Dwarsrug Wind Energy Facility (WEF) near Loeriesfontein in the Northern Cape (Van Rooyen *et al*. 2014), based on the proposed amendment to the environmental authorisation in June 2019.

The proposed changes are as follows:

Aspect	Authorised	Proposed amendment
Turbine hub height	Up to 150m	Up to 200m
Turbine rotor diameter	Up to 150m	Up to 200m
Number of turbines	70	Up to 70

Given the potential changes to the turbine specifications, a re-assessment of the potential turbine collision impact was carried out in light of the proposed amendment, in order to establish if the original pre-mitigation assessment by Van Rooyen *et al*. (2014) should be revised and if the original mitigation measures need to be revised.

It is concluded that the proposed increase in the turbine dimensions require the original pre-mitigation impact significance rating of **"low"** for the risk of mortality due to turbine collisions, to be changed to **"medium",** if the current authorised layout remains unchanged. However, should the number of turbines reduce significantly, and a six (6) km minimum turbine zone implemented around the Martial Eagle nests, it will result in the collision rating remaining unchanged, or even reducing, depending on the extent of the reduction in the number of turbines.

The proposed amendment would be advantageous from a bird impact perspective if the number of turbines is reduced as a result of the amendment, and the revised buffer zone and associated mitigation are implemented. Should the turbine dimensions increase as proposed, and the number of turbines remain unchanged at 70, it would increase the risk of collisions and it would then be a disadvantage from the bird impact perspective.

In view of new knowledge gained since the original studies were completed, and the increased risk brought about by the proposed changes in the turbine dimensions, the original mitigation measures as formulated by Van Rooyen *et al.* (2014) need to be revised to retain a post-mitigation impact significance of "**low".** This entails that the 2km turbine-free buffer zone around the Martial Eagle nests on the Aries – Helios 400kV transmission line should be converted to a 5km turbine-free zone, and the number of turbines beyond the 5km turbine-free zone, up to a radius of 6km from the nest, should be restricted to an absolute minimum.

The revised mitigation measures are subject to a walk-through by the avifaunal specialist prior to construction commencement, to confirm the location and status of all priority species nests within the area of influence of the wind farm.

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1 Background

The purpose of this addendum report is to revisit the avifaunal impact assessment for the proposed Dwarsrug Wind Energy Facility (WEF) near Loeriesfontein in the Northern Cape (Van Rooyen *et al*. 2014), based on the proposed amendment to the environmental authorisation in June 2019. The proposed changes are provided in **Table 1** below.

Table 1: Proposed turbine dimensions amendments

Aspect	Authorised	Proposed amendment
Hub height	Up to 150m	Up to 200m
Rotor diameter	Up to 150m	Up to 200m
Number of turbines	70	Up to 70

2 Terms of reference

Due to the proposed changes in **Table 1**, and in accordance with the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), a re-assessment of potential impacts on the associated avifauna is required to be undertaken before an Amendment to Environmental Authorisation can be granted for the revised WEF development. **The impact which is specifically relevant in this instance is the risk of priority species mortality due to collisions with the turbines.**

The Terms of Reference (ToR) for this addendum report are as follows:

- Assess the impacts related to the proposed change from the authorised turbine specifications (if any);
- Assess advantages or disadvantageous of the proposed change in turbine specifications (comparative assessment between the authorised hub height and rotor diameter, versus the proposed specifications); and
- Identify additional or changes to the mitigation measures required to avoid, manage or mitigate the impacts associated with the proposed turbine specifications (if any).

3 The findings of the original bird impact assessment reports

The original Bird Specialist Study (Van Rooyen *et al*. 2014) identified risks (**Table 2**) of bird collisions with the wind turbines**.**

The key species which Van Rooyen *et al.* (2014) identified in the original Bird Specialist Study as being most at risk is the Martial Eagle *Polemaetus bellicosus*.

Table 2: Original bird collision risk

Environmental parameter	Impact	Rating prior to mitigation	Rating post mitigation
Avifauna	Priority species mortality due to collision with the turbines	-26 (low negative)	-24 (low negative)

4 The relevance of turbine numbers and dimensions in avifaunal mortality risk

Most of the studies to date found turbine dimensions to play a relatively unimportant role in the magnitude of the collision risk relative to other factors such as topography, turbine location, morphology, behaviour and a species' inherent ability to avoid the turbines, and may only be relevant in combination with other factors, particularly wind strength and topography (see Howell 1997, Barrios & Rodriguez 2004; Barclay *et al.* 2007, Krijgsveld *et al.* 2009, Smallwood 2013; Everaert 2014). Three (3) studies found a correlation between hub height and mortality (De Lucas *et al.* 2008; Loss *et al.* 2013 and Thaxter *et al*. 2017).

The Summary below provides a list of published findings on the topic:

- Howell *et al.* 1997 states on p.9: "*The evidence to date from the Altamont Pass does not support the hypothesis that the larger rotor swept area (RSA) of the KVS–33 turbines contributes proportionally to avian mortality, i.e. larger area results in more mortalities. On the contrary, the ratio of K-56 turbines to KVS-33 turbines rather than RSA was approximately 3.4:1 which as consistent with the 4.1:1 mortality ratio. It appears that the mortality occurred on a per-turbine basis, i.e. each turbine simply presented an obstacle."*

- Barrios & Rodriguez 2004 states on p. 80: "*Most deaths and risk situations occurred in two rows at PESUR with little space between consecutive turbines. This windwall configuration (Orloff & Flannery 1992) might force birds that cross at the blade level to take a risk greater than in less closely spaced settings. However, little or no risk was recorded for five turbine rows at PESUR having exactly the same windwall spatial arrangement of turbines. Therefore, we conclude that physical structures had little effect on bird mortality unless in combination with other factors*."

- Barclay *et al.* 2007 states on p. 384: "*Our analysis of the data available from North America indicates that this has had different consequences for the fatality rates of birds and bats at wind energy facilities. It might be expected that as rotor swept area increased, more animals would be killed per turbine, but our analyses indicate that this is not the case. Rotor-swept area was not a significant factor in our analyses. In addition, there is no evidence that taller turbines are associated with increased bird fatalities. The per turbine fatality rate for birds was constant with tower height*."

- De Lucas *et al.* 2008 states on p. 1702: "*All else being equal, more lift is required by a griffon vulture over a taller turbine at a higher elevation and we found that such turbines killed more vultures compared to shorter turbines at lower elevations.*"

- Krijgsveld *et al.* 2009 states on p. 365: "*The results reported in this paper indicate that collision risk of birds with larger multi-MW wind turbines is similar to that with smaller earlier-generation turbines, and much lower than expected based on the large rotor surface and high altitude-range of modern turbines. Clearly, more studies of collision victims are needed before we can confidently predict the relationship between size and configuration of wind turbines and the risk for birds to collide with a turbine.*"

- Smallwood *et al*. 2013 states on p.26 – 27 (see also Fig 9 on p.30): "*Red-tailed hawk (Buteo jamaicensis) and all raptor fatality rates correlated inversely with increasing wind-turbine size (Figs. 9A, B). Thousands of additional MW of capacity were planned or under construction in 2012, meaning that the annual toll on birds and bats will increase. However, the expected increase of raptor fatalities could be offset by reductions of raptor fatalities as older wind projects are repowered to new, larger wind turbines, especially if the opportunity is taken to carefully site the new wind turbines (Smallwood and Karas 2009, Smallwood et al. 2009).*"

- Loss *et al.* 2014 states on p. 208: "*The projected trend for a continued increase in turbine size coupled with our finding of greater bird collision mortality at taller turbines suggests that precaution must be taken to reduce adverse impacts to wildlife populations when making decisions about the type of wind turbines to install*."

- Everaert, 2014 states on p. 228: "*Combined with the mortality rates of several wind farms in the Netherlands (in similar European lowland conditions near wetlands or other areas with water), no significant relationship could be found between the number of collision fatalities and the rotor swept area of the turbines (Fig. 4). In contrast to more common landscapes, Hötker (2006) also found no significant relationship between mortality rate and the size of wind turbines near wetlands and mountain ridges.*"
- In the most recent paper on the subject by Thaxter *et al*. (2017), the authors conducted a systematic literature review of recorded collisions between birds and wind turbines within developed countries. They related collision rate to species-level traits and turbine characteristics to quantify the potential vulnerability of 9 538 bird species globally. For birds, larger turbine capacity (megawatts) increased collision rates; however, deploying a smaller number of large turbines with greater energy output reduced total collision risk per unit energy output. In other words, although there was a positive relationship between wind turbine capacity and collision rate per turbine, the strength of this relationship was insufficient to offset the reduced number of turbines required per unit energy generation with larger turbines. *Therefore, to minimize bird collisions, wind farm electricity generation capacity should be met through deploying fewer, large turbines, rather than many, smaller ones*.

The authorised rotor diameter of 150m for the Dwarsrug WEF translates into a rotor swept area of approximately 17 671m² per turbine. An increase of the rotor diameter to 200m will result in a rotor swept area of approximately 31 415m². This amounts to an increase of 77.7% in the rotor swept area per turbine.

5 Re-assessment of collision mortality impact

Given the proposed changes to the turbine specifications, a re-assessment of the potential collision impact was carried out for the proposed amendment, in order to establish if the original pre-mitigation assessment of by Van Rooyen *et al*. (2014) should be revised. The increase of 77.7% in rotor swept area per turbine is significant, and unless the number of turbines is reduced, it will result in an increase in the overall collision risk. However, should the number of turbines reduce significantly, it will result in the collision rating remaining unchanged, or even reducing, depending on the extent of the reduction in the number of turbines (see also section 6 below).

Given the significant proposed increase in rotor swept area, it is concluded that the original pre-mitigation impact significance rating of **"low"** for potential collision mortality will not be valid anymore, should the proposed change in the turbine dimensions be applied to the current layout of 70 turbines. In that case, a collision risk rating of "**medium**" would be more appropriate (see **Table 3** below).

Table 3: Impact and ratings table 3

Environmental Parameter	*Avifauna*
Issue/Impact/Environmental Effect/Nature	*Collisions of priority species with the turbines in the operational phase (pre-mitigation).*
Extent	***2 = Local*** *- especially if a Martial Eagle is killed.*
Probability	***3 = Probable*** *- The impact may occur (between a 50% to 75% chance of occurrence).*
Reversibility	***2= Partially reversible*** *- The operational activities could cause collision mortality of some priority species. With the application of mitigation measures such as buffer zones, blade painting, curtailment or another appropriate, proven deterrent strategy this impact could be partially reversed.*
Irreplaceable loss of resources	***3 = Significant loss of resources*** *- If a pair of eagles is killed, and the area is occupied by a new pair, which also gets killed in due course, the cycle could continue for the lifetime of the project. This sink could result in a significant loss of resources in the long term.*

Duration	*Long term. The risk of collision will be present for the lifetime of the development.*	
Cumulative effect	***Low cumulative impact** - There are two (2) applications for wind energy facilities and five (5) applications for solar facilities within a 100km radius around Dwarsrug, which will result in the construction of hundreds of wind turbines and thousands of solar panels. It is difficult to guess at this stage how severe the cumulative collision impact of all these proposed wind developments will be on priority species on a regional basis, firstly because for many species no or inaccurate baseline population and mortality data exists, and secondly because the extent of actual impacts will only become known if the wind farms are actually developed and post-construction monitoring is implemented. It is therefore imperative that post-construction monitoring is implemented at all the sites, in accordance with best practice. This will provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species, especially for future developments in the region. Within the context of the previous statement and without detracting from it in any way, it could be speculated that because the priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (exceptions are Red Lark and Sclater's Lark which are more range restricted but are not likely to be significantly impacted by turbine collisions), the potential cumulative impact of turbine collisions on priority species on a regional scale should be relatively minor, especially if the impact is envisaged to be low to start with as is likely to be the case here. It should be borne in mind that power lines kill many bustards in the Karoo (Shaw 2013), therefore any additional mortality even on a small scale, may well have a more significant cumulative impact than what is evident at first glance. However, it is envisaged that collisions of priority species, particularly Ludwig's Bustard, with the turbines will not be a major impact, for reasons already stated above. Provided the recommendations in this report and presumably similar ones at all the other developments are implemented, it is envisaged that the cumulative impact of mortality of priority species due to collisions with the turbines is likely to be low, on a regional level.*	
Intensity/magnitude	***Medium** - The operational activities could cause mortality of some priority species, but re-colonisation may happen.*	
ALTERNATIVE 1 (EXPANDED LAY-OUT)		
Issue/Impact/Environmental Effect/Nature	**Pre-mitigation impact rating**	**Post mitigation impact rating**
Extent	2	2
Probability	3	1
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	3	2
Significance rating	**45 (medium negative)**	**24 (low negative)**

6 Revised mitigation measures

The mitigation measures originally proposed for the Dwarsrug WEF by Van Rooyen *et al.* (2014) needs to be revisited in light of two (2) factors:

- The proposed increase in the rotor diameter will result in an increased risk of collisions for priority species (see Section 5 above).
- The "Best Practice Guidelines for Avian Monitoring and Impact Mitigation at Proposed Wind Energy Development Sites in Southern Africa", (Jenkins *et al*. 2011) revised in 2015, requires that either all, or part of the pre-construction monitoring is repeated if there is a time period of three (3) years or more between the data collection and the construction of the wind farm. This re-assessment is necessary in order to take cognisance of any changes in the environment which may affect the risk to avifauna, and to incorporate the latest available knowledge into the assessment of the risks. In order to give effect to this requirement, nest searches were repeated in June 2019 to ensure current information on the breeding status of priority species at the proposed Dwarsrug WEF is recorded.

Since the original Bird Specialist Study was completed in 2014, the local knowledge with regard to the impacts of wind turbines on avifauna has increased significantly with the experienced gained from operational wind farms, see for example (Ralston-Patton *et al*. 2017). This has also resulted in the publication of two (2) new sets of guidelines, one (1) for Cape Vultures (Pfeiffer *et al*. 2018) and one (1) for Verreaux's Eagles (Ralston-Patton 2017), while work is almost finished for the Black Harriers. Guidelines for a range of other sensitive species are also planned, including Martial Eagles, as they have proven to be highly vulnerable to wind turbine collisions.

The site contains two (2) Martial Eagle nests on the Aries – Helios 400kV transmission line, which runs through the northern part of the project area. Both nests are used as alternative nests by the pair of eagles, e.g. one nest was active in 2016, and the other in 2019. The average territory size of a large eagle represents an important area which can contribute to conservation planning and should be considered the absolute minimum area for conservation (Ralston-Patton 2017). Global Positioning System (GPS) tracking of Martial Eagles in the Kruger National Park indicates average territory sizes of 110km² (Percy Fitzpatrick Institute 2015), which equates to a 6km circular zone around the nest. Given the proven vulnerability of the species to wind turbine collisions which is now firmly established, 5-6km should be taken as the minimum turbine-free buffer zone around a Martial Eagle nest[1].

The following revised mitigation measure is proposed to ensure that the post-mitigation significance remains at a **"low"** level:

> The 2km turbine-free buffer zone around the Martial Eagle nests on the Aries – Helios 400kV transmission line should be converted to a 5km turbine-free zone, and the number of turbines beyond the 5km turbine-free zone, up to a radius of 6km from the nest, should be restricted to an absolute minimum.

Should the above buffer zones and associated mitigation measures be implemented the post mitigation impact rating would remain unchanged.

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[1] It should be recognised that Martial Eagle territories in an arid environment like Bushmanland are likely to be much larger than in the mesic Lowveld of the Kruger National Park, therefore a 5-6km turbine free buffer should be seen as an absolute minimum.

7 Conclusions

Given the potential changes to the turbine specifications, a re-assessment of the potential turbine collision impact was carried out in light of the proposed amendment, in order to establish if the original pre-mitigation assessment by Van Rooyen *et al*. (2014) should be revised and if the original mitigation measures need to be revised.

It is concluded that the proposed increase in the turbine dimensions require the original pre-mitigation impact significance rating of **"low"** for the risk of mortality due to turbine collisions, to be changed to **"medium",** if the current authorised layout remains unchanged. However, should the number of turbines reduce significantly, and a 6km minimum turbine zone implemented around the Martial Eagle nests, it will result in the collision rating remaining unchanged, or even reducing, depending on the extent of the reduction in the number of turbines.

The proposed amendment would be advantageous from a bird impact perspective if the number of turbines is reduced as a result of the amendment, and the revised buffer zone and associated mitigation are implemented. Should the turbine dimensions increase as proposed, and the number of turbines remain unchanged at 70, it would increase the risk of collisions and it would then be a disadvantage from the bird impact perspective.

In view of new knowledge gained since the original studies were completed, and the increased risk brought about by the proposed changes in the turbine dimensions, the original mitigation measures as formulated by Van Rooyen et al. (2014) need to be revised to retain a post-mitigation impact significance of "low". This entails that the 2km turbine-free buffer zone around the Martial Eagle nests on the Aries – Helios 400kV transmission line should be converted to a 5km turbine-free zone, and the number of turbines beyond the 5km turbine-free zone, up to a radius of 6km from the nest, should be restricted to an absolute minimum. Ideally, no turbines should be present within a 5km zone around the nests. Those turbines remaining with in the 6km zone should be mitigated through the painting of one blade (black or red), or through an alternative, proven deterrent strategy.

The revised mitigation measures are subject to a walk-through by the avifaunal specialist prior to the construction commencing, to confirm the location and status of all priority species nests within the area of influence of the wind farm.

8 References

- Barclay R.M.R, Baerwald E.F and Gruver J.C. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology. 85: 381 – 387.
- Barrios, L., Rodríguez, A., 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. J. Appl. Ecol. 41, 72–81.
- De Lucas, M., Janss, G.F.E., Whitfield, D.P., Ferrer, M., 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. J. Appl. Ecol. 45, 1695–1703.
- Everaert, J. 2014.Bird Study (2014) 61, 220–230, http://dx.doi.org/10.1080/00063657.2014.894492.
- Hockey PAR, Dean, WRJ and Ryan P 2005. Robert's birds of southern Africa – VII edition. The John Voelcker Bird Book Fund, Johannesburg.
- Howell, J.A. 1997. Avian Mortality at rotor swept area equivalents Altamont Pass and Montezuma Hills, California. Report for Kenetech Wind Power.
- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Revised in 2015.
- Krijgsveld K.L., Akershoek K., Schenk F., Dijk F. & Dirksen S. 2009. Collision risk of birds with modern large wind turbines. Ardea 97(3): 357–366.
- Loss S.R., Will, T., Marra, P.P. Estimates of bird collision mortality at wind facilities in the contiguous United States. Biological Conservation 168 (2013) 201–209.
- Percy Fitzpatrick Institute of African Ornithology. 2015. Marshalling forces. The Fitzpatrick Report. African Birdlife, March/April 2015.
- Pfeiffer, M., Ralston-Patton, S. 2018. Cape Vultures and Wind Farms. Guidelines for impact assessment, monitoring and mitigation. BirdLife South Africa, Johannesburg.
- Ralston-Paton, S., Smallie, J., Pearson, A.J., Ramalho, R. 2017. Wind Energy Impacts on Birds in South Africa: A Preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. BLSA. Occasional Report Series: 2.
- Ralston-Patton, 2017. Verreaux's Eagles and Wind Farms. Guidelines for impact assessment, monitoring and mitigation. BirdLife South Africa.
- Smallwood, K.S. 2013. Comparing bird and bat fatality rate estimates among North American Wind-Energy projects. Wildlife Society Bulletin 37(1):19–33; 2013; DOI: 10.1002/wsb.260.
- Taylor, M.R., Peacock F, & Wanless R.W (eds.) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg, South Africa.
- Thaxter, C.B., Buchanan, G.M., Carr, J., Butchart, S.H.M., Newbold, T., Green, R.E., Tobias, J.A., Foden, W.B., O'brien, S., And Pearce-Higgins, J.W. Proceedings of the Royal Society B, volume 284, issue 1862. Published online 13 September 2017. DOI: 10.1098/rspb.2017.0829.

Appendix C2

BAT IMPACT ASSESEMENT

BAT IMPACT ASSESSMENT: AMENDMENT

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DWARSRUG WIND ENERGY FACILITY, NORTHERN CAPE

DECLARATION OF INDEPENDENCE

In terms of the National Environmental Management Act of 1998, I, Stephanie C Dippenaar, owner of Stephanie Dippenaar Consulting, operating as a sole proprietor, do hereby declare that I have no conflicts of interest related to the work of this Second Amendment of the Bat Impact Assessment Report: Dwarsrug Wind Energy Facility, Northern Cape. I have no personal or financial connections to the relevant property owners, developers, planners, financiers or consultants of the development.

Stephanie C Dippenaar

Signed at Stellenbosch on 5 July 2019

BAT IMPACT ASSESSMENT AMENDMENT:

DWARSRUG WEF

1. PROJECT DESCRIPTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) received Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA) in 2015 for development of the Dwarsrug Wind Farm, located near Loeriesfontein in the Northern Cape Province. Mainstream is currently submitting an amendment application to the DEA to modify turbine specifications. Stephanie Dippenaar Consulting has been contracted by Mainstream Renewable Power South Africa to undertake an assessment of the project amendments (Table 1) with regards to the potential impacts to bats.

Table 1: Aspects of the proposed amendment

Aspect to be amended	Previously assessed	Proposed amendment
Hub height	Up to 150 m	Up to 200 m
Rotor diameter	Up to 150 m	Up to 200 m

Dwarsrug WEF will have a total capacity of 140MW, but the exact turbine specifications that will be deployed are not known yet. It is recommended that a maximum of 60 turbines are deployed, but due to an overall output of 140 MW, it is expected that less turbines will be installed.

The main negative impact of turbines on bats is the encroachment of air space where bats forage or commute. Table 2 and Figure 1 indicate the increase in the volume of the total sweep area, if turbine sweep is calculated as a sphere. For example, would 60 turbines be installed, with the amended turbine specifications, there will be a 103,17% increase in sweep area. The lowest point of the sweep of the turbine blades is also indicated, as this could have an impact on bat mortality, see Section 1.1.

Table 2: Changes in area of collision

Aspect to be amended	Previously assessed (70 turbines)	Proposed amendment (60 turbines)	Difference between previously assessed and amendment specifications
Total volume of the sweep of the turbines blades, if calculated as a sphere	0,12369656 km^3	0,25132 km^3	0,12762344 km^3 more airspace is occupied
Lowest point of the sweep of the turbine blades, from ground level	75 m	100 m	25 m higher from ground level

2. TERMS OF REFERENCE

The purpose and scope of this report is to assess whether the proposed amendments to the EA will alter the impacts identified in the original bat impact assessment performed by Animalia Consultants (Pty) Ltd (Information source: Final Report of a 12-month Long-Term Bat Monitoring Study (2015). Animalia Consultants are no longer undertaking bat assessments such that a different Bat Specialist (that did not undertake the preconstruction monitoring study) was appointed for this amendment assessment.

Amendments or additions to the mitigation measures in the existing Environmental Management Programme (EMPr) will be identified in this report in order to prevent, manage and mitigate impacts of the proposed turbine changes (if found to be necessary). The cumulative impacts (of wind energy developments within a 20 km radius of the WEF) identified in the original bat impact assessment will be reviewed considering the current developments and updated if necessary.

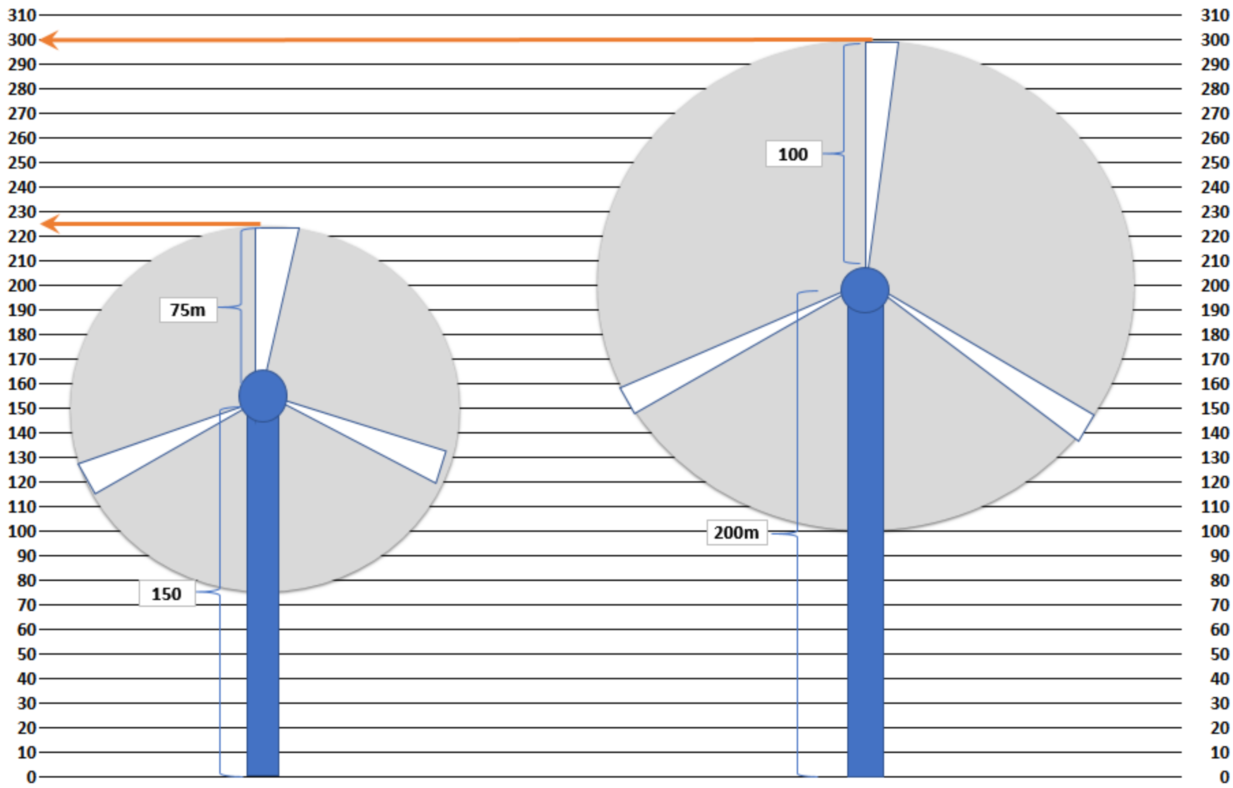

Figure 1: Changes in specifications of turbine dimension

3. METHODS

The current scientific literature was reviewed to gain insight into the relationship of turbine size on bat mortalities to aid in the assessment of the impacts of greater turbine hub height and rotor diameter. The literature was also reviewed for effective mitigation measures for the relevant impacts.

The original bat impact assessment report was reviewed with critical assessment of bat species richness and activity levels on site, the sensitivity map, impact assessment, cumulative impact assessment and recommended mitigation measures considering the proposed project amendments.

4. RESULTS

4.1 Literature review

The proposed increased turbine dimensions result in a larger rotor swept area and greater overall height per turbine. The impact relevant to this amendment is the change in risk of direct collision of bats in flight with moving turbine blades. Two studies by Barclay *et al.* (2007) and Georgiakakis *et al*. (2012) reported a positive exponential relationship of bat mortalities with turbine tower height, with no effect of the size of rotor sweep area (blade diameter). Whereas Rydell *et al.* (2010) found significant positive effects of tower height and rotor swept area with bat mortality. Studies by Johnson *et al.* (2003) and Fiedler *et al*. (2007) corroborated findings of increased mortalities with increased turbine dimensions. However, Thompson *et al*. (2017) performed a synthesis and review of mortality data from 218 North American studies representing 100 wind farms and did not find a significant relationship between increased turbine height and increased bat mortality. It is important to note that turbine specifications in the above-mentioned studies (hub height range of 44 m to 98 m and maximum rotor diameter of 180 m) are smaller than the maximum dimensions applied for in this amendment and, the wind farms consisted of much fewer turbines. Rydell *et al.* (2010) found the bat mortality rate to be independent of the size of the wind farm (number of turbines) however, the survey covered a maximum of 18 turbines which is substantially fewer than the proposed 59 turbines for Dwarsrug WEF.

Thaxter and co-workers (2017) undertook the first global quantitative assessment from published literature of the effects of wind farms on bat and bird mortality. They detected a strong positive association between turbine capacity (MW) and collisions per turbine for both bats and birds. Per wind farm energy output, a large number of small turbines resulted in higher predicted mortality rates than fewer larger turbines. The modelled mortality rate was highest when a 1000 turbines of 0.01MW each were used, thereafter the mortality rate decreased exponentially up to 1.2 MW turbines. The mortality for bats then increased again from 14 bats with 1.2 MW turbines, to 24 bats with 2.5 MW turbines. Thus, increasing the turbine dimensions with a reduction in total number of turbines would reduce mortality up to a point (1.2 MW turbines), thereafter mortality would increase with an increase in turbine dimensions.

The other consideration is that a greater turbine hub height increases the height of the lower blade tip from the ground, and may shift the species-specific risks towards open air foraging and high-flying species, such as the Molossidae family (Free-tailed bats), while reducing the risk for species flying closer to ground level (Willig *et al.,* 2018). Willig and co-workers (2018) investigated the vertical distribution of bat activity within the European Alps. They demonstrated a clear trend of decreased activity with increased height, most activity was recorded below 50 m height. Mathews et al. (2016) found greater species richness and activity levels at ground level than at heights between 30 and 80 m. Wind farm fatalities of clutter-edge foraging species, that do not typically occupy open air spaces high above the ground, have been found in South Africa (Aronson *et al*., 2013; MacEwan, 2016). Additionally, the Bat Specialist/Consultant has observed the trend of higher activity and species richness at lower monitoring systems, usually situated around 10 m, in most preconstruction bat monitoring studies conducted across South Africa. Therefore, it seems that the proportion of bat species at risk may decrease with increased hub height, but open-air high-flying species would have an increased mortality risk.

4.2 Review of the Final Progress Report of 12-month Long-Term Bat Monitoring Study

4.2.1 Species richness and activity trends

Acoustic monitoring was conducted at 10 and 50 m heights on the meteorological mast on site. The height at which monitoring took place is an important consideration for the proposed amendment to assess the relevance of the trends in species richness and activity levels detected at 50 m height, relative to the proposed amended turbine specifications. The height at which monitoring took place is no longer within the proposed amendment turbine sweep area which may limit the application of the findings of the previous monitoring study.

The final EIA report does not present bat species abundances and activity levels (from the met mast monitoring system) for a full 12-month period, but only from June 2014 to February 2015. A supplementary letter was provided by Werner Marais of Animalia Consultants in June 2015, stipulating the 12 months of monitoring at 50 m height was completed and that the impact assessment and recommendations of the report remain unchanged. It is difficult to critically assess the results of the preconstruction monitoring study without presentation of the full dataset.

As expected, species richness was greater at the 10 m monitoring height than detected at 50 m. However, contrary to expectations, higher activity levels were detected at the 50 m recording height than 10 m height on the met mast. *Tadarida aegyptiaca* (Egyptian free-tailed bat) was the most abundant species on site and at the 50 m monitoring height. This is a high-flying species with a high risk of collision with turbine blades (Sowler et al., 2017). Bat abundance and activity levels were relatively low across all monitoring systems on site. Higher overall bat activity levels were detected during the spring and summer of the year, and predominantly during the first half of the night.

4.2.2 Sensitivity map

The sensitivity map during the EIA phase identified areas of moderate bat sensitivity and designated a buffer area of 100 m around the demarcated areas. The final EIA report recommended that turbines located within the sensitivity areas and buffers receive priority during the operational monitoring study and also priority for application of mitigation measures if found to be necessary during operation.

Considering the increase in overall height and rotor sweep area for this amendment, the classification of the sensitivity areas as moderate is insufficient for effective protection and conservation of local bat fauna. The sensitivity areas must be upgraded to high sensitivity with a **minimum buffer zone of 200 m**. High sensitivity entails the full exclusion of turbines from sensitivity areas as well as their buffer zones. Turbine blade tips must also be excluded from entering the buffer areas.

The Applicant must ensure that turbines are placed an appropriate distance away from bat sensitivity areas. If, for example turbines with the maximum dimensions of 200 m rotor diameter and 200 m hub height are employed, the turbine base should then be placed 300 m from the sensitive area so as to prevent blade tips from entering the buffer zones.

The turbine layout should be approved by a bat specialist upon finalisation of turbine specifications.

4.2.3 Impact assessment

Section 5 of the final report assesses the impact of Dwarsrug WEF on bats. Of the impacts identified in the EIA, only bat mortalities due to direct blade impact or barotrauma during foraging activities, is relevant to this amendment. The impact was identified as moderate (score of -45) without mitigation and was reduced to low (score of -24) with the mitigation of adhering to the bat sensitivity map.

The only concrete mitigation recommendation from the final EIA report is the micro siting of turbines out of sensitivity areas and the flagging of three turbines encroaching on the delineated sensitivity area/buffer. Section 6 of the final report describes the potential mitigation measures that may be employed on Dwarsrug WEF based on the results of an operational monitoring programme. The final EIA report describes the need for mitigation implementation to be an adaptive management approach that will require turbine mitigation to be implemented immediately and in real time when required. In order to keep the impact rating as low, it is recommended that all turbines are prevented from freewheeling from the start of operation, as bat activity is markedly higher over low wind speed periods. Preventing freewheeling should not affect energy production significantly and will be a significant bat conservation mitigation measure.

Considering the greater turbine dimensions proposed in the amendment application, the impact ratings would remain unchanged from the last assessment, if the following are adhered to:

- Apply the increased 'no-go' sensitivity buffer as described in section 4.2;
- A bat specialist approve the final layout;
- All turbines are prevented from freewheeling at all times;
- A maximum of 60 turbines are deployed;
- A post construction bat monitoring programme must be put in place before operation and operational bat monitoring should start when turbines start to operate.

4.2.4 Cumulative impact assessment

The pertinent threat to bats, from the cumulative impact of several wind energy facilities operating within a single general area, is mortality from turbine blade collision and barotrauma. There is potential for significant loss of locally active bats and migratory bats that will essentially reduce the effective population size and may cause population crashes. The cumulative impact was not assessed in the final bat EIA report. Currently, there are 9 authorised wind farms within a 20 km radius of the Dwarsrug WEF, namely:

- !Xha Boom WEF (Mainstream)
- Khobab WEF (Mainstream)
- Loeriesfontein WEF (Mainstream)
- Graskoppies WEF (Mainstream)
- Hartebeest Leegte WEF (Mainstream)
- Ithemba WEF (Mainstream)
- Kokerboom 1 WEF (Business Venture Investments No. 1788 (Pty) Ltd)
- Kokerboom 2 WEF (Business Venture Investments No. 1788 (Pty) Ltd)
- Kokerboom 3 WEF (Business Venture Investments No. 1788 (Pty) Ltd)

Additionally, The Orlight SA Solar Photovoltaic Power Plant (Orlight SA (Pty) Ltd), Photovoltaic Solar facility (Orlight SA (Pty) Ltd) and Cpv/Pv Solar Power Plant (Mainstream) are proposed to be developed in the immediate vicinity. Although solar power installations do not typically contribute directly to bat mortalities, they do result in habitat destruction that may interrupt foraging behaviours.

Currently, there are no guidelines or recommendations of how to mitigate for the cumulative impact of wind farms within a greater area. This amendment assessment assumes all neighbouring facilities will implement appropriate mitigation measures informed by their preconstruction EIA studies, and that the mitigation measures proposed in this report are adhered to.

5. CONCLUSION

After review of relevant scientific literature and the long-term preconstruction monitoring report, it does seem likely that the requested amendments to the turbine dimensions proposed for the Dwarsrug wind energy facility would increase the negative impacts to bats as identified in the EIA. The risk of mortality may be decreased for two recorded species (*Eptesicus hottentotus* and *Neoromicia capensis*) flying at lower heights above the ground as the lower blade tip height increases with larger turbine dimensions. However, there is a higher risk of mortality for high flying species (*Tadarida aegyptiaca*) as the rotor swept area and higher blade tip height are increased with larger turbine dimensions. Considering the greater turbine dimensions proposed in the amendment application, the impact ratings would remain unchanged from the last assessment, on condition of the implementation of the increased 'no-go' sensitivity buffer calculation recommended in section 4.2.2 of this report, as well as the restriction of freewheeling below cut-in speed, as mentioned in section 4.2.3.

The turbine layout must adhere to the sensitivity areas and buffers; and the layout should be approved by a bat specialist upon finalisation of turbine specifications.

To reduce bat mortality risk, a three-pronged consideration must be used when selecting the appropriate turbine technology for the wind farm:

- Turbine dimensions with a greater hub height (to increase lower blade tip height and reduce collision risk with lower flying species)
- Turbine dimensions with the smallest rotor diameter (to decreased total tip height and reduce collision risk with high flying species)
- Least number of turbines required to generate the total megawatt output of the facility

An operational monitoring study must be implemented immediately upon construction of the wind farm and be already in place when turbines are starting to operate. All applicable mitigation measures should be incorporated in the EMPr and mitigation measures recommended by the Bat Specialist during the operational monitoring study must be implemented immediately and in real time.

REFERENCES

Aronson, J.B., Thomas, A.J. and Jordaan, S.L. (2013). Bat fatality at a wind energy facility in the Western Cape, South Africa. African Bat Conservation News 31, 9-12.

Barclay, R.M.R., Baerwald, E.F. and Gruver, J.C. (2007). Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology-Revue Canadienne De Zoologie 85(3):381–7.

Fiedler, J.K., Henry, T.H., Tankersley, R.D. and Nicholson., C.P. (2007). Results of bat and bird mortality monitoring at the expanded Buffalo Mountain Windfarm, 2005, Tennessee Valley Authority, Knoxville, Tennessee.

Georgiakakis, P., Kret, E., Carcamo, B., Doutau, B., Kafkaletou-Diez, A., Vasilakis, D., et al. (2012). Bat fatalities at wind farms in north-eastern Greece. Acta Chiropterologica 14(2):459–68.

Johnson, G.D., Erickson, W.P., Strickland, M.D., Shepherd, M.F., Shepherd, D.A. and Sarappo, S.A. (2003). Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. The American Midland Naturalist 150, 332-342.

MacEwan, K. (2016). Fruit bats and wind turbine fatalities in South Africa. African Bat Conservation News 42.

Mathews, F., Richardson, S., Lintott, P. and Hosken, D. (2016). Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management. Report by University of Exeter.

Mitchell-Jones, T. and Carlin, C. (2014). Bats and Onshore Wind Turbines Interim Guidance, In Natural England Technical Information Note TIN051. Natural England.

Rydell, J., Bach, L., Dubourg-Savage, M.-J., Green, M., Rodrigues, L. and Hedenström, A. (2010). Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12, 261-274.

Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Forssman, K. and Lötter, C. (2017). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Edition 4.1. South African Bat Assessment Association.

Thaxter, C.B. *et al.* (2017). Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proc. R. Soc. B 284: 20170829. http://dx.doi.org/10.1098/rspb.2017.0829

Thompson, M., Beston, J.A., Etterson, M., Diffendorfer, J.E. and Loss, S.R. (2017). Factors associated with bat mortality at wind energy facilities in the United States. Biological Conservation 215, 241-245.

Wellig, S.D., Nusslé, S., Miltner, D., Kohle, O., Glaizot, O., Braunisch, V., *et al*. (2018). Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. PLoS ONE 13(3): e0192493. https://doi.org/10.1371/journal.pone.0192493

Appendix C3

NOISE IMPACT ASSESEMENT

EAR
Enviro Acoustic Research

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Date: 7 June 2019
Ref: Dwarsrug WEF

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Attention: Ms. Andrea Gibb

Dear Madam

SPECIALIST STUDY: NOISE IMPACT ASSESSMENT: PROPOSED DWARSRUG WIND ENERGY FACILITY NORTH OF LOERIESFONTEIN: CHANGE OF LAYOUT AND WIND TURBINE SPECIFICATIONS

The above-mentioned issue as well as report MS-DWEF/ENIA/201411-Rev 0 is of relevance.

I conducted an Environmental Noise Impact Assessment (ENIA) during 2014 for the proposed Dwarsrug Wind Energy Facility (WEF), with two layouts evaluated (see layout option 1 illustrated in **Figure 1**). With the input data as used, this assessment indicated that the proposed project will have a noise impact of a ***low significance*** on all Noise Sensitive Developments (NSDs) in the area during both the construction and operational phases using the Vestas V112 3.0 MW wind turbine for all wind speeds (both layout options). This wind turbine has a maximum sound power generation level of 106.9 dBA. The projected maximum noise levels would be less than 35 dBA at the closest NSD. Due to the low significance, no mitigation was required or recommended.

The wind energy market is fast changing and adapting to new technologies as well as site specific constraints. Optimizing the technical specifications can add value through, for example, minimizing environmental impact and maximizing energy yield. As such the developer has been evaluating several turbine models, however the selection will only be finalized at a later stage once the most optimal wind turbine are identified (factors such as meteorological data, price and financing options, guarantees and maintenance costs, etc. must be considered).

Because of the availability of more optimal or efficient wind turbines, the developer of the Dwarsrug WEF is considering changing the wind turbine specifications and optimizing the layout. As the specifications of the final selection are not yet defined, this review will evaluate a potential worst-case scenario, considering a wind turbine with a sound power emission level of 109 dBA. Other changes include:

- Rotor Diameter increase up to **200m**
- Hub height up to **200m**

All of the proposed wind turbines are further than 2,000m from any potential noise-sensitive receptors (see **Figure 1**) and even with the higher potential sound power emission level (worst-case of 109 dBA), the maximum projected noise level will be less than 35 dBA at the closest NSD.

Because of the ***low significance*** of the noise impact, changing the wind turbine specifications have no advantages or disadvantages in terms of acoustics. Considering the location of the wind turbines and the potential noise impact, it is my opinion that the change will not increase the significance of the noise impact. A full noise impact assessment with new modeling will not be required and the findings and recommendations as contained in the previous document (report MS-DWEF/ENIA/201411-Rev 0) will still be valid.

Should you require any further details, or have any additional questions, please do not hesitate to call me on the above numbers.

Yours Faithfully,

Morné de Jager
Enviro-Acoustic Research cc

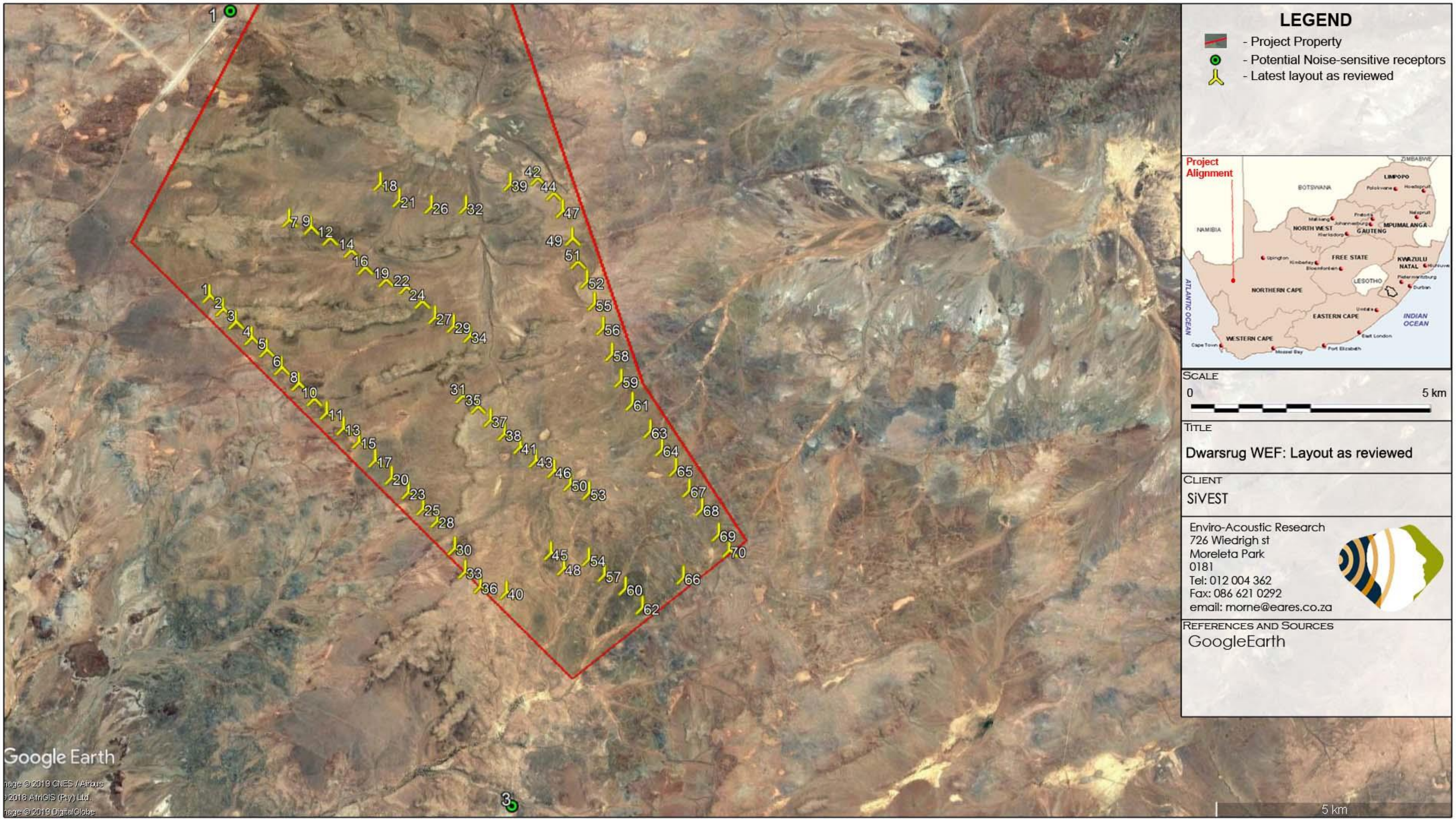

Figure 1: Locations of wind turbines as evaluated

Appendix C4

VISUAL IMPACT ASSESEMENT

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Established 1952

South Africa Mainstream Renewable Power
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Your reference: N/A
Our reference: 15659
Date: 19 June 2019

ATTENTION: REBECCA THOMAS

Dear Ms Thomas,

VISUAL SPECIALIST COMMENT IN RESPECT OF PROPOSED AMENDMENTS TO THE AUTHORISED TURBINE SPECIFICATIONS FOR THE DWARSRUG WIND FARM NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

- **DEA Reference: 14/12/16/3/3/2/690 (As amended)**

1. BACKGROUND

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as Mainstream) was issued with an Environmental Authorisation (EA) for the proposed 140MW Dwarsrug Wind Farm, near Loeriesfontein in the Northern Cape Province on 28 September 2015 (DEA Reference 14/12/16/3/3/2/690). This authorisation made provision for the construction of a total number of 70 wind turbines, each with a hub height of up to 150m and a rotor diameter of 150m.

Mainstream is now proposing to submit a Part 2 Amendment application to change the approved turbine specifications for the Dwarsrug Wind Farm to allow for turbines with a hub height of up to 200m and a rotor diameter of up to 200m.

Following on from the EIA level Visual Impact Assessment conducted for the Dwarsrug Wind Farm, SiVEST has been requested to provide visual specialist comment in respect of the proposed amendments.

2. SPECIALIST COMMENT

The EIA phase VIA, conducted by SiVEST in May 2015, assessed the potential visual impacts in relation to the wind farm layout comprising 70 turbines, each with a hub height and rotor diameter up to 150m (i.e. a maximum tip height of 225m). The proposed new turbine specifications would allow for a maximum tip height of 300m, approximately equivalent to a 100-storey building, some 75m higher than the height currently authorised. The significance of this change from a visual perspective is assessed below.

The increased height as proposed will increase the visibility of the turbines and extend the area from which the turbines will be visible (viewshed). This will be exacerbated by the lack of natural screening elements in the broader study area resulting from the relatively flat terrain and the prevalence of low shrubland vegetation cover. It is however important to note that visual impacts are only experienced when there are receptors present to experience this impact. The original VIA for this development found that the broader study area is not typically valued for its tourism significance and there is limited human habitation resulting in relatively few potentially sensitive receptors in the area. In light of this and given the relatively remote location of the proposed Dwarsrug Wind Farm, the extended viewshed is unlikely to affect any additional receptors.

Visual impacts resulting from the larger turbines would be greatest within a 1km to 2km radius, from where the increased height of the structure would be most noticeable. The VIA for Dwarsrug identified five (5) potentially sensitive receptors within the visual assessment zone, all of which are farmsteads situated more than 2kms from the buildable area. One these receptors is approximately 4km from the buildable area, while the remaining four receptors are located more than 5km from the buildable area. While the larger turbines would be more visible from these receptors, the overall impact is expected to remain largely unchanged from these distances.

The overall impact rating conducted for the Dwarsrug Wind Farm VIA revealed that the proposed wind farm is expected to have a low negative visual impact rating during construction and a medium negative visual impact rating during operation, with relatively few mitigation measures available. In light of the above comments, the increase in the proposed turbine height will not change this impact rating. Furthermore, no additional recommendations or mitigation measures will be required and all of the mitigation measures set out in the VIA remain valid.

3. IMPACT STATEMENT

It is SiVEST's opinion that the proposed changes to the authorised turbine specifications for Dwarsrug Wind Farm do not give rise to additional visual impacts or exacerbate the impacts previously identified in the VIA for this development. Given the low level of human habitation and the relative absence of sensitive receptors in the area, the increased turbine height is deemed acceptable from a visual perspective and the Environmental Authorisation (EA) should be amended. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

Yours sincerely

Andrea Gibb
Divisional Manager
SiVEST Environmental

Appendix C5

OTHER SPECIALIST COMMENTS

Johann Lanz

Soil Scientist (Pri.Sci.Nat)

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Part 2 (substantive) amendment for the Dwarsrug wind energy project

The following 2 amendments are proposed to the above project:

- Increase in the hub height up to 200m
- Increase in the rotor diameter up to 200m

This letter confirms that these amendments will not increase or change the nature of the impact which was assessed in my original agricultural specialist report.

Johann Lanz (Pri. Sci. Nat.)
20 September 2019

3Foxes Biodiversity Solutions
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Att: Andrea Gibb

20 September 2019

RE: Amendment Application for the Dwarsrug Wind Energy Facility, near Loeriesfontein

This statement letter is in reference to the authorised Dwarsrug Wind Energy Facility and the request from SiVEST for comment on the ecological implications of the proposed changes to the turbine specifications that would be included in the amendment application to the Department of Environmental Affairs.

The changes to the layout and technical specifications of the turbines include the following:

- Increase in the hub height up to 200m
- Increase in the rotor diameter up to 200m

SiVEST have requested confirmation regarding the amendment in terms of the previously assessed impacts and whether these changes would affect any of these assessed impacts

a) The amendment will not increase or change the nature of the impact which was initially assessed; or
b) The amendment will increase or change the nature of the impact which was initially assessed.

I have reviewed the proposed changes, and these would not result in any significant changes to the proposed layout (apart from dropping some of the turbines as a result of bird and bat sensitivities) or to the terrestrial ecological impact of the facility, there are no reasons to indicate that the amendment would increase the impacts of the development as assessed. As such, the original assessed impacts are considered to hold for the amendment and there are no additional impacts or mitigation measures that would need to be applied.

Based on the above conclusion, the amendment to the Dwarsrug Wind Energy Facility can be supported from an ecological point of view and there are no reasons to oppose the changes as applied for.

Prepared by Simon Todd

Director

3Foxes Biodiversity Solutions

20 September 2019

Pr.Sci.Nat
SACNASP 400425/11.

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23 September 2019

SiVEST Environmental Division

Attention: Mr Stephan Jacobs

PROPOSED DEVELOPMENT OF THE DWARSRUG WIND FARM NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE: HERITAGE STATEMENT

SiVEST has been appointed by South Africa Mainstream Renewable Power Developments to undertake the part 2 (substantive) amendments for the Dwarsrug Project.

The DEA has responded to the application forms submitted by SiVEST and requesting for comment from all the specialists previously involved in the project.

1. SCOPE OF AMENDMENT

The proposed amendments are as follows:

- Increase in the hub height up to 200m
- Increase in the rotor diameter up to 200m.

2. HERITAGE OPINION

PGS Heritage has previously completed the Heritage Impact Assessments (HIA) for the project and me as principal heritage specialist.

I have evaluated the proposed amendments to the approved project and find that the change in hub height and rotor diameter will not change the findings of the HIA for this project.

It should be noted that the implementation of the management measures for chance finds have been included in the previously submitted EMPr and will be carried through to the proposed amendments.

3. CONSLUSION

It is therefore my considered opinion that based on the above, it is not expected that any further specialist input would be required to inform this amendment application.

Any further questions can be forwarded to Wouter Fourie of PGS Heritage (Pty) Ltd, on +27 (12) 332 5305.

Regards,

Wouter Fourie
Director /Accredited Heritage Specialist (APHP) Accredited Archaeologist (ASAPA)
PGS Heritage (Pty) Ltd

Celebrate Development Diversity

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20 September 2019

To whom it may concern

RE: IMPLICATIONS OF THE CHANGES OF THE HUB HEIGHT AND ROTOR DIAMETER OF WIND TURBINES IN THE PROPOSED DWARSRUG WIND FARM, THE NORTHERN CAPE PROVINCE ON THE ASSESSED SOCIO-ECONOMIC IMPACTS

This letter is written in response to the proposed changes made by the project proponent, Mainstream Renewable Power (Pty) Ltd, South Africa with respect to the above-mentioned project. The following amendments to Dwarsrug wind farms planned to be developed in the Northern Cape are proposed:

- Increase in the hub height of turbine towers of up to 200m
- Increase in the rotor diameter of wind turbines of up to 200m

The proposed amendments will not affect the total output capacity authorised for the above mentioned project, which is 140 MW.

1. Socio-economic impacts and their ratings assessed during the original studies

The socio-economic impact assessment undertaken of the above project during 2014 identified the following potential impacts to be exerted by these projects during construction and operation phases:

Table 1: Socio-economic impacts during construction and operation assessed before mitigations

Impact	Status	Dwarsrug wind Farm
Construction phase		
Temporary employment creation	Positive	Medium (39)
Skills development and training	Positive	Medium (42)
Change in demographics due to migration	Negative	Medium (30)
Increase in social pathologies	Negative	Medium (48)
Temporary increase in production and temporary stimulation of GDP	Positive	Medium (30)
Temporary increase in household income	Positive	Medium (39)
Temporary increase in government revenue	Positive	Low (17)

Impact	Status	Dwarsrug wind Farm
Deterioration of living and working conditions	Negative	Low (28)
Added pressure on infrastructure	Negative	Medium (45)
Sterilisation of agricultural land	Negative	Medium (45)
Operation phase		
Sustainable employment creation	Positive	High (57)
Skills development and training	Positive	Medium (38)
Sustainable increase in production and GDP	Positive	Medium (38)
Sustainable increase in household income	Positive	High (54)
Increase in government revenue	Positive	Medium (40)
Investment in local communities due to SED and ED	Positive	High (51)
Altered sense of place	Negative	Low (16)
Impact on property and land value	Negative	Low (13)

2. Implications on socio-economic impacts during the construction period

Considering the propose amendments, there is a possibility that the costs of developing the wind farm will increase due to the need to use more materials to construct a higher turbine tower. Such materials – steel and cement predominantly - are likely to be procured from within South Africa and will increase the impact on GDP, employment, and household income during construction. A bigger rotor diameter is also likely to lead to a greater cost than originally planned; however, rotors are to be imported.

As indicated in the table above, the impact on employment, household income and GDP during construction was of medium significance. Since the exact increase in the project's cost associated with the increase in hub height is not known, it would be prudent to assume that the changes will not be so significant that will affect the magnitude of the impacts and will lead to the changes in the overall rating of the impacts. As a result, the following significance ratings will remain for the three impacts that are expected to be most sensitive to the proposed amendments:

Table 2: Impact rating of the impacts that are likely to be affected due to proposed amendments

Impact	Status	Dwarsrug Wind Farm
Temporary employment creation	Positive	Medium (39)
Temporary increase in production and temporary stimulation of GDP	Positive	Medium (30)
Temporary increase in household income	Positive	Medium (39)

Despite the impact ratings for the above-mentioned three socio-economic impact remaining unchanged, the benefit of the proposed amendment lies in the possibility of creating a greater number of Full-Time-Equivalent employment opportunities due to the need to construct a higher turbine tower, and possibly a greater foundation. The possible increase in demand for construction materials will also stimulate the business of suppliers. All of the above could also lead to some increase in the total household income earned by the directly and indirectly affected parties.

No additional measures aside from those recommended in the original studies are required for both impacts.

3. Implications on socio-economic impacts during the operational period

Greater rotor diameter and hub could increase the efficiencies of the wind farms and lead to greater electricity generation, which in turn could increase the revenues of the project. Since the amount allocated towards Socio-Economic Development (SED) and Enterprise Development (ED) is directly linked to the revenue generated by the wind farms, the possible increase in revenue could lead to higher allocations of wind projects towards SED and ED initiatives.

Socio-economic impact associated with the investment in local communities was initially rated as high for the project. Therefore, whether the project will indeed lead to higher SED and ED allocations or not, the impact rating will remain the same. Local communities could, though, benefit from that increase.

4. Concluding statement

Considering the above assessment, it can be stated that the proposed amendments will not change the nature of the socio-economic impacts identified during the original study and will not lead to the change in ratings.

Yours sincerely,

Elena Broughton
For URBAN-ECON Development Economists (Pty) Ltd
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Your reference: Dwarsrug
Our reference: Dwarsrug SWA
Date: 20th September 2019

ATTENTION: ANDREA GIBB

Dear Madam

PROPOSED DEVELOPMENT OF THE DWARSRUG WIND FARM NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE: SURFACE WATER ASSESSMENT ADDENDUM

Since receiving Environmental Authorisation (EA) for the proposed Dwarsrug Wind Farm near Loeriesfontein, the project proponent has been required to alter certain technical parameters of the wind turbines to meet the power production requirements of the site, and the prevailing wind conditions.

As such, the following parameters have been changed:

- The hub height of the turbine has been increased to 200m above ground; and
- The rotor diameter has been increased to 200m.

The proposed changes, and subsequent amendment of the authorisation will have no impact on the surface water resources on site, and thus the amendment will not increase or change the nature of the impact which was initially assessed in the Surface Water Impact Assessment Report of March 2015.

Should you wish to discuss any facet of the above, or attached, please feel free to contact me on 083 795 2804, or alternatively on 033 347 1600.

Yours faithfully

Stephen Burton (*Pr.Sci.Nat.*)
Environmental Scientist, Faunal & Wetland Specialist
SiVEST Environmental Division