Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report

On behalf of

WKN Windcurrent SA (Pty) Ltd

27 July 2018

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

Office 220 Cube Workspace
Icon Building
Cnr Long Street and Hans Strijdom Avenue
Cape Town
8001

T +27 (0) 21 412 1529 l **E** AshlinB@arcusconsulting.co.za
W www.arcusconsulting.co.za

Registered in South Africa No. 2015/416206/07

TABLE OF CONTENTS

Figure List

SPECIALIST DECLARATION

Andrew Pearson is an Avifauna Specialist at Arcus. Andrew has a four year BSc (hons. equivalent) in Conservation Ecology, certificates in Environmental Law, as well as ten years' experience as an environmental management professional, including over seven years as an Avifaunal Specialist.

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The specialist performed the work required in an objective manner, and declare that there are no circumstances which may compromise the objectivity in performing such work. Arcus has no business, financial or other interests in the proposed project except for financial compensation for specialist work conducted.

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNSP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith." Andrew and Anja are professional members of the SACNSP, as detailed below:

Investigator:	Andrew Pearson (Pri.Sci.Nat)
Qualification:	BSc Conservation Ecology
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400423/11
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Andrew Pearson

27 July 2018

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Page v
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix II
(c) an indication of the scope of, and the purpose for which, the report was prepared;	1.1 & 2
(cA) an indication of the quality and age of base data used for the specialist report;	3.2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	7
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	3.4
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	3 & Figure 1
(g) an identification of any areas to be avoided, including buffers;	Figure 10
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 10
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	3.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	5 & 8
(k) any mitigation measures for inclusion in the EMPr;	7
(l) any conditions for inclusion in the environmental authorisation;	8
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	7 & 8
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	8
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	3.8
(p) any other information requested by the competent authority	NA
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	NA

1 INTRODUCTION

WKN Windcurrent South Africa (Ltd) Pty ('WKN-WC') are proposing the Highlands Wind Energy Facility (WEF), and associated infrastructure including grid connection infrastructure (the Proposed Development), located near the town of Somerset East in the Eastern Cape Province (Figure 1). The Proposed Development Site is situated within the Cookhouse REDZ and the affected land parcels cover an area of approximately 11 180 hectares. The area of interest for development within these land parcels is approximately 9000 hectares.

WKN-WC appointed Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') to conduct a pre-screening/feasibility assessment of the project site. Following a site visit and a desktop study a feasibility report was issued to WKN-WC in March 2017. WKN-WC thereafter appointed Arcus to conduct the required pre-construction bird monitoring for the project, the results of which have been used to advise the Environmental Impact Assessment (EIA) processes for the proposed development

While monitoring covered the whole development site, for the EIA process the applicant has decided to split the project into three phases (North, South and Central) as discussed in more detail in the project description below. Each WEF phase was assessed separately and it was concluded that each phase can be approved (from an avifaunal perspective). This conclusion was made knowing that all 49 proposed turbines from all three phases cannot be built, due to capacity constraints on the grid connection lines, and to allow the applicant flexibility when choosing the optimal turbine positions that will ultimately be built. It is understood that the likely number of turbines to be constructed will be, far less than the potential 49 turbines being cumulatively applied for(depending on the final turbine model), and it is advised that it is preferable that less than 40 are constructed, from an avifaunal perspective. It must be reiterated though that all 49 proposed turbine positions are acceptable, from which the applicant should be able to choose which 40 (or less) positions to take through to construction.

1.1 Project Description

The proposed development consists of three phases: North, Central and South. For all three phases, turbines with a maximum height to blade tip of 200 m will be considered (a hub height of up to 135 m, and a rotor diameter of up to 150 m).

The proposed **Highlands North WEF** will comprise of 17 turbines with a maximum generation capacity of 5 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location (Substation A) will form part of this phase. Two route alternatives are proposed for the Grid Connection for Highlands North WEF. The maximum length will be 5 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side). The line will either be a 66 kV line, or a 132 kV line

The proposed **Highlands Central WEF** will comprise of 14 wind turbines, with each turbine having an installed maximum generation capacity of 5 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location (Substation B) will form part of this phase. An existing access road may require upgrading as part of this phase. Two route alternatives are proposed to connect Highlands Central WEF to the grid . The maximum length will be 8 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side).

The proposed **Highlands South WEF** will comprise of 18 wind turbines, with each turbine having an installed maximum generation capacity of 5 MW per turbine. Internal roads will

connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. Two on-site substation locations (Substation C1 and C2) will form part of this phase, and two route alternatives are proposed. It will be either a 66 kV line, and /or a 132 kV line. The maximum length of the line will be 20 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side).

There are therefore 49 wind turbine positions proposed for approval across all three phases of the proposed development. However, only a maximum of 140 MW can be bid in the Renewable Energy Independent Power Producer Procurement (REIPPP) programme. Furthermore, there are grid connection constraints on the existing lines in the area, and the REIPPP only allows for one grid connection per project. Therefore, if the projects are successful in obtaining Environmental Authorisation, and are to be bid in the REIPPP, turbines from the Highlands Central WEF (Phase 2) will be combined with turbines either from Highlands North (Phase 1) or Highlands South (Phase 3), depending on meteorological data, for bidding as one project in the REIPPP. A second project (to connect to the second existing HV line on the project site) may also bid, again drawing on turbine locations from one or more of the approved WEF sites.

There are two existing Eskom Transmission lines located within the Proposed Development Site boundary, one a 66 kV and the other a 132 kV. Both have a limited but available capacity, and both will be required to connect the Highlands WEF to the national grid. It is unknown at this stage how many turbines can connect to which line, based on uncertainty surrounding the available capacities on each line and the downstream constraints (for example the Eskom main transmission system (MTS) substations). The technical and financial feasibility for the optimum Project split can only be determined on finalising the ongoing analysis of meteorological data – this will ultimately determine whether the larger of the two projects connecting to the 132 kV line will be located to the north or the south of the smaller project connecting to the 66 kV line.

Pre-construction bird monitoring was conducted across the entire proposed development site (i.e. for all three WEF phases simultaneously), however separate avifaunal specialist impact assessments are produced for each phase, as well as one combined assessment which considered one WEF of up to a maximum of 140 MW (but potentially split across two REIPPP project applications).

1.2 Purpose and Aims

The purpose and aims of this report are to provide:

- A confirmation of the terms of reference adopted for the avifaunal study;
- Description of the monitoring programme as part of the impact assessment;
- Findings of the completed 12 month bird monitoring programme;
- A description of the avifaunal status quo (i.e. the avifaunal baseline), including a description of avifaunal microhabitats available on site;
- A description of potential predicted impacts to avifauna;
- An impact assessment and significance rating for each impact and a cumulative impact assessment for all three development phases; and
- Recommendations and required mitigation measures.

2 TERMS OF REFERENCE

The following terms of reference were utilised for the preparation of this report:

- Provide summarised results from the full 12 month bird pre-construction monitoring programme;

- Describe the proposed development site baseline with regard to avifauna for the study area, focussing on the characteristics which may be impacted upon by the proposed development during construction, operation and decommissioning;
- Describe the sensitivity of the baseline environment with regard to avifauna specifically with regard to the conservation status of species;
- Identify the Regional Red Data and priority species present and potentially present on the project site;
- Identify the nature of potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation;
- Conduct a significance rating and impact assessment of identified impacts;
- Identify mitigation or enhancement measures to minimise impacts to avifauna or deliver enhancement from the proposed project; and
- Identify information gaps and limitations;

3 METHODOLOGY

The approach to the monitoring followed the requirements of the Best Practice Guidelines applicable at the time of the surveys (Jenkins *et al.* 2015) ('the guidelines') and those of the National Environment Management Act, 1998 (Act No 107 of 1998), as amended and the EIA Regulations (GNR 326 of 4 December 2014, as amended 7 April 2017). The monitoring approach was also advised by a site feasibility study for the proposed development site. This study (Arcus 2017), which included a short site visit and thorough desk-based review and was completed in March 2017, found that there were no fatal flaws evident that would exclude development of a WEF, but did highlight the potential for a number of sensitive species to be present as well as the need for the Verreaux's Eagle guidelines to be followed (as detailed in section 3.4).

The following terminology is used:

- **Priority species** = all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list (Retief *et al.* 2011 updated 2014). This list consists of 107 species with a priority score of 170 or more, and most likely to be affected negatively by WEFs. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs, physical size, species behaviour, endemism, range size and conservation status;
- **Red Data species** = species whose regional conservation status is listed as Near-Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);
- **Endemic or Near-endemic** = Endemic or near endemic (i.e. ~70% or more of population in South Africa) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BLSA Checklist of Birds in South Africa, 2014.

3.1 Defining the Baseline

The baseline avifauna environment for the proposed development site was defined utilising a desk-based study and informed by four seasons of pre-construction bird monitoring and a specialist nest survey. This information was examined to determine the potential location and abundance of avifauna which may be sensitive to development, and to understand their conservation status and sensitivity.

3.2 Sources of Information

- Bird distribution data of the Southern African Bird Atlas Project (SABAP-1) (Harrison *et al.* 1997) and Southern African Bird Atlas Project 2 (SABAP-2) obtained from the Avian Demography Unit of the University of Cape Town (Brooks 2018);
- Animal Demography unit (ADU) Co-ordinated Water-bird Count (CWAC) project (Taylor *et al.* 1999);
- ADU Co-ordinated Avifaunal Road counts (CAR)[1];
- The Important Bird Areas of southern Africa (IBA) project (Marnewick *et al.* 2015);
- Publically available satellite imagery;
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);
- Results of the four seasonal surveys (summer, autumn, winter and spring) and nest survey conducted for the pre-construction avifaunal monitoring programme for the Highlands WEF.
- Most recent publically available information regarding post-construction results from operational monitoring at wind farms in South Africa (Ralston Paton *et al.* 2017, BLSA 2017a);
- Nojoli Wind Farm Eastern Cape Operational Phase Bird and Bat Monitoring Programme (Smallie & MacEwan 2018);
- Final Report from the Amakhala Emoyeni Wind Farm Operational phase bird & bat monitoring programme (Smallie & MacEwan 2017);
- Cookhouse Wind Farm Operational Bird and Bat Monitoring Year 1 Final Report (IWS 2016); and
- Publically available peer reviewed literature on the effects of wind energy developments on birds.

3.3 Limitations and Assumptions

- The SABAP-1 data covers the period 1986 – 1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. (For a full discussion of potential inaccuracies in SABAP data, see Harrison *et al.* 1997);
- There is still limited information available on the environmental effects of wind energy facilities in South Africa. Only a summary of the results of post-construction monitoring from eight wind farms in South Africa is available (Ralston Paton *et al.* 2017), as well as information from BirdLife South Africa (BLSA) in the form of a presentation (2017a). Estimates of impacts are therefore also based on knowledge gained internationally, which should be applied with caution to local species and conditions;
- There is no guideline or standard scientifically reviewed method for extrapolating observed bird flight activity to a spatial set of sensitivity classes on a map. Flight sensitivity classes are also qualitatively assigned, and while for example a 'High Flight Sensitivity' area may represent an area where impacts are more likely, collisions are also possible in areas where there is little or no flight sensitivity. This is primarily due to the potential for inter-annual variation in bird activity, the sampling nature of the monitoring (i.e. monitoring is not conducted on site over all 365 days of a year) and the unpredictability of bird flight behaviour and inherent mobility of birds;
- While sampling effort was conducted as recommended in the guidelines, it represents only a small fraction of actual time, and to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.

[1] http://car.adu.org.za/index.php

3.4 Pre-Construction Bird Monitoring Survey Design

The monitoring programme was developed by Arcus to be in line with the latest best practice guidelines (Jenkins *et al.* 2015). Use of these guidelines is a requirement of the Department of Environmental Affairs (DEA) for assessment of proposed WEFs. Furthermore, in 2017 BLSA released species specific Verreauxs' Eagle Guidelines (BLSA 2017b). These guidelines become applicable "where a wind farm is proposed within potentially important Verreaux's Eagle habitat". It was the specialist's opinion, based on the results of the feasibility study, that the proposed project site meets this criterion and the guidelines should be followed. Therefore, these were considered in the design of the monitoring programme.

To obtain data for accurate 'before-after' comparison, the monitoring programme included data collection in a control area, at least 5 km from the nearest proposed turbines, and where there are no future known plans for renewable energy development.

Prior to the first seasonal survey, the avifaunal specialists visited the WEF site, control site, and surrounding areas between 15 and 17 May 2017 for the 'site set up' to confirm survey locations and effort. This visit confirmed that the locations and methods (as described below) were accessible and suitable.

The first seasonal survey was conducted from 18 to 30 May 2017 (autumn). This was followed by a specialist nest survey in winter between 11 and 14 July 2017. The second seasonal survey (winter) was conducted 11 – 25 August 2017, while the third (spring) survey was conducted from 30 October 2017 to 09 November 2017. The final summer seasonal survey was conducted between 16 and 28 January 2018.

The standard seasonal bird monitoring was conducted by a team of four observers and comprised flight activity surveys from various Vantage Points (VPs), as well as walked transects, driven transects, and focal site surveys (Figure 2). Relevant species were also recorded incidentally in the course of travelling the length of the site and on route to survey locations.

Target species are those particular bird species that are to be recorded by a specific survey method. Target species per survey method:

- Vantage Point (VP) Surveys: all raptors; all large (non-passerine) priority species; all waterfowl (e.g. ducks and geese);
- Walked Transects (WT): all birds;
- Driven Transects (DT): all raptors; all large (non-passerine) priority species;
- Incidental Observations: all raptors; all large (non-passerine) priority species; and
- Focal Sites (FS): all species associated, utilising or interacting at/with the focal site.

The target species per method were recorded using the following methods, as described in more detail below.

3.4.1 Vantage Points

Six vantage points were surveyed on the project site, and one on the control site (CVP) (Figure 2). The location of the VPs was designed to maximise coverage of the inclusion areas identified by WKN-WC, taking into account accessibility.

Observer pairs monitored a viewshed of 360 degrees with a radius of at least 2 km from each VP. These viewsheds were the focus of observation, however if target species were noted beyond these (or if a species being recorded flew out of the viewshed but was still visible), they would also be recorded. For each flight of a target species the flight path was recorded on a large scale map along with data on the number/species of bird(s) and type of flight, flight duration and flight height. Flight heights were recorded through five height bands: 1: 0-20 m; 2: 20-40 m; 3: 40-120 m; 4: 120-200 m and 5: >200 m. In the analysis

of flight data, height bands 2, 3 and 4 are considered to be within the potential Rotor Swept Height (RSH) of turbines, and fights within the RSH are considered to be at a higher risk of collision.

VPs on the development and control sites were monitored for 18 hours each per season[2], with a maximum of six hours per observer pair per day. This resulted in 72 hours per VP, and total of 432 hours of VP monitoring on the WEF site and 72 hours on the control site over the 1 year programme. VPs were always surveyed by a pair of observers, to prevent fatigue, increase safety and increase the quality of the data collected.

3.4.2 Walk Transects

To sample abundances and species richness of small terrestrial species, four walked transects of 1 km each in length on the development site and two on the control site, were established (Figure 2). WT1-WT3 were each conducted twice during each of the four seasonal surveys. WT4 was added at the start of the third (spring) survey, to increase the sampling effort in the north, and was conducted twice in spring and twice in summer.

Each time a WT was conducted, two observers walked between the start and end points of the transects whilst recording all birds seen or heard up to 150 m on either side of the transect. Beyond 150 m, only priority species were noted and were recorded as incidental sightings.

3.4.3 Drive Transects

To sample abundances of large terrestrial birds and raptors, three driven transect routes were conducted twice per season within and around the project site (DT1, DT2 and DT3) and one transect was conducted twice per season at the control site (CDT) (Figure 1). The length of each DT was as follows: DT1 = 5.44 km; DT2 = 9.36 km; DT3 = 5.22 km; and CDT = 8 km. Target species were recorded by driving slowly (+- 25 km/h) with all windows open, and stopping occasionally to listen and scan the surrounding environment. When a target species was located, a GPS co-ordinate was recorded along with the distance and direction from the vehicle to the observed bird and additional information such as weather conditions and habitat type.

3.4.4 Nest Survey

A dedicated cliff nest survey was conducted by an avifaunal specialist and assistant from 11 -14 July 2017. The majority of potential cliff habitat on and within 3 km of the proposed development site was surveyed (Figure 2).

The survey methodology broadly followed the methods recommended in Malan (2009), and involved an initial desk-based screening using satellite imagery, to identify the location of possible cliffs. The specialist also utilised his knowledge of the site from the monitoring set up, prior to the autumn survey, to identify cliffs that required surveying. These areas were then visited (with the largest and most accessible cliff's generally being visited first) using a 4 x 4 and walking where possible. Cliffs were surveyed using a combination of 10 x 42 binoculars as well as a tri-pod mounted 20-60 x 60 Nikon Prostaff 5 fieldscope. The aim was to locate Verreaux's' Eagle nests (which are typically large), however the presence of any cliff nest (active or inactive) was noted if observed.

[2] On the WEF site, VP5 was relocated after 15 hours in autumn to a better location (VP5b) which was used for the rest of the autumn season, the winter season and the spring season. For the last season, another location (VP5c) was used instead of VP5b.

3.4.5 Focal Sites

Focal Sites (FS) may include cliff-lines, quarry faces, power lines, and stands of large trees, nest sites, dams, water points, marshes and wetlands.

Fourteen focal sites on and around the development site were surveyed. These comprised of seven dams (FS1-FS6, and FS8) and seven nest sites (N1-N7) (Figure 2). On the control site, two dams were surveyed as focal sites (CFS1 and CFS2). The amount of times each focal site was surveyed differed per season and per site, depending on importance and access restrictions.

FS1-F3, FS6 and FS8 were each surveyed eight times (i.e. twice per seasonal survey). FS4 and FS5 were each surveyed six times, as they were found to be dry in spring and summer, and were not surveyed in summer.

Each nest site (N1-N9) were surveyed at least once (i.e. during the nest survey in winter). Most nest sites were not surveyed in autumn, as they were only located after the nest survey in winter. N1 was surveyed again in summer. N2 was located prior to the autumn surveys (during feasibility site work) and was surveyed again in on two occasions in autumn, and two occasions in winter. N3 was surveyed twice in winter and once in summer. N4 was surveyed once in each of winter spring and summer, as was N5. N6 was visited twice in winter and once in summer. N7 was surveyed once in winter and once in spring.

When a focal site was visited, it was surveyed for approximately 15 min per visit, in order to record all species associated, utilising or interacting at/with the focal site at that time, and taking care not to record birds more than once. If required, additional time was spent at nest site focal sites to try to determine the status of the nest.

3.4.6 Incidental Observations

All other incidental sightings of priority species on the WEF site, control site and within the broader area were recorded and geo-referenced, along with additional relevant information such as weather and habitat type.

3.5 Identification of Potential Impacts

After collation of the baseline data from the source of information listed above the potential impacts of the project were identified (separately for the WEF and Grid Connection of each proposed phase), for the construction, operational and decommissioning phases.

The key potential impact types on avifauna from WEFs and associated grid connection infrastructure are:

- Collision with turbines;
- Electrocution;
- Collision with power lines;
- Disturbance and displacement;
- Disruption of bird movements; and
- Habitat destruction.

3.6 Impact Assessment Methodology

Each of the potential impacts (identified above and discussed in more detail in Section 6), on the baseline environment presented in Section 5, is assessed in Section 7 using the methodology provided by the Environmental Assessment Practitioner (Hacking 2001). For each impact, the significance was calculated by determining the probability and consequence for each impacts. The consequence considered the severity, duration and spatial scale of each impact. An indication of confidence in the assessment is provided and the status (neutral/positive/negative) of each impacts is indicated. All of the above is done

for each impacts in the absence of any mitigation ('without mitigation'). Mitigation measures were identified and the significance was re-rated, assuming the effective implementation of the mitigation ('with mitigation'). The assessment 'without mitigation' assumes the worst case scenario in which the maximum proposed number of turbines for each phase is constructed anywhere in the proposed development site. The assessment 'with mitigation' assumes that all turbines are constructed outside of avifaunal no-go areas identified, and all additional mitigations described in the tables in Section 7 are also adequately implemented.

The assessment included determining the value of the avifaunal receptors. This was done primarily though the compilation of a list of focal species by considering factors such as abundance, behaviour on site, breeding and flight activity (i.e. by considering the survey results) as well as priority species status (as per Retief *et al.* 2014), Regional Red Data status (Taylor *et al.* 2015) and whether the species is endemic or range-restricted or not.

Cumulative impacts were assessed as the incremental impact of the proposed activity on the baseline presented in Section 5, when added to the impacts of other past, present or reasonably foreseeable future relevant activities in a 50 km radius. The following, operational, proposed or approved developments within 50 km were identified for consideration in the cumulative assessments:

- Operational 140 MW Cookhouse Wind Farm
- Operational 88 MW Nojoli Wind Farm
- Operational 134 MW Amakhala Emoyeni Wind Farm
    - Potential 140 MW Msenge Emoyeni Wind Farm (under same EA as Amakhala)
- Proposed Cookhouse II Wind Energy Facility[3]
- Proposed 140 MW Middleton Wind Energy Project
- Proposed Golden Valley 1 and Golden Valley 2 Wind farms[4]
- 10mw Photovoltaic (PV) Solar Farm In Pearston
- 10 Mw Photovoltaic Solar Farm In Pearston on Erf 468-Portion Of The Pearson Municipal Commonage.
- A 55MW PV Solar Farm And Associated Infrastructure On Portion 2 Of The Farm Kraan Vogel Kuil No.50, Pearston

Any publically available specialist, EIA or BA reports were obtained and reviewed in terms of avifaunal impacts, and included in the cumulative assessment.

3.7 Determination of Avian Sensitivity and No-Go Areas

Avifaunal Flight Sensitivity Zones were designated based on observed flight activity during 12 months of avifaunal monitoring sessions on the WEF site.

Observed flight sensitivity was determined by creating a Grid Cell Sensitivity Score (GCSS), falling within either a Low, Medium, Medium-High or High classification for a 200 m x 200 m grid covering the WEF site. The GCSS was derived by analysing the following characteristics of all mapped priority species and raptors flight lines passing through each grid cell:

- Priority species score and the number of individuals associated with each flight line;
- Risk height factor, which considered if the flight was within the Rotor Swept Height;
- The duration of the flight; and
- The length of the flight.

[3] It is our understanding that this project, was previously authorised as two separate wind farms 'the Great Fish River Wind Farm' and the Bedford Wind Farm' and has since been re-named as 'Nxuba Wind Farm' which has been selected as a preferred bidder in bid window 4 of the REIPPP programme.

[4] It is our understanding that one of these projects has been selected as a preferred bidder in bid window 4 of the REIPPP programme.

These factors were considered in the following equation to determine a Flight Section Sensitivity Score (FSSS), for each section of flight within a grid cell. The GCSS is the sum of these flight sections within the grid cell, giving a sensitivity score specific to the cell.

FSSS = PSS x N x (X/Y x D) x (P+1)
Where:

- PSS is the Priority Species Score (Retief *et al.* 2011, updated 2014).
- N is the number of birds that are associated with the flight line.
- X is the length of the flight line section that is within a particular Grid Square.
- Y is the length of the whole flight line.
- D is the duration of the whole flight.
- P is the proportion of the flight line at Risk Height.

Grid cells within the WEF site boundary without a GCSS did not have any recorded priority species flights passing through from the monitoring survey, either because no species were recorded, or they were beyond the viewsheds covered by VP watches.

The resultant GCSS scores were weighted to account for survey effort (which in this case was 72 hours per VP) and then categorised into Flight Sensitivity Zones as follows: low <500, medium <1250, med-high <2500, high 2,500 to 10,000, and very high >10,0000.

No-Go areas for turbines only (other infrastructure permitted) include nest buffers (dependent on species and as indicated in Table 7, where for example Verreaux's Eagle nests are buffered by 3 km); steep slopes and steep slopes buffered by 200m; cultivated lands and a 200 m buffer of National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands (including dams). They also include high and very high sensitivity zones buffered by 50 m (to allow for some error in observer accuracy).

No-Go areas for all infrastructure are 1 km buffers around selected active nest sites and 1.5 km buffers around active Verreaux's Eagle nests sites, in line with applicable guidelines, and primarily intended to reduce disturbance and displacement impacts.

3.8 Stakeholder Consultation

Birdlife SA has been consulted and is aware of the preconstruction monitoring methodologies. The Endangered Wildlife Trust and Vulpro were consulted during the bird feasibility study, particularly to request data. Vulpro provided the most up to date available Cape Vulture data for roost sites in the broader area. The specialist also had discussions with local birdwatchers, Greg Brown and Allan Collet, as well as various farmers and landowners to obtain local information. Additional stakeholders will be consulted and engaged accordingly, as part of the public participation process of the EIA, as and when required.

4 POLICY AND LEGISLATIVE CONTEXT

The legislation relevant to this specialist field and the proposed project is as follows:

4.1 National Environmental Management Act, No 107 of 1998 (NEMA).

South Africa's framework environmental act was established to provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

Through the Environmental Impact Assessment (EIA) Regulations (2014, as amended), the act requires certain activities and developments to undergo an EIA process. Certain

specialist studies are required, depending on the development type, scale and location. In the case of a WEF development, and avifaunal specialist study is required.

4.2 The Convention on Biological Diversity (CBD), 1993

A multilateral treaty for the international conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising from natural resources. The CBD is based on the precautionary principle which states that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat and that in the absence of scientific consensus the burden of proof that the action or policy is not harmful falls on those proposing or taking the action.

4.3 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), 1983

An intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The fundamental principles listed in Article II of this treaty state that signatories acknowledge the importance of migratory species being conserved and agree to take action to this end "whenever possible and appropriate", "paying special attention to migratory species the conservation status of which is unfavourable and taking individually or in cooperation appropriate and necessary steps to conserve such species and their habitat".

4.4 The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 1999

An intergovernmental treaty developed under the framework of the Convention on Migratory Species (CMS), concerned the coordinated conservation and management of migratory waterbirds throughout their entire migratory range. Signatories of the Agreement have expressed their commitment to work towards the conservation and sustainable management of migratory waterbirds, paying special attention to endangered species as well as to those with an unfavourable conservation status.

4.5 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Threatened or Protected Species List (TOPS)

Amendments to the TOPS Regulations and species list were published on 31 March 2015 in Government Gazette No. 38600 and Notice 256 of 2015. The amended species list excluded all species threatened by habitat destruction and which are not affected by other restricted activities, but included the following potentially relevant target species for this study:

Endangered – Martial Eagle, Ludwig's Bustard, Cape Vulture; *Vulnerable* – Denham's Bustard; *Protected* – Kori Bustard, Blue Crane.

4.6 Nature and Environmental Conservation Ordinance (No. 19 of 1974)

Developed to protect both animal and plant species within the province which warrant protection. These may be species which are under threat or which are already considered to be endangered. Is applicable in the Eastern Cape and lists birds which are protected.

4.7 The Civil Aviation Authority Regulations, 2011

These are relevant to the issue of lighting of wind energy facilities, and to painting turbine blades, both of which are relevant to bird collisions with turbine blades.

4.8 The Equator Principles (EPs) III, 2013

The principles applicable to the project are likely to include:

- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 8: Covenants.

These principles, among various requirements, include a requirement for an assessment process (e.g. EIA process), an Environmental and Social Management Plan (ESMP) to be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards, and the appointment of an independent environmental expert to verify monitoring information.

5 BASELINE AVIFAUNAL ENVIRONMENT

The baseline avifauna environment was determined for the proposed development site as a whole (i.e. the area covering all three WEF phases) by considering a number of data sources. The primary data source, upon which most emphasis was placed was the recent pre-construction bird monitoring programme.

5.1 Southern African Bird Atlas Project 1

The SABAP1 data was collected between 1986 and 1997 and is one of the best long term data sets on bird distribution and abundance available in South Africa at present[5]. This data was collected in quarter degree squares, with the proposed development covering the following squares: 3225CB and 3225CD. Table 1 indicates the reporting rate for all raptors and priority species as well frequently recorded aerial foragers and waterbirds within these squares.

Table 1: All Priority Species and Raptors, as well as frequently recorded Aerial Foragers and Waterbirds recorded in the SABAP1 Quarter Degree Squares covering the Proposed Development Site

Species	Regional Red Data Status (Taylor *et al.* 2015)	Priority Species Score	QDGS Report rate (%) **	
			3225CB	3225CD
Total species			*162*	*135*
Number of cards submitted			*26*	*8*
Wind Farm priority species or raptors				
Stork, White		220	19	-
Stork, Black	VU	330	4	-
Secretarybird	VU	320	4	50
Kite, Black-shouldered		174	31	63
Eagle, Verreaux's	VU	360	15	13
Eagle, Booted		230	-	25
Eagle, Martial	EN	350	4	38

[5] Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1: Non-passerines. BirdLife South Africa, Johannesburg.

Species	Regional Red Data Status (Taylor *et al.* 2015)	Priority Species Score	QDGS Report rate (%) **	
			3225CB	3225CD
Buzzard, Steppe		210	31	38
Buzzard, Jackal		250	23	25
Goshawk, Pale Chanting		200	35	88
Harrier, Black	EN	345	-	25
Harrier-Hawk, African		190	4	-
Falcon, Peregrine		240	4	-
Kestrel, Rock			58	75
Kestrel, Lesser		214	8	25
Francolin, Grey-winged		190	-	13
Crane, Blue	NT	320	4	50
Bustard, Denham's	VU	300	4	-
Bustard, Kori	NT	260	-	13
Bustard, Ludwig's	EN	320	4	38
Korhaan, Karoo	NT	240	4	-
Korhaan, Black (Southern)	VU	270	4	50
Owl, Spotted-Eagle		170	8	-
Kite, Yellow-billed			8	-
Owl, Western Barn			-	13
Frequently recorded aerial foragers				
Swallow, Greater-striped			62	63
Swallow, Barn			27	38
Swift, Little			15	38
Swift, Alpine			12	13
Martin, Rock			27	88
Frequently recorded waterbirds				
Duck, African Black			35	25
Duck, Yellow-billed			15	25
Hamerkop			31	50
Goose, Egyptian			19	63
Shelduck, South African			54	63
Cormorant, Reed			31	-
Heron, Black-headed			42	38

* Report rates are percentages of the number of times a species was recorded in a square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire two quarter degree squares of which only a portion covers the proposed development site.

Important priority species with relatively high reporting rates are: Blue Crane, Ludwig's Bustard, Southern Black Korhaan, Martial Eagle, and Secretarybird. It is worth noting that three bustard species have been recorded in the area.

5.2 Southern African Bird Atlas Project 2

The Southern African Bird Atlas Project 2 is part of an on-going study by the Animal Demography Unit, a research unit based at the University of Cape Town. SABAP2 data was examined for the pentads (which are roughly 8 km x 8 km squares, and are smaller than the squares used in SABAP1) extending over any part of, or bordering the site for which data exist. These are pentads 3235_2515 (2 cards), 3235_2525 (1), 3240_2515 (3), 3240_2520 (5), 3240_2525 (4), 3245_2515 (1), 3245_2520 (5), 3245_2525 (8), and 3250_2520 (1 card) (Figure 1). A total of 30 full protocol cards[6] have been submitted for these pentads. The SABAP 2 data recorded a total of 193 species across these pentads including 20 priority species (Table 2).

Table 2: SABAP2 recorded Priority Species and Raptors, as well as frequently recorded Aerial Foragers and Waterbirds in 9 Pentads in and around the Proposed Development Site

Species	Regional Red Data Status	Endemic / Near-Endemic	Priority Score	Reporting Rate (%) (from 30 cards in 9 pentads)
Priority species or raptors				
Bustard, Kori	NT		260	10.0
Bustard, Ludwig's	EN		320	26.7
Buzzard, Steppe			210	10.0
Buzzard, Jackal		X	250	30.0
Crane, Blue	NT		320	50.0
Eagle, African Fish			290	13.3
Eagle, Booted			230	10.0
Eagle, Martial	EN		350	3.3
Eagle, Verreauxs'	VU		360	23.3
Falcon, Lanner	VU		300	6.7
Francolin, Grey-winged			190	3.3
Goshawk, Gabar			-	3.3
Goshawk, Pale Chanting			200	40.0
Harrier, Black	EN	X	345	3.3
Harrier-Hawk, African			190	13.3
Kestrel, Greater			174	Ad hoc
Kestrel, Rock			-	60.0
Kite, Black-shouldered			174	10.0
Korhaan, Karoo	NT		240	3.3
Korhaan, Southern Black	VU	X	270	26.7

[6] The number of 'cards' indicates the number of times a particular pentad has been counted by a citizen scientist, for a at least a total of 2 hours, and a list of the birds recorded has been produced, submitted to the ADU and verified.

Species	Regional Red Data Status	Endemic / Near-Endemic	Priority Score	Reporting Rate (%) (from 30 cards in 9 pentads)
Owl, Spotted Eagle-			170	3.3
Secretarybird	VU		320	30.0
Frequently recorded aerial foragers				
Martin, Brown-throated				13.3
Martin, Rock				56.7
Swallow, Barn				20.0
Swallow, Greater Striped				26.7
Swallow, Pearl-breasted				13.3
Swallow, White-throated				20.0
Swift, African Black				10.0
Swift, Alpine				13.3
Swift, White-rumped				20.0
Frequently recorded waterbirds				
Cormorant, Reed				10.0
Duck, African Black				10.0
Duck, Yellow-billed				36.7
Goose, Egyptian				73.3
Grebe, Little				16.7
Heron, Black-headed				10.0
Heron, Grey				33.3
Lapwing, Blacksmith				36.7
Plover, Three-banded				43.3
Shelduck, South African				20.0
Spoonbill, African				13.3
Stilt, Black-winged				13.3

The pentad with the highest number of cards (Pentad 3240_2535 with 25 cards) in the broader area was also consulted (Figure 1). Priority species recorded in this pentad but not listed above are Buff-streaked Chat (18.18%), Crowned Eagle (40.91%), Black Sparrowhawk (45.45%) and White Stork (18.18%) and Cape Vulture (4.55%). Verreaux's Eagle has a reporting rate of 36.36% in this pentad and Martial Eagle 22.73%. As this pentad covers similar habitat as the proposed development site and is less than 20 km from the site boundary, it is possible that these species may also occur there.

5.3 Important Bird Areas (IBA) Project

The proposed development site does not fall within a BLSA Important Bird and Biodiversity Area (IBA). The Camdeboo National Park IBA lies approximately 75 km to the North West of the development site and is the closest IBA, while the Amatola-Katberg Mountain IBA is approximately 100 km east north east of the project site. While some larger species may move between the general project area and these IBA's, this is unlikely, and data from

these IBA's will not provide any further information to advise the study, and is therefore not considered further in this study.

5.4 Coordinated Avifaunal Roadcounts (CAR)

CAR counts comprise a census of birds (focussed on large terrestrial species) performed twice annually (in winter and summer) by volunteer birdwatchers. The purpose is to provide population data for use in science, especially conservation biology, by determining findings about the natural habitats and the birds that use them.

There are three car count routes (ES03, ES07 and ES11) within 15 km of the proposed development site.

Table 3 shows summarised results for priority species from the last 10 years of surveys (2008-2017) across all three routes. Generally, each route was conducted twice per year (in winter and in summer), with a total of 2147.5 km having been driven. An indication of the average Index of Kilometric Abundance (IKA) is given, which shows that the average IKA for priority species on these routes was ~0.32 birds/km, which represents a relatively moderate to low density in the specialists experience.

Table 3: Total Numbers of Birds of Priority Species Recorded in Winter and Summer across three CAR Routes between 2008 and 2017

	Summer				**Winter**				**Total Birds**	**Total IKA**
Row Labels	**ES03**	**ES07**	**ES11**	***Total***	**ES03**	**ES07**	**ES11**	***Total***		
Black Harrier							1	*1*	**1**	0.0005
Black Stork	1			*1*				-	**1**	0.0005
Blue Crane	26	44	60	*130*	97	18	126	*241*	**371**	0.1728
Denham's Bustard					7	2	1	*10*	**10**	0.0047
Karoo Korhaan	24			*24*	49	1		*50*	**74**	0.0345
Kori Bustard	3	5		*8*	5	2		*7*	**15**	0.0070
Ludwig's Bustard	16	2	11	*29*	37	18	4	*59*	**88**	0.0410
Northern Black Korhaan					2			*2*	**2**	0.0009
Secretary Bird	2	6	1	*9*	5	1	1	*7*	**16**	0.0075
Southern Black Korhaan	15	9	31	*55*	11	5	6	*22*	**77**	0.0359
White Stork	12	1	11	*24*				-	**24**	0.0112
Grand Total	**99**	**67**	**114**	***280***	**213**	**47**	**139**	***399***	**679**	**0.3162**

Generally, more priority species bird were recorded in winter. This is not overly surprising, as one of the most conspicuous (and easy to spot) larger terrestrial bird, the Blue Crane, gathers in large flocks in winter, and much higher numbers of this species were recorded in winter. Blue Crane had the highest IKA (0.17 birds/km), followed by Ludwig's Bustard (0.04 birds/km) and Southern Black Korhaan (0.036 birds/km). It is noted that White Stork and Black Stork were only recorded in summer, while Denham's Bustard was only recorded in winter.

5.5 Coordinated Waterbird count (CWAC) data

Coordinated Waterbird Counts (CWAC) consist of a programme of mid-summer and midwinter censuses at a large number of South African wetlands. The counts are conducted by citizen scientists at more than 400 wetlands around the country and provide a useful

source of information on wetland bird species in South Africa. There are no CWAC sites within 60 km of the proposed development site, and therefore this data set is not deemed relevant, and is therefore not considered further in this study.

5.6 Bird Microhabitats

In order to determine which bird species are more likely to occur on the proposed development site, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro-habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors.

Aerial photographs, satellite imagery, a vegetation type layer[7], supplemented by three different site visits by the bird specialist and four seasonal site surveys by the observer team, has been used to identify the following micro-habitats[8] on the proposed development site:

5.6.1.1 Open Grasslands

The majority of the proposed site falls within the 'Bedford Dry Grassland' Vegetation type. Open grasslands (whether disturbed or natural, depending on land use practises), are a dominant avifaunal micro-habitat on the site. These areas may be important for various priority species including Blue Crane, Denham's Bustard, Ludwig's Bustard, Secretarybird, Southern Black Korhaan, Lanner Falcon, Martial Eagle, Black Harrier, Black-shouldered Kite, Jackal Buzzard, as well as numerous passerines such as larks, pipits and cisticolas.

5.6.1.2 Thicket and Scrub

Thicket vegetation is prevalent on the site, particularly associated with slopes and valleys to the west of the proposed development site. These areas generally coincide with the 'Camdeboo Escarpment Thicket' vegetation type. Thicket and Scrub is utilised by smaller passerine birds such as larks, chats, eremomelas, prinias, robin-chats and shrikes. A variety of raptors may also forage over these areas, such as Southern Pale Chanting Goshawk, Jackal Buzzard, Martial Eagle and Verreaux's Eagle.

5.6.1.3 Cultivated Fields and Pastures

Limited areas of irrigated agricultural land and pastures occur around farmhouses or associated with watercourses and rivers. These areas may provide a feeding ground for many species of birds, as land preparation makes insects, seeds, bulbs and other food sources readily available. This habitat type may be used by cranes, ibises, herons, storks, egrets, geese, francolins and a variety of passerine species. Most importantly, flocks of Blue Crane and White Stork may congregate in cultivated fields.

5.6.1.4 Rivers and Drainage Lines

There are no major rivers on or near the proposed development site. Smaller rivers, streams and drainage lines in the area may not always carry water, these features are dominated by denser and taller riparian scrub and generally have a higher abundance of bird life than the surrounding vegetation. Drainage lines, streams and rivers may form flyways for amongst others, ibises, ducks, cormorants, geese and storks, while riparian scrub will host a number of smaller passerine species. Rivers responsible for eroding cliff faces into the landscape may also therefore indirectly provide roosting and nesting habitat for geese, ibises, herons, storks, Hamerkop and raptor species such as Rock Kestrel, Verreaux's Eagle, African Harrier Hawk and Jackal Buzzard.

[7] Mucina and Rutherford, 2006.

[8] Except for Natural Forest, which is only present in the broader area and not on the proposed development site.

5.6.1.5 Farm Dams

Dams are important attractions for various bird species in the South African landscape, and are often the only source of water during the dry season in the area. A number of dams are present on the proposed development site and were found to attract various waterfowl, such as shelduck, geese and ducks. Storks, African Spoonbill, herons and egrets may also frequent these water bodies, as well as fish-eating raptors such as African Fish Eagle. Blue Cranes are known to use farm dams as roost sites.

5.6.1.6 Ridges and/or Cliffs

Long ridges run north to south along the western boundary of the proposed development site. An escarpment running north east to south west borders the development site to the north. The central and eastern area of the site has less hills and ridges, and is more open and flat.

The hills and ridges are important for various raptors, e.g. Rock Kestrel, African Harrier Hawk, Jackal Buzzard and Verreaux's Eagle, that may use the slopes for soaring and to gain lift. Rocky outcrops and cliffs may be important nesting habitat for various raptors, including Verreaux's Eagle, which is likely to spend time hunting along rocky outcrops and ridges. Black Stork may also nest on suitable cliffs. Rocky ridges are also home to Rock Hyrax ('Dassie') an important prey species of Verreaux's Eagle, which may hunt regularly in these areas. While most of the extensive, and large cliff faces are north of the site, there are some rocky areas and cliffs on the site itself. Dassies will frequent these areas, which are may attract foraging Verreaux's Eagles.

5.6.1.7 Farmsteads and Feeding Kraals

Farmsteads are disturbed areas surrounding farm houses or areas of human activity, while feeding kraals are areas where livestock gather for food, shelter and water provided by the farmers. These habitats are frequented by small passerine birds such as sparrows, starlings, doves, weavers and larks but also by egrets, ibis, crows and guineafowl. Farmsteads are utilised by a variety of raptors such as Black-shouldered Kite and Barn Owl, which prey on various rodent species that occur in these areas.

5.6.1.8 Stands of Alien Trees

Stands of alien trees such as poplars and blue gums occur scattered around the site, mainly near farmsteads, rivers and drainage lines. These may be utilised as roosts and/or perches by raptors such as Verreaux's Eagle, Martial Eagle and Jackal Buzzard, and also frequented by a variety of passerines such as doves, starlings and weavers.

5.6.1.9 Natural Forest

While forest habitat was not observed on site, it is present in the broader area, particularly on the slopes of the large mountain ranges to the north and north east (e.g. Bruintjieshoogte and Boschberg). Forests may hold breeding raptors such as Martial Eagle, Crowned Eagle and sparrow-hawks, while forest associated species such as Fork-tailed Drongo, Olive Bush-shrike, Terrestrial Brownbul, Klaas's' Cuckoo, Tambourine Dove, Forest Canary and Grey Cuckoo-shrike are likely to be present. In similar forest (approximately 22 km east north east from the proposed site), a Martial Eagle nest and a Crowned Eagle nest (respective approximate locations: -32.695167°S; 25.622992°E and -32.692940°S; 25.630563°E) have been located on the farm Glen Avon (pers comm. Greg Brown).

5.7 Pre-construction Monitoring Results

5.7.1 Vantage Points

During VP watches on the WEF site in the final summer season survey, 321 flights of target species were recorded totalling 841 birds, and this equates to an average of 3 target bird flights and 7.8 target birds per hour over the 108 hours of observation. If only priority species are considered, there were 258 flights (2.4 flights/hour) and 739 birds (6.8 birds/hour) recorded in summer. This is a substantially higher passage rate than what was observed in the previous three seasons. In autumn 116 target species flights were recorded (totalling 152 birds) during observations on the WEF site (an average of 1.4 target birds per hour). In winter 213 target species flights were recorded (totalling 261 birds) during observations on the WEF site (an average of 2.4 target birds per hour), while in spring 179 flights totalling 246 birds were recorded at an average 2.3 target birds per hour of observations.

The higher activity observed in summer was primarily due to the presence of summer migrants e.g. Lesser Kestrel, Amur Falcon and Steppe Buzzard.

Across all four seasonal surveys a total of 809 flight paths from 32 positively identified target species have been recorded on the proposed development site, totalling 1475 individual birds[9]. This equates to approximately 3.41 target species birds per hour of observation. Recorded flights paths are presented in Figures 3 - 7.

For priority species only (including unidentified raptors which are likely priority species), the overall passage rate on the WEF is calculated as 2.75 birds/hour of observation. Considering that the data is heavily skewed by the influx of summer migrants, if one removes Amur Falcon and Lesser Kestrel for the calculation, the resultant passage rate for the remaining priority species is calculated at 1.60 birds/hour on the WEF site.

Generally, these figures discussed above represent a moderate to high level of flight activity compared to other sites in South Africa in the specialists' experience. Compared with sites in the Eastern Cape, the activity is also moderate to high in general, with some sites reporting lower activity and other similar or even higher levels of flight activity. For example, at a site in the Coega IDZ 1.15 target species birds/hour were recorded, while at a site south of Middleton, 1.17 birds/hour were recorded. At another proposed WEF in the Coega IDZ Arcus recorded an average of 1.2 birds/hour. At Jeffrey's bay wind farm flight activity pre-construction was 4.69 birds/hour, a figure that was inflated by the presence of Amur Falcons, but is higher than what has been recorded at the proposed Highlands WEF. Caution must be taken when interpreting passage rates of birds/hour as it is greatly influenced by large flocks, especially flocks of Blue Crane and Ludwig's Bustard which usually flew low, and in lower valleys away from turbine locations, as well as flocks of Lesser Kestrel and Amur Falcon, which were only present in summer. The 32 VP target species recorded included 11 Red Data species, four of which are *Endangered* (Cape Vulture, Martial Eagle, Ludwig's Bustard and Black Harrier). A total of 23 priority species were recorded from VPs, which is a relatively high number in the specialist's experience, compared to other South African sites, but a moderate number when compared to Eastern Cape sites. At a proposed WEF in the Coega IDZ we recorded 17 priority species after three seasonal surveys. At a site near Riebeek East, 28 priority species were recorded after five site visits. A site near Murraysburg (although not in the eastern cape) recorded 24 priority species during 1 year of surveys, while surveys on a site near Elliot recorded 25 priority species after only two seasonal surveys Table 4 shows a summary of the VP flights recorded

[9] A flock of birds flying together is recorded as a single flight path. However, the majority of flight paths to date were of a single bird, with two flights (both by Southern black Korhaan) recording 2 birds each.

for each target species on the WEF site, as well as an indication of the flights potentially at Rotor Swept Height (RSH).

Analyses of flight paths indicate that while target species utilised various height categories, 76% of target species flights included at least some time at RSH. This is a moderate amount of flights in the potential risk zone, and may be indicative of the species recorded, as raptors (the group of birds most recorded) do tend to fly at risk height while soaring, hovering, and gliding and change heights regularly.

While data was collected on the control site, it is not analysed and presented here as it is not required for purposes of assessing the proposed development site. This data is kept and will be analysed to compare with operational phase data for before /after comparisons. In general, a similar suite of priority species were recorded at the control site, and similar levels of flight activity were recorded.

Table 4: Flight Path Target Species

Species	Species Priority Score	Red List Status (Taylor *et al.* 2015)	Total no. of Flight paths	Total no. of birds recorded*	Max. Flock Count	Flights with a portion at RSH (% at RSH)	Flights per hour of observation	Birds per hour of observation
African Fish Eagle	290	-	3	3	1	2 (67%)	0.007	0.007
African Spoonbill	-	-	5	7	2	3 (60%)	0.012	0.016
African Harrier Hawk	190	-	5	6	2	4 (80%)	0.012	0.014
Amur Falcon	210	-	79	348	30	49 (62%)	0.183	0.806
African Sacred Ibis	-	-	3	14	8	2 (67%)	0.007	0.032
Black-chested Snake Eagle	230	-	10	10	1	8 (80%)	0.023	0.023
Black Harrier	345	EN	4	4	1	2 (50%)	0.009	0.009
Blue Crane	320	NT	56	144	18	30 (53%)	0.130	0.333
Black Stork	330	VU	5	6	2	4 (80%)	0.012	0.014
Booted Eagle	230	-	9	9	1	7 (78%)	0.021	0.021
Brown Snake-Eagle	180	-	1	1	1	1 (100%)	0.002	0.002
Cape Vulture	405	EN	11	40	8	9 (82%)	0.025	0.093
Denham's Bustard	300	VU	4	6	3	2 (50%)	0.009	0.014
Egyptian Goose	-	-	19	44	6	8 (42%)	0.044	0.102
Grey Heron	-	-	1	1	1	1 (100%)	0.002	0.002
Grey-winged Francolin	190	-	1	2	2	0	0.002	0.005
Hamerkop	-	-	2	2	1	2 (100%)	0.005	0.005
Jackal Buzzard	250	-	155	180	3	144 (93%)	0.359	0.417
Kori Bustard	260	NT	1	1	1	0	0.002	0.002
Lanner Falcon	300	VU	1	1	1	1 (100%)	0.002	0.002
Lesser Kestrel	214	-	43	144	9	27 (63%)	0.100	0.333
Ludwig's Bustard	320	EN	18	23	3	12 (67%)	0.042	0.053

Martial Eagle	350	EN	3	4	2	3 (100%)	0.007	0.009
Pale Chanting Goshawk	200	-	26	29	2	12 (46%)	0.060	0.067
Rock Kestrel	-	-	181	199	3	140 (77%)	0.419	0.461
South African Shelduck	-	-	4	8	2	4 (100%)	0.009	0.019
Secretarybird	320	VU	2	2	1	2 (100%)	0.005	0.005
Spur-winged Goose	-	-	2	7	4	2 (100%)	0.005	0.016
Steppe Buzzard	210	-	31	34	2	25 (81%)	0.072	0.079
Unidentified kestrel	-	-	2	3	2	2 (100%)	0.005	0.007
Unidentified raptor	-	-	22	33	5	18 (82%)	0.051	0.076
Verreaux's' Eagle	360	VU	98	143	3	85 (87%)	0.227	0.331
White Stork	220	-	1	13	13	0	0.002	0.030
Yellow-billed Duck	-	-	1	4	4	1 (100%)	0.002	0.009
Total	**809**	**1475**	**NA**	**NA**	**NA**	**612 (76%)**	**1.873**	**3.414**

**Some flight paths (recorded as a single flight) may have included multiple birds i.e. a flock. As separate flights may have included the same individual bird/s, this figure should not be seen as an indication of abundance or population size, but rather an indication of activity of a particular species.*

5.7.2 Walk Transects

Across the four seasonal surveys on all four transects on the WEF site (n =30) 666 observations recorded 1532 individual birds representing a total WT IKA of 51 birds/km. This represents a relatively high abundance of birds recorded by the walked transects compared to the specialists experience of other WEF sites in South Africa, and a moderate abundance in general compared to other sites in the Eastern Cape

Table 5 shows a summary of the total (i.e. across all four seasonal surveys) observations and numbers of birds recorded on each walk transect. Even though it had fewer repetitions (n=6), WT4 had the most observations (204) and recorded the highest number of birds (509 individuals), resulting in an average of 84.8 birds recorded per kilometre. This high IKA is largely attributable to two observations of flocks of 30 and 40 Amur Falcon respectively. WT3 had the lowest IKA, recording on average 39 birds/km. Red Data species recorded during the WTs included Blue Crane, Southern Black Korhaan, African Rock Pipit, Verreaux's Eagle, Kori Bustard and Ludwig's Bustard.

Common passerine species that were frequently recorded and abundant across most transects were: African Pipit; Cape Turtle Dove; Grey-backed Cisticola; Eastern Clapper Lark; Neddicky; Pied Starling; African Stonechat; Cape Longclaw; Large-billed Lark; Spike-heeled Lark; and Bokmakierie. Corvids (i.e. crows and ravens) were abundant as was Hadeda Ibis.

Table 5: Walked Transect Results

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Priority Species (P), Red Data Species (Status), Important (I)	Frequently Recorded and/or Abundant.	IKA (birds/km)
WT1 (n=8)	159 (362)	Blue Crane (P, NT); Southern Black Korhaan (P, VU); African Rock Pipit (P, NT) and Pale Chanting Goshawk (P).	African Pipit, Cape Crow, Cape Turtle Dove, Chinspot Batis, Grey-backed Cisticola, Grey-backed Sparrow-lark, Pied Crow, Eastern Clapper Lark, Hadeda Ibis, Neddicky, Plain-backed Pipit, Pied Starling.	45.25
WT2 (n=8)	147 (349)	Jackal Buzzard (P); Rock Kestrel (I); Verreaux's Eagle (P, VU); Amur Falcon (P); African Rock Pipit (P, NT); and Blue Crane (P, NT); Grey-winged Francolin (P);	African Pipit, African Stonechat, Acacia Pied Barbet, Bokmakierie, Eastern Clapper Lark, Cape Crow, Cape Turtle Dove, Cape Longclaw, Grey-backed Cisticola, Pied Crow, Hadeda Ibis, Large-billed Lark, Neddicky, Speckled Pigeon, Pied Starling, Wattled Starling.	43.63
WT3 (n=8)	156 (312)	Blue Crane (P, NT); Kori Bustard (P, VU); Ludwig's Bustard (P, EN); and Pale Chanting Goshawk (P).	African Pipit, Blue Crane, Ludwig's Bustard, Cape Crow, Cape Turtle Dove, Cloud Cisticola, Common Fiscal, Eastern Clapper Lark, Grey-backed Cisticola, Hadeda Ibis, Large-billed Lark, Spike-heeled Lark, Neddicky, Pied Starling, Southern Masked Weaver.	39.00

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Priority Species (P), Red Data Species (Status), Important (I)	Frequently Recorded and/or Abundant.	IKA (birds/km)
WT4 (n=6)	204 (509)	Blue Crane (P, NT); Ludwig's Bustard (P, EN); Gabar Goshawk (I); African Fish Eagle (P); Jackal Buzzard (P); Amur Falcon (P); and Pale Chanting Goshawk (P).	Amur Falcon, Acacia Pied Barbet, Ant-eating Chat, Barn Swallow, Chinspot Batis, Bar-throated Apalis, Bokmakierie, Cape Turtle Dove, Familiar Chat, Eastern Clapper Lark, Grey-backed Cisticola, Hadeda Ibis, Karoo Prinia, Karoo Scrub Robin, Neddicky, Red-faced Mousebird, Pied Starling, Rufous-eared Warbler, Rufous-naped Lark, White-necked Raven.	84.8

EN=Endangered; VU=Vulnerable; NT=Near-Threatened. I=Important, noteworthy, or uncommon species deemed relevant to highlight by the specialist.

5.7.3 Drive Transects

The driven transects resulted in a relatively moderate to high number of records of target species, with a total of 86 records across the three WEF site transects after four seasonal surveys. A total of 160.16 km of transects were driven on the WEF site across the four seasonal surveys, recording a total of 201 target species birds from 16 positively identified species and unidentified raptors and kestrels (Table 6). The overall IKA for the WEF site of 1.255 target species birds recorded per kilometre was moderate, while the IKA of priority species only was calculated as 1.180 birds/km which is also considered a moderate level of abundance in the specialist's experience of other proposed WEF sites in South Africa.

The most numerous and regularly encountered target species during driven transects was Blue Crane with 54 birds observed in 23 records (IKA ~0.337 individuals per km) followed by Ludwig's Bustard with 36 birds observed from 11 records (IKA ~0.225 individuals per km) and Amur Falcon with 32 birds from 8 records (IKA ~0.2 individuals per km). All the Amur Falcon records were from summer, and if one considers that this species was not present (and therefore could not be recorded) during the other surveys, its actual IKA should be calculated using the length of transects driven in summer only (i.e. 40.4 km), which would result in a DT IKA for this species of ~0.792.

Table 6: Summary of Driven Transect Results

Species	Total Individuals Recorded	Maximum Flock Count	No. Records			IKA (WEF Site)
			DT1	DT2	DT3	
African Harrier-Hawk*	3	1	-	1	2	0.019
Amur Falcon*	32	10	4	4	-	0.200
Black Headed Heron	1	1	-	1	-	0.006
Blue Crane*	54	11	13	7	3	0.337
Gabar Goshawk	1	1	-	1	-	0.006
Grey-winged Francolin*	4	4	-	1	-	0.025
Jackal Buzzard*	5	2	3	1	-	0.031
Kori Bustard*	3	2	-	2	-	0.019
Lesser Kestrel*	19	9	1	5	-	0.119

Species	Total Individuals Recorded	Maximum Flock Count	No. Records			IKA (WEF Site)
			DT1	DT2	DT3	
Ludwig's Bustard*	36	9	1	5	5	0.225
Pale-chanting Goshawk*	5	1	1	4	-	0.031
Rock Kestrel	8	3	1	2	3	0.050
Southern Black Korhaan*	1	1	1	-	-	0.006
Steppe Buzzard*	6	1	3	3	-	0.037
Unidentified Kestrel*	14	11	-	3	-	0.087
Unidentified Raptor*	4	4	1	-	-	0.025
Verreaux's Eagle*	3	1	1	1	1	0.019
White-breasted Cormorant	2	2	1	-	-	0.012
Total	**201**	**NA**	**31**	**41**	**14**	**1.255**
				Priority Species		***1.180***

**Priority Species*

5.7.4 Nest Survey

The results from the cliff nest surveys conducted on and around the project site are shown in Table 7 below, with the locations of known nest sites given in Figure 2. A total of nine nest sites have been found to date.

The activity at 6 nest sites (i.e. whether the nest is currently being used for breeding activities) could not be determined, while three active nests were confirmed including two active Verreaux's Eagle nest sites.

Standard best practise (locally and internationally) is to design protective no-go buffers around nest sites. These buffers are intended not only to limit possible disturbance during the breeding season, but to also protect what is assumed to be the core activity/use area of the territory, and thus reduce the risk of collision. Another intention of nest buffers are to protect fledged birds from collision risk during the first few months after fledging.

Table 7 also shows the recommended No-Go (for turbine placement) buffers around each nest site. These recommended buffers have all been adhered to in the latest proposed turbine layouts for all three WEF phases. The current Verreaux's Eagle Guidelines state "*BirdLife South Africa recommends a 3 km buffer around nest sites (including alternate nests). This figure is the radius of the mean 90% utilisation distributions, based on data from eagles tracked using GPS during the pre-breeding season in the Cederberg and Sandveld (Murgatroyd pers comm.). It is also roughly half the mean inter-nest distance averaged across sites in South Africa (excluding the Gaap plateau).* Furthermore the guidelines state that the *"3 km buffer is intended to reduce the risk of collisions and disturbance. This is a precautionary buffer and may be reduced (or increased) based on the results of rigorous avifaunal surveys*".

The recommended Jackal Buzzard and unidentified raptor nest buffers are based on our specialist experience to date of other projects worked on and recommendations given in South Africa by other specialists. Certain nests listed below were (after being found during the nest survey in July 2017) designated as focal sites and monitored during the remaining seasonal surveys.

Table 7: Highlands Wind Farm - Cliff Nest Survey Results and Nest Focal Site Results

Nest	Co-ordinates		Species	Activity	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites.	Recommended No-Go Buffer (for WTGs)	Approx. distance to nearest turbine
	South	East						
N1	-32.678205°	25.479486°	Verreaux's Eagle	Unconfirmed	Long distance view of a large stick nest on large prominent cliff. Some white-wash evident. No birds observed.	No Verreaux's Eagle seen. Three Rock Kestrels observed near cliff in summer. Landowner confirmed they occasionally see Verreaux's Eagle, but not recently near the nest.	3 km	9 km
N2	-32.656660°	25.342739°	Verreaux's Eagle	Active	Large stick nest on 'left side' cliff (i.e. south west facing cliff). Pair of adult bird observed in vicinity. Adult bird observed landing on nest.	Pair of Verreaux's Eagle observed in a 'courting display' above nest in autumn. Pair seen flying above a ridge 1 km from nest in winter. Other species recorded at/near the site were Pale-chanting Goshawk, Jackal Buzzard and White-necked Raven.	3 km	4.2 km
N3	-32.738573°	25.324521°	Jackal Buzzard	Unconfirmed	One adult flushed from cliff perch near to nest site. Adult pair observed flying overhead. Relatively long distance view. No clear evidence of use.	No Jackal Buzzards recorded. Nest status remains unconfirmed. Rock Kestrel and White-necked Raven observed in vicinity.	500 m	600 m
N4	-32.764181°	25.333358°	Unidentified raptor	Unconfirmed	Medium stick nest behind small bush/tree on cliff. Suspect Booted Eagle or possibly Jackal Buzzard nest. No clear evidence of use. No birds observed.	Status and species unconfirmed. In spring, baboon dropping seen next to and above nest. In summer, there was no evidence of recent use and no white-wash.	1 km	2.1 km

Nest	Co-ordinates		Species	Activity	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites.	Recommended No-Go Buffer (for WTGs)	Approx. distance to nearest turbine
	South	East						
N5	-32.769651°	25.325759°	Verreaux's Eagle	Active	Large stick nest, relatively low down on cliff face. Adult bird observed on nest with a small chick. Extensive white-wash and evidence of recently added green foliage on nest.	Breeding success unclear, but it is likely the juvenile had fledged and left the nest site. In spring (early November) only one adult bird seen flying above nest. No Verreaux's Eagles recorded at the site in summer.	3 km	3.1 km
N6	-32.781130°	25.323837°	Unidentified raptor	Unconfirmed	Small/medium stick nest. No clear evidence of use.	Activity and species unconfirmed. No birds observed on or near nest. Booted Eagle and Rock Kestrel observed in vicinity flying above the gorge.	1 km	2.8 km
N7	-32.782973°	25.303377°	Unidentified bird	Unconfirmed	Small/medium stick nest. Suspect raptor, but possibly a White-necked Raven nest.	Activity and species unconfirmed. No priority species or raptors recorded.	1 km	4.8 km
N8	-32.795636°	25.307968°	White-necked Raven	Active	Evidence of animal fur/wool and orange rope used on small nest. White-necked Rave observed flying overhead.	Not surveyed as focal site	NA	4.2 km
N9	-32.849262°	25.348887°	Unidentified raptor	Unconfirmed	Nest pointed out by Land-owner who says it is a Verreaux's Eagle nest. No birds seen in vicinity and/or on nest and no evidence of recent nest preparation (e.g. green twigs/leaves etc.) Some white wash on cliffs. Nest appears too small for Verreaux's Eagle, however, the possibility can't be ruled out that it may be a Verreaux's Eagle nest site.	Not surveyed as focal site	3 km	3.6 km

5.7.5 Focal Sites

Relatively low numbers of waterbirds (and/or water related species) have been recorded at the seven focal sites that are dams (i.e. FS1-FS6 and FS8), and the project site in general does not appear to be important for any large numbers of waterbirds or waterfowl (Table 8). Many dams were dry, and a number of species recorded were smaller common passerines in vegetation around the dams. Various aerial foraging species (e.g. swallows), that are summer migrants arrived in spring and were foraging above the dam sites in spring and summer.

Table 8: Focal Site Summary Records (Dams)

Focal Site	Site Description	Numerous / Abundant Water Associated Species	Priority Species (P), Red Data Species (Status), Important (I)	Notes
FS1	Two small dams.	Blue Crane; Egyptian Goose; and Three-banded Plover	Amur Falcon (P); Blue Crane (P, NT); Pale Chanting Goshawk (P); and Steppe Buzzard (P).	One dam was mostly dry, and most species were observed around dam and overhead, including aerial foragers. Small flock of 7 Blue Crane observed near dam in spring.
FS2	Small/medium dam.	Egyptian Goose; Blacksmith Lapwing; and Three-banded Plover.	Blue Crane (P, NT)	Two groups of Blue Crane (one of 2 birds, and one of 3 seen on separate days. Other species were common passerines and aerial foragers.
FS3	Two small dams.	Egyptian Goose; and Brown-throated Martin.	Amur Falcon (P); Lesser Kestrel (P); and Steppe Buzzard.	The three priority species recorded were hunting over the side or near the two dams. Other species were aerial foragers e.g. Greater-striped Swallow and passerines e.g. doves, pipits, larks, sunbirds and chats recorded around the dams.
FS4	Small dam.	None recorded	Blue Crane (P, NT)	No water in dam in winter and spring. Not surveyed in summer. Most species observed around dam and overhead, including aerial foragers.
FS5	Medium dam.	Blacksmith Lapwing; and Three-banded Plover	None recorded	No water in dam in winter and spring. Not surveyed in summer. Birds recorded in vicinity included doves, starlings, cisticolas and crows.
FS6	Medium-large dam ('Rietfontein dam').	Egyptian Goose; Brown-throated Martin; Cape Wagtail; Three-banded Plover; and Yellow-billed Duck.	None recorded	Birds observed in vegetation around the dam included pipits; hoopoes; barbets; starlings; doves, canaries, sparrows, chats and mousebirds. Various aerial foragers included Barn Swallow, Pearl-breasted Swallow, Greater Striped Swallow, Rock Martin and White-throated Swallow.

Focal Site	Site Description	Numerous / Abundant Water Associated Species	Priority Species (P), Red Data Species (Status), Important (I)	Notes
FS8	Medium-large dam.	African Spoonbill; Egyptian Goose; Common Greenshank; Pied Avocet; South African Shelduck; Three-banded Plover; and Yellow-billed Duck.	Blue Crane (P, NT), Pale Chanting Goshawk (P), Rock Kestrel (I).	Moderate numbers of water associated birds including a flock of over 50 Egyptian Geese in spring.

Seven nest sites (N1-N7) were surveyed as 'focal sites', and the results of these additional visits to these sites are shown in Table 7 in the nest survey results section.

5.7.6 Incidental Observations

A total of 260 incidental records were made of 25 target species (including 20 priority species), comprising 665 birds (Table 9) across the entire study area traversed by the observers (i.e. within the proposed development site and beyond the site extending to the control site). While this is a relatively high amount of incidental records in the specialists experience, it must be noted that many records may have been repeat observations (of the same birds but at different times), and that two observer teams in two vehicles were used over a long period of time, resulting in a very high amount of observer effort/time within which to make incidental observations. Of the 25 species recorded incidentally, nine are Red Data species including two classified as Endangered (Martial Eagle, Ludwig's Bustard) and four as Vulnerable (Verreaux's Eagle, Denham's Bustard, Secretarybird and Southern Black Korhaan). The geographical locations of the observers while recording the priority species incidental observations (as well as priority species observed during driven transect surveys) are indicated in Figure 8, giving an indication of the general location of the various species on and around the WEF site.

The species most regularly recorded incidentally was Blue Crane, followed by Ludwig's Bustard, Pale Chanting Goshawk, Rock Kestrel and Amur Falcon. Blue Crane was observed throughout the site and was occasionally recorded in large flocks of up to 42 birds, and therefore had the highest total number of individuals recorded of all incidental species. Most Ludwig's Bustard records were from the central and southern areas of the development site. The majority of incidental Verreaux's Eagle records were from the north of the proposed development site, while only one of the Martial Eagle records was on the site (in the south of the site).

Table 9: Number of Incidental Records of Target Species

Species	Number of records	Total Birds**	Maximum flock count
African Rock Pipit*(NT)	3	7	3
African Spoonbill	1	1	1
African Harrier Hawk*	5	5	5
Amur Falcon*	13	37	15
Black-chested Snake Eagle*	1	1	1
Blue Crane*(NT)	73	348	42
Black-shouldered Kite*	1	1	1

Species	Number of records	Total Birds**	Maximum flock count
Denham's Bustard*(VU)	2	4	3
Egyptian Goose	1	7	7
Gabar Goshawk	2	2	1
Grey-winged Francolin*	3	4	2
Hamerkop	3	3	1
Jackal Buzzard*	7	8	2
Kori Bustard*(NT)	5	7	2
Lesser Kestrel*	11	59	15
Ludwig's Bustard*(EN)	32	59	5
Martial Eagle*(EN)	4	4	1
Pale Chanting Goshawk*	26	27	2
Rock Kestrel	23	25	2
Southern Black Korhaan*(VU)	12	14	2
Secretarybird*(VU)	3	4	2
Spotted Eagle-Owl*	1	1	1
Steppe Buzzard*	17	19	2
Unidentified korhaan*	1	1	1
Unidentified raptor	1	3	3
Verreaux's Eagle*(VU)	8	12	2
White Stork*	1	2	2
TOTAL	**260**	**665**	**NA**

**Priority species. **Where more than one bird recorded, the same individual bird may have been recorded more than once. The figures in this column therefore do not necessarily indicate the number of individuals of this species present or the population size. EN = Endangered; VU = Vulnerable; NT = Near-Threatened.*

5.7.7 Species Summary and Discussion

A total of 167 positively identified species have been recorded across both the WEF site and the control site after four seasonal surveys (Appendix I).

Twenty-six priority species including 13 regional Red Data species (Taylor *et al.* 2015) have been recorded (Table 10). Four species are classified as *Endangered* (Black Harrier, Ludwig's Bustard, Cape Vulture and Martial Eagle), six as *Vulnerable* (Secretarybird, Black stork, Denham's Bustard, Verreaux's' Eagle, Lanner Falcon and Southern Black Korhaan), and three as Near-Threatened (Blue Crane, African Rock Pipit, and Kori Bustard). Of these, Blue Crane, Ludwig's Bustard, Verreaux's Eagle and African Rock Pipit were regularly recorded, while generally there were only occasional sightings of the others.

A total of 164 species were observed on the WEF site, with only three species (Klaas' Cuckoo, Long-billed Pipit and Karoo Thrush) being recorded on the control site only. 121 species were recorded at the control site. This lower number can be attributed to less time spent at the control site versus the WEF site, and is not necessarily a reflection of local diversity.

These results represent a relatively moderate to high diversity of species, and a relatively high number of Red Data and priority species in the specialists' experience of other WEF sites worked on in South Africa, and generally in the Eastern Cape, although some sites in the Eastern Cape have recorded similar numbers of Red data and priority species.

Table 10: Priority Species and Regional Red Data Species Recorded During the Surveys on the Control and WEF Sites

Alphabetical Name	Red Data Status	Priority Score	Autumn		Winter		Spring		Summer	
			WEF	Control	WEF	Control	WEF	Control	WEF	Control
Bustard, Denham's	VU	300							x	
Bustard, Kori	NT	260	x	x	x	x		x	x	
Bustard, Ludwig's	EN	320	x	x	x	x	x	x	x	x
Buzzard, Jackal		250	x		x	x	x	x	x	
Buzzard, Steppe		210					x	x	x	x
Crane, Blue	NT	320	x	x	x	x	x	x	x	x
Eagle, African Fish		290	x		x		x		x	
Eagle, Black-chested Snake		230			x				x	
Eagle, Booted		230			x		x		x	x
Eagle, Brown Snake		180							x	
Eagle, Martial	EN	350	x	x	x	x				
Eagle, Verreauxs'	VU	360	x	x	x		x	x	x	
Falcon, Amur		210							x	x
Falcon, Lanner	VU	300							x	
Francolin, Grey-winged		190	x				x		x	
Goshawk, Pale Chanting		200	x	x	x	x	x	x	x	x
Harrier, Black	EN	345	x		x					
Hawk, African Harrier-		190	x		x	x	x		x	
Kestrel, Lesser		214							x	
Korhaan, Southern Black	VU	270	x		x	x	x	x	x	
Owl, Spotted Eagle-		170	x							
Pipit, African Rock	NT	200			x		x		x	
Secretarybird	VU	320	x		x		x	x	x	x
Stork, Black	VU	330			x					
Stork, White		220							x	
Vulture, Cape	EN	405							x	

The full species list (of positively identified species) indicating their conservation status and endemism are provided in Appendix I. This table shows that 23 endemic or near-endemic species[10] have been recorded, and one (Knysna Turaco) is a restricted-range species. Endemic or near-endemic species that were relatively abundant or frequently recorded, and for which the proposed development site represents important habitat are: Cape Bulbul, Jackal Buzzard, Sickle-winged Chat, Fiscal Flycatcher, Grey-winged Francolin, African Rock Pipit, Large-billed Lark, Pied Starling, Southern Double-collared Sunbird, Grey Tit and Ground Woodpecker. Priority species recorded that are also endemic or near-endemic were Jackal Buzzard, African Rock Pipit, Black Harrier, Grey-winged Francolin and Southern Black Korhaan.

Generally the diversity and abundance of small passerine species was moderate to high with most WTs recording high IKAs. Possibly of most concern regarding these species is the Near-threatened African Rock Pipit, which is also a priority species.

Following the conclusion of the monitoring work, and considering all the other desk-based data sources, the following species were identified as being key for the assessment of impacts of the WEFs and grid connections proposed on the development site. These 'focal species' are discussed in more detail below and are: Ludwig's Bustard; Blue Crane; Secretarybird; Cape Vulture; Verreaux's Eagle; Black Harrier; Amur Falcon; Lesser Kestrel; Jackal Buzzard; and African Rock Pipit.

Ludwig's Bustard were relatively widespread and recorded across all seasons on both the WEF and control site. They were usually recorded in small groups of up to five birds. Generally, they spent more time on the ground, but were occasionally observed flying (especially when flushed). Ludwig's Bustard was occasionally seen flying from VPs, with a low recorded passage rate of 0.053 bird/hour. Most flights were recorded over flat open grasslands (Figure 4), particularly in the south east of the proposed development site near VP6. Ludwig's Bustard is known to be nomadic and to have seasonal movements in line with rainfall patterns, and considering it was recorded in all seasons, shows the good suitability of the area for this species. While the species is well known to be very vulnerable to power line collisions, no mortalities have been recorded from turbine collisions in South Africa to date. The species may be susceptible to displacement impacts, however post-construction monitoring at one wind farm in South Africa concluded that the similar Denham's Bustard has not been affected and there was no displacement with 0.35 birds/km recorded pre-construction and 0.51 birds/km during the first year of operation.

Blue Crane was one of the most abundant and regularly recorded priority species on the WEF site. While no nest locations could be found, the species is likely to be breeding on the proposed WEF site, as on a few occasions, pairs of adult birds were seen with juveniles. While most often recorded walking and foraging on the ground, a number of flights were also recorded over the year for this species (Figure 4), particularly in valleys near agriculture (which was not extensive) and over more flat open grassland areas. Blue Crane has suffered some mortality from turbines in South Africa, but not nearly at the level initially feared prior to the commencement of operation of a number of WEFs within the range of this species. It also does not seem to be overly impacted upon by disturbance and displacement effects, with a number of known cases were birds have continued to breed successfully in close proximity to operational turbines. The greatest impact on this species is likely to come from collisions with overhead power lines and disturbance during construction, both of which can be well mitigated against.

Secretarybird were occasionally recorded, usually on the ground as incidental or DT records, and only two flights (both in the far north of the WEF site) were recorded

[10] Endemic or near-endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.

(Figure 4). With one collision mortality recorded for this species to date in South Africa, it is prone to collisions, especially when it flies at height during elaborate courtship displays. A male and female pair was observed in the area, and this coupled with the fact that the habitat on site appears very suitable for this species, lead to the possibility that there is at least one breeding pair resident and possibly nesting on the proposed development site.

Cape Vulture was only recorded during the final summer season, and only from VP watches when 11 flights were recoded for this species (mostly conducted by birds from one flock of 8 birds) (Figure 6). The recorded passage rate of 0.093 birds/hour is low, there are no breeding colonies within 175 km and the closest known active roost site is at Agieskloof[11], 60 km away. New breeding colonies and roosts were searched for by field workers and extensive consultation with landowners, local birders (pers. comm. Allan Collet and Greg Brown) and Vulpro, and none were located. Considering the above, Cape Vulture is only likely to be an occasional visitor to the Highlands WEF, and should mortalities occur for this species, they could be mitigated (or prevented in future) by implementing mitigation such as carcass management strategies and/or shut down on demand strategies. BLSA (2017) reported six Cape Vulture fatalities, all from the Cookhouse/Bedford area, although a review of more recent operational monitoring reports (Smallie and MacEwan, 2017; Smallie and MacEwan, 2018) and a discussion with the specialist (per. Com Jon Smallie) shows that this number is now at least ten fatalities.

Verreaux's Eagle were confirmed as breeding on the proposed development site. A second active nest site was located off the development site. Both of these nest sites are more than 3 km from proposed turbine locations. However, VP monitoring has shown that the species does not necessarily remain within the 3 km buffer of nests sites, and flights were recorded across the proposed development site. Beyond the 3 km buffer, areas associated with higher levels of flight activity have been excluded from the development through a detailed sensitivity mapping process, while other areas potentially with higher risk (e.g. steep slopes) but not necessarily where more flights were recorded, have also been excluded. These actions are likely to reduce the potential collision risk to this species. Recorded Verreaux's Eagle flight activity was relatively high compared with other priority species recorded on the Highlands WEF site (particularly in the north and north west and central west areas around the edge of the escarpment), although when compared with the activity of this species on other WEFs in SA, the activity levels are moderate. Verreaux's Eagle are predominantly found in mountainous, rocky habitat (Davies & Allan 1997), and the regional population (i.e. for South Africa, Lesotho and Swaziland) has been estimated to be between 3 500 and 3 750 mature individuals, but confidence in these figures is low (Taylor *et al.* 2015). Verreaux's Eagle are territorial and their territories surround their nest sites, but their nests are not necessarily in the centre of their territory (Gargett 1990). Nests are usually built on cliffs and ledges (Gargett 1990), although they have been recorded nesting on power lines and occasionally in trees or on telephone poles (pers. obs.). The rough density (approximately 1 pair/75 km^2)[12] of Verreaux's Eagle on the proposed development site and it's surrounds is low when compared to other relatively high density populations of this species studied in other parts of the region (e.g. Nuweveld escarpment, Beaufort West: mean density 1 pair/24 km^2 (Davies 1997); Cederberg, W Cape: mean inter-pair distance 4.7 km (n = 22, range 3.4-7.2 km); Sandveld, W Cape: mean inter-pair distance 5.8 km (n = 24, range 1.6-15.2 km) – Jenkins 2014: Pers. Comm.; proposed Umsinde Emoyeni WEF, Murraysburg : approximately 1 pair/57 km^2 (Arcus 2015). Nonetheless, this population (of approximately two breeding pairs, one or two single floating adults, and one or two juveniles), represents an important biodiversity asset of the site, and are likely to be important components of the local ecology. Verreaux's Eagle is an

[11] This roost is approximately 15 km from the operational Cookhouse WEF.

[12] This figure is approximate, and should be used with caution, as it is based on 2 pairs of eagles (and two active nests) being located within an area of approximately 150 km^2, within which additional nests may be located.

apex predator which plays an important ecological role. Single birds recorded on the WEF, may be a young adult/s without an established territory (territorial adults are usually observed in pairs), termed a 'floater' that is searching for a territory. The species has been recorded as a turbine collision fatality, and at least six fatalities have been recorded on WEFs in South Africa to date (Ralston Paton *et al.* 2017; pers. comm BARESG). It is likely that this species will suffer collision mortality at some stage during operations of the proposed WEF, however the amount and frequency of collisions are not expected to reach a level that would be unsustainable for the regional population, and if they do, mitigation options such as habitat management, deterrent devices and shut down on demand would need to be implemented.

Five fatalities of the *Endangered* Black Harrier have been recorded on WEFs in South Africa to date (Ralston Paton *et al.* 2017; pers. comm. BARESG). However, activity of this species was very low over the year of monitoring, and it was only recorded in autumn and winter. All four recorded flights over the one year programme, were in the north of the WEF site (Figure 5) and the majority of the time flying was at low heights below rotor swept height.

Lesser Kestrel and Amur Falcon were absent during the autumn, winter and spring surveys, and this had an effect on the overall priority species flight activity and abundance which was generally lower in these seasons than in summer. The two species were observed often together, across the WEF site (Figure 5), seemingly favouring open flat grass areas over which they hunted. Lesser Kestrel breed in Europe and Asia, migrating to southern Africa over the northern winter, arriving in the Karoo in late October or early November and staying to late March. It is estimated that approximately 50,000 birds spend the southern spring and summer in South Africa, although numbers do vary from year to year. They roost communally (often with Amur Falcon), and usually in large alien trees in nearby towns. The specialist is aware of a roost site in Graaff Reinet, approximately 85 km north west of the proposed development, but it is likely that there are other roost sites closer to the site. At the time of writing, Lesser Kestrel had not suffered from turbine collision mortality in South Africa, while Amur Falcon had suffered high levels with 32 mortalities recorded, making it the third most affected species to date (BLSA 2017a). Given that the population of this migratory species is large (a national census on 2009 recorded approximately 111 000 individuals in South Africa (Symes & Woodborne 2010) and the species is not currently threatened (BirdLife International 2018), the impact on the species' population is unlikely to be significant at this stage. However, Amur Falcon is listed under the Convention of Migratory Species and its flocking behaviour may present a risk of multiple fatalities in a short space of time. The species may also provide valuable ecosystem services and impacts should therefore be monitored, and where possible mitigated (Ralston Paton *et al.* 2017).

Jackal Buzzard was abundant and had very high levels of flight activity on the site. It was recorded at all VPS as well as other survey methods across the site, and one suspected nest site was located. The species is highly susceptible to wind turbine collisions, and with 63 mortalities reported on WEFs in South Africa as of September 2017 (BLSA, 2017), it is the bird species that has been most impacted upon. High fatality rates have been reported for other *Buteo* species including Common Buzzard (*B. buteo*) in Europe (Hötker *et al.* 2006), White-tailed Hawk (*B. albicaudatus*) in Latin America (Ledec *et al.* 2011) and Red-tailed Hawks (*B. jamaicensis*) in the United States (Smallwood & Thelander 2008). Collisions of Jackal Buzzard are likely at the proposed development, however, it is noted that this species is a common and widespread species in South Africa, and if all mitigations are followed the potential impacts are likely to be sustainable.

The Near-threatened African Rock Pipit was recorded often on the proposed development site and is primarily associated with rock strewn slopes and ridges; areas that are likely to be avoided for infrastructure placement in the proposed development. It mainly forages on the ground and is unlikely to suffer collision impacts.

5.7.8 Avifaunal Site Sensitivity

The pre-construction monitoring results were used to calculate the flight sensitivity of the site (Figure 9).

A combined Avifaunal Sensitivity Map (Figure 10) shows areas of varying sensitivity as well as Avifaunal No-Go Areas (for either turbines only, or turbines and other infrastructure).

No turbines in the assessed turbine layout fall within No-go Areas.

6 IDENTIFICATION OF IMPACTS

The possible impacts arising from the construction, operation and decommissioning of each of the three WEF phases and each of the grid connection phases have been identified below. The impacts described in sections 6.1 to 6.4 can occur on either WEF phase while those described in sections 6.5 to 6.7 can occur on either grid site phase.

6.1 Background to Interactions between Wind Energy Facilities, Power Lines and Birds

South Africa has experienced an increase in the number of wind energy developments (both in terms of applications and those that have been built) in the past seven years, but still lacks some information about the effects that these developments have on certain aspects of the environment. In South Africa, while post-construction monitoring is being conducted on the majority of operational sites, publically available data and information of operational results is limited and restricted to information supplied to BirdLife SA and made available by them to the public in the form of a report (Ralston Paton *et al*. 2017), and a public presentation (BLSA 2017a).

International experience, and results from South Africa have shown that birds can be impacted negatively by wind farms and that the severity of these impacts can differ drastically from site to site (Bose *et al.* 2018; Grünkorn *et al.* 2017; Ralston-Paton *et al.* 2017; Thaxter *et al*. 2017). Overall, it appears that severe impacts, such as the high mortality numbers of Golden Eagle observed at Altamont Pass in California (Hunt *et al.* 1998; Orloff & Flannery 1992) seem to be the exception rather than the rule, with the majority of facilities recording relatively low mortalities (Strickland *et al.* 2011; de Lucas *et al.* 2008; Erickson *et al.* 2001). The effects of one poorly placed facility, or some poorly sited turbines within a facility, can however affect the population of certain species at a regional, national or even global level (Bellebaum *et al*. 2013; Dahl *et al.* 2012; Carrete 2009). Hence, it is important to assess the impacts of wind energy facilities, and to base this assessment on a thorough investigation of the local avifauna prior to construction, which is being done for the proposed development.

The main impacts of wind energy facilities and their associated infrastructure on birds have been identified as (a) displacement through disturbance and habitat destruction and (b) mortality through collisions with turbines and/or powerlines and (c) mortality through electrocution on live power infrastructure (Rydell *et al.* 2017; Drewitt & Langston 2006; Hötker *et al.* 2006; Percival 2005; van Rooyen 2004).

6.2 WEF Impacts Construction Phase

6.2.1 Habitat Destruction

During the construction of the WEFs, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for turbine placements, and the levelling of substation yards, development of laydown areas and turbine bases. The removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting (Dwyer *et*

al. 2018; Tarr *et al.* 2016). This habitat destruction is a direct impact that is restricted to the site. If no mitigation (rehabilitation) occurs the impact can be permanent.

The scale of direct habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, generally speaking, is likely to be small per turbine base. Typically, actual habitat loss amounts to 2 – 5 % of the total development area (Drewitt & Langston 2006) of a WEF although it is likely less in the case of the proposed Highlands WEF phases.

6.2.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Dwyer *et al.* 2018; Percival 2005; Frid & Dill 2002). There are various potentially sensitive species occurring on the proposed development site including African Rock Pipit, Southern Black Korhaan, Black Harrier, Ludwig's Bustard, Blue Crane, Secretarybird and Verreaux's' Eagle. Disturbance can cause these (or other) species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

6.3 WEF Impacts Operational Phase

6.3.1 Collisions with Wind Turbines

WEFs can cause bird mortalities through the collision of birds with moving turbine blades (Bose *et al.* 2018; Dwyer *et al.* 2018; Thaxter *et al.* 2017; Vasiliakis *et al.* 2017, Marques *et al.* 2014; Ralston Paton *et al*. 2017). A number of factors influence the number of birds impacted by collision, including:

- Number of birds in the vicinity of the WEF;
- The species of birds present and their flying patterns and behaviour (which is often influenced by topographical, environmental and climatic conditions); and
- The design of the development including the turbine layout, height and size of the rotor swept area.

It is important to understand that not all birds that fly through the WEF at heights swept by rotors automatically collide with blades. In fact avoidance rates for certain species have proven to be extremely high internationally, while avoidance rates have not been determined for South African species. In a radar study of the movement of ducks and geese in the vicinity of an off-shore wind facility in Denmark, less than 1% of bird flights were close enough to the turbines to be at risk, and it was clear that the birds avoided the turbines effectively (Desholm and Kahlert 2005). Whilst avoidance rates for SA species are currently unknown due to the lack of data, comparisons can be drawn between functionally similar species, for example Verreaux's' Eagle with Golden Eagle, in order to inform an assessment. Whitfield (2009) reviewed the avoidance rates for Golden Eagle and reported estimates varying between 98.64% and 99.89%.

The majority of studies on collisions caused by wind turbines have recorded relatively low mortality levels (Madders & Whitfield 2006). This is perhaps largely a reflection of the fact that many of the studied wind farms are located away from large concentrations of birds. It is also important to note that many records are based only on finding carcasses, with no correction for carcasses that were overlooked or removed by scavengers (Marquez *et al.* 2014; Drewitt & Langston 2006). Relatively high collision mortality rates have been recorded at several large, poorly-sited wind farms in areas where large concentrations of birds are present (including IBAs), especially among migrating birds, large raptors or other

large soaring species, e.g. in the Altamont Pass in California, USA (Thelander *et al.* 2003), and in Tarifa and Navarra in Spain (Barrios and Rodrigues 2004).

In northern Germany one study estimated an annual mortality of 8500 common Buzzards, 11 300 Wood Pigeons and 13 000 Mallards from wind turbine collisions (Grunkorn *et al.* 2017). They also concluded that for the majority of wind farms studied, the numbers of collision victims predicted by collision risk modelling (CRM) using the BAND model, were clearly below the number of collision victims estimated from carcass searches and that the suitability of the BAND-Model for the evaluation of an anticipated collision risk at an 'average' onshore site is limited. Although large birds with poor manoeuvrability (such as cranes, korhaans, and bustards) are generally at greater risk of collision with structures (Jenkins *et al*. 2015), it is noted that these classes of birds (unlike raptors) do not feature prominently in literature as wind turbine collision victims. It may be that they avoid wind farms, resulting in lower collision risks, or that they are not distracted and focussed on hunting and searching the ground while flying, as is the case for raptors.

A minimum of 636 birds have been killed by turbines in South Africa to date (BLSA 2017a). Ralston Paton *et al.* (2017) found that mortality estimates for eight studied wind farms in South Africa ranged from 2.1 to 8.6 birds per turbine per year, which is within range of average estimates from Europe (6.5) and North America (1.6) (Rydell *et al.* 2012). Raptors and passerines are the groups most affected by collisions in South Africa to date. Eleven Red Data species (Taylor *et al.* 2015) have been affected, including fatalities of six Blue Crane (Near Threatened), six Verreaux's' Eagle (Vulnerable), six Cape Vulture (Endangered), five Black Harrier (Endangered), four Lanner Falcon (Vulnerable), three Southern Black Korhaan (Vulnerable) and two Martial Eagle (Endangered). Notably, a large number of the not red listed but endemic Jackal Buzzard (63) have been killed (Ralston Paton *et al.* 2017), as well as a number of Rock Kestrel (33) and passerines such as Bokmakierie (21), White-rumped Swift (21) and Red-capped Lark (24).

Verreaux's Eagle is ranked third on the South African Birds and Renewable Energy Specialist Group's priority list and has been confirmed as vulnerable to collisions. During the first year of monitoring at operational wind farms in South Africa, one wind farm recorded four Verreaux's Eagle fatalities in the first year of operation (Ralston-Paton *et al.* 2017). The fatalities occurred a considerable distance (at least 3.5 km) from suitable Verreaux's Eagle breeding habitat and on relatively flat ground (Smallie 2015). A single adult fatality occurred at another wind farm in August, again some distance from a nest 3.8 km away (Ralston-Paton *et al.* 2017). As of 28 September 2017, 6 mortalities of Verreaux's Eagle had been recorded at wind farms in South Africa (BLSA 2017a). Some of these fatalities were unexpected as they occurred in areas not identified as sensitive during pre-construction monitoring. Therefore it is important to consider that collisions may not necessarily occur where predicted, and that they can occur away from areas perceived to be preferred use areas. On the other hand, no fatalities have been reported to date for several species predicted to be susceptible to collisions. Due to these uncertainties a pre-cautionary approach was adapted in the assessment of the impact of collisions with turbines.

Eagle mortalities at wind farms are not unexpected. Fatalities at wind farms have been reported for Golden Eagle (e.g. Smallwood 2013), White-tailed Sea Eagle (e.g. Hötker *et al.* 2006), Bald Eagle (Pagel *et al.* 2013) and White-bellied Sea Eagle (Smales & Muir 2005). Verreaux's Eagle has recently been up-listed to *Vulnerable* and rough estimates of the population size are between 3 500 and 3 750 mature individuals (Taylor *et al.,* 2015).

The most effective mitigation for collision impacts currently available is wind farm placement, as well as specific turbine placement within a WEF to avoid high use areas. Such recommendations have been made. While not yet tested in South Africa, deterrent devices and shut-down on demand strategies have been implemented internationally. Foss *et al.* (2017) found monochromatic LEDs that specifically target avian photoreceptors could

provide a useful tool to divert raptors from hazardous situations, while in Scotland trials are underway by Scottish Natural Heritage (SNH) using laser beams to deter Sea Eagles from feeding on lambs[13]. Tome *et al*. (2017) found that a Radar Assisted Shutdown on Demand (RASOD) system at the Barão de São João wind farm in Portugal's Sagres region resulted in zero mortality of soaring birds over five consecutive autumn migratory seasons. While such strategy should not be relied upon completely (also considering that they are used internationally during migration events), they should not be discounted and may well hold valuable application in South Africa.

6.3.2 Collisions with Power Lines

Collisions with power lines are a well-documented threat to birds in southern Africa (van Rooyen 2004), and smaller lines pose a higher threat of electrocution but can still be responsible for collisions. Wind energy facilities may have overhead lines between turbine strings and substations that pose a collision threat, although this is not often the case as internal power is usually transferred between turbines and the on-site substation via underground cabling. Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision and electrocution sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long-living, slow-reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the proposed development site include Blue Crane, Ludwig's Bustard, Secretarybird, and Southern Black Korhaan. Ludwig's Bustard and Blue Crane are known to be particularly prone to collision (pers. comm. R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

6.3.3 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines and substation components is an important and well documented cause of bird mortality, especially for raptors and storks (van Rooyen and Ledger 1999; APLIC 1994). Electrocution may also occur within newly constructed substations. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocutions are generally more likely for larger species whose wingspan is able to bridge the gap such as vultures, eagles or storks. A few large birds susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area and may occasionally be present on the proposed development site namely: Cape Vulture, Verreaux's' Eagle and Martial Eagle. Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls.

6.3.4 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line and turbine maintenance, fencing, and noise can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Tarr

[13] http://www.bbc.com/news/uk-scotland-highlands-islands-42578354

et al. 2016; Ledec et al. 2011; Percival 2005; Larsen & Madsen 2000). Small songbirds have been known to have been displaced from operational turbines which cause disturbance through noise, vibrations and shadow-flicker (Rydell *et al.* 2017). Disturbance distances (the distance from wind farms up to which birds are absent or less abundant than expected) can vary between species and also within species with alternative habitat availability (Drewitt & Langston 2006). Some international studies of various species have recorded disturbance distances of 80 m, 100 m, 200 m and 300 m (Shaffer & Buhl 2015; Larsen & Madsen 2000) from turbine positions, but distances of 400 m (Reichenbach & Steinborn 2006), 600 m (Kruckenberg & Jaehne 1999) and up to 800 m have been recorded (Drewitt & Langston 2006).

Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80 m of the turbines, indicating that displacement did occur, at least in this case. A comparative study of nine wind farms in Scotland (Pearce-Higgins *et al.* 2009) found seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Raptors are generally fairly tolerant of wind farms, and continue to use the area for foraging (Ralston Paton *et al.* 2017; Thelander *et al.* 2003, Madders & Whitfield 2006), and may not be affected by displacement, however this increases their collision risk.

In South Africa the results available thus far have shown little evidence that displacement and disturbance of priority species has occurred (Ralston Paton *et al.* 2017). However, due to the limited number of operational wind farms in South Africa and short monitoring efforts, the precautionary principle should be applied, and disturbance and displacement must still be regarded as a potential impact.

It is expected that some species potentially occurring on the WEF site will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Secretarybird, Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance.

6.3.5 Disruption of Local Bird Movement Patterns

Wind energy facilities may form a physical barrier to movement of birds across the landscape, this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as ephemeral wetlands or prey sources altogether. Turbines can also be disruptive to bird flight paths, with some species altering their routes to avoid them (Pettersson & Stalin 2003; Tulp *et al.* 1999; Dirksen *et al.* 1998). While this reduces the chance of collisions it can also create a displacement or barrier effect, for example between roosting and feeding grounds and result in an increased energy expenditure and lower breeding success (Percival 2005). This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. Some mitigation may be possible by avoiding turbine placement in obvious flyways and making turbines more visible through lighting, but this will not change the significance of this impact.

6.4 WEF Impacts-Decommissioning Phase

6.4.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the facility can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons).

6.5 Grid Connection Impacts- Construction Phase

6.5.1 Habitat Destruction

During the construction of the grid connection infrastructure, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for pylon placements, and the development of laydown areas. The removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting.

6.5.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Percival 2005; Frid & Dill 2002). There are various potentially sensitive species occurring on the Grid Connection route alternatives including Verreaux's Eagle, Martial Eagle, Secretarybird, Blue Crane, Black Harrier and Ludwig's Bustard. Disturbance can cause these species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

6.6 Grid Connection Impacts - Operational Phase

6.6.1 Collisions with Power Lines

Collisions with large (132 kV or above) power lines is a well-documented threat to birds in southern Africa (van Rooyen 2004). Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long living, slow reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the Grid Connection route alternatives include Blue Crane, Ludwig's Bustard, Kori Bustard, Secretarybird, White Stork, African Spoonbill and Southern Black Korhaan. Ludwig's Bustard and Blue Crane are known to be particularly prone to collision (pers. Com R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

6.6.2 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines is an important and well documented cause of bird mortality, especially for raptors and storks (van Rooyen and Ledger 1999; APLIC 1994). With regard to the grid connection infrastructure, overhead

power line infrastructure with a capacity of 132 kV or more does not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large species (such as Cape Vulture, Verreaux's' Eagle and Martial Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) may occur in the area.

6.6.3 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line maintenance, can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Percival 2005; Larsen & Madsen 2000;). During operation of the grid connection, servitudes for the power line will have to be cleared of excess vegetation at regular intervals. This is done to allow access to the power line for maintenance, to prevent vegetation from intruding into the prescribed clearance gap between the ground and the conductors, and to minimize the risk of fire under the line which can result in electrical flashovers. These and other maintenance activities can disturb sensitive species occurring on site.

It is expected that some species potentially occurring on the Grid Connection route alternatives will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance. Potential species at risk of this are Lanner Falcon, Martial Eagle, Verreaux's Eagle and Greater Kestrel.

6.7 Grid Connection Impacts - Decommissioning Phase

6.7.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons). Particularly Martial Eagle (*Endangered*) is known to utilise pylons for nesting and could be susceptible to disturbance, and experience a resulting reduced breeding success. Martial Eagle has been recorded by monitoring at the development site. Lanner Falcon and Verreaux's Eagle as well as Greater Kestrel are three other priority species that may nest on pylons.

7 IMPACT ASSESSMENT

7.1 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Construction Phase

The following potential construction impacts on birds have been identified, and may occur on either of the WEF phases. As the resultant impact significances are the same for all three of the WEF phases, only one table for each impact is given. Each table and the significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.1.1 Habitat Destruction

The extent of this impact is local and confined to the development site. Habitat destruction can be temporary in the case of, for example construction offices and laydown areas, or will last for the duration of the project, in the case of turbine foundations and substation

compounds. The impact can be permanent if no rehabilitation takes place, following the decommissioning of the development, although it is assumed that rehabilitation will occur and therefore the duration will be for the life of the WEF. The severity of this impact is considered to be medium negative as a partial loss of habitat and resources will occur. As habitat destruction will definitely occur during construction the probability of this impact is high. The resulting significance of the impact is medium with a high confidence.

Mitigation can reduce the duration and probability of the impact to low, and decrease the significance to low negative (Table 11).

Table 11: Impact Rating Table for Habitat Destruction for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?	YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning						
Will impact cause irreplaceable loss or resources?	NO – rehabilitation of habitat is possible. There is extensive avifaunal habitat on the project site and beyond that will remain intact and be available for use.						
Can impact be avoided, managed or mitigated?	YES –The total area of impact (and thus the severity rating) can be minimised.						

Mitigation measures to reduce residual risk or enhance opportunities:

- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat;
- Environmental Control Officers to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- High traffic areas and buildings such as offices, batching plants, storage areas etc. should where possible be situated in areas that are already disturbed;
- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths;
- No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas;
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded; Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species;
- Any clearing of large trees (>5m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site should be approved first by an avifaunal specialist. Before, clearing, the location and description of the trees should be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing. .
- The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. If any nests or breeding locations for this species are located, an avifaunal specialist is to be contacted for further instruction; and

- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP.

7.1.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding. This may result in these species being displaced from the WEF site into other areas. The extent of this impact will be restricted to the immediate WEF site (local). It is expected that the majority of displacement will occur for the duration of the construction phase. The impact is considered to be of moderate severity and negative. The probability of some displacement occurring is considered moderate with a high confidence during the busy construction period, resulting in a medium significance of this impact prior to mitigation. The severity and probability of the impact can be reduced with mitigation, resulting in a Low impact significance after mitigation.

Table 12: Impact Rating Table for Disturbance and Displacement for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Construction							
Potential impact description: Disturbance and Displacement of Birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	PARTIALLY – In some areas of the operational WEF, birds disturbed during construction may return to their activities after completion of construction.						
Will impact cause irreplaceable loss or resources?	POSSIBLE – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.						
Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the activities associated with construction.						
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. Environmental Control Officers to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final infrastructure (e.g. road, substation, offices, turbine positions etc.) to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who should advise on an appropriate buffer, within which construction activities may not occur during key breeding times; - The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed;							

- During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites (see point below); and
- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and should be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.

7.2 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Operational Phase

The following potential operational impacts on birds have been identified, and may occur on either of the WEF phases. As the resultant impact significances are the same for all three of the WEF phases, only one table for each impact is given. Each table and the significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.2.1 Collisions with Wind Turbines

The duration of the impact will be at least for the operational phase of the facility, but could impact populations more permanently through local/regional extinctions. The severity of the impact is high, as it results in mortality. The resulting significance of the impact prior to mitigation is moderate negative.

If mitigation measures are implemented, especially turbine placement is informed by the avifaunal sensitivity map and No-go Areas, then the probability of the impacts could be reduced. The resulting significance with mitigation would be medium.

Table 13: Impact Rating Table for Collisions with Wind Turbines for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by collision with wind turbine blades and/or towers							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	M	M	Negative	H	M	M
With Mitigation	H	M	M	Negative	M	M	M
Can the impact be reversed?	PARTIALLY – Bird fatalities caused by collisions with turbines are irreversible. However local populations may recover if the occurrence of deaths is low.						
Will impact cause irreplaceable loss or resources?	POSSIBLY – Collisions with turbines cause bird fatalities, which could significantly impact local and/or regional populations of certain species.						
Can impact be avoided, managed or mitigated?	PARTIALLY – The probability of the impact can potentially be reduced through informed placement of turbines.						
Mitigation measures to reduce residual risk or enhance opportunities: - The minimum number of turbines should be constructed to achieve the required MW output. It is preferable to have smaller number of turbines with larger rotor, compared with more turbines with smaller rotor. - Turbines must not be constructed within any designated No-Go Areas. The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this;							

- The hierarchy of sensitivity zones identified should be considered where possible with preferential placement of turbines in areas with no sensitivity score, followed by low sensitivity, medium sensitivity and medium-high sensitivity;
- Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines;
- Develop and implement a minimum 12 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring. The results of this monitoring and the carcass searchers should advise the need for any additional ongoing activity monitoring or nest surveys beyond the 12 month period;
- Conduct frequent and regular review of operational phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review should also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development;
- The above reviews should strive to identify sensitive locations at the development including turbines and areas of increased collisions with power lines that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA, relevant stakeholders and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. Mitigations that may need to be implemented (and should be considered in the project's financial planning) include:
    - Onsite and off-site habitat management. A habitat management plan which aims to prevent an influx/increase in preferred prey items in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site.
    - Implementing a carcass management plan on the WEF site, to remove any dead livestock as soon as possible, to reduce the likelihood of attracting vultures to the WEF site.
    - Using deterrent devices (e.g. visual and noise deterrents) and/or shutdown systems e.g. Automatic bird detectors (e.g. automated camera based monitoring systems – McClure et. al. 2018) if commercially available; or Radar Assisted Shutdown on Demand (RASOD) to reduce collision risk.
    - Identify options to modify turbine operation (e.g. temporary curtailment or shut-down on demand) to reduce collision risk if absolutely necessary and other methods have not had the desired results.
    - Possibly offset programmes if no suitable mitigation measures can be implemented to reduced impacts sufficiently.

7.2.2 Collisions with Power Lines

The extent of this impact is restricted to constructed powerlines within the WEF, but can occur for the duration of the projects lifespan. The impact potentially has a high severity, depending on the number and species killed, and the resultant significance before mitigation is Medium. If mitigation are adhered to the severity and probability of the impact can be reduced, resulting in a low significance rating.

Table 14: Impact Rating Table for Collisions with Power Lines for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by collision overhead powerlines on the WEF site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	L	M	Negative	M	M	M

With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – Bird fatalities caused by collisions with overhead power lines are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Collisions with overhead power lines causes bird fatalities which may significantly impact populations of certain species.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.				
Mitigation measures to reduce residual risk or enhance opportunities: - All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area); - Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - If some spans are to be above ground, where possible place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines); - Attach appropriate marking devices (BFDs) on all new overhead power lines on the WEF to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used and the type of pylon structure to be used; and - Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.							

7.2.3 Electrocution

The impact occurs locally and is restricted to powerlines within the WEF site, but can occur throughout the lifespan of the project. As the result of the impact is mortality it could affect the breeding success of species and their populations, therefore the intensity is considered potentially moderate. As electrocution is known to affect many species in South Africa the impact is medium probability of it occurring in the absence of mitigation.

If all powerlines are either underground or of a bird-friendly design as detailed in the table below the probability of electrocution occurring can be reduced to low, resulting in an impact of low significance.

Table 15: Impact Rating Table for Electrocution for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by electrocution on the WEF site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities caused by electrocution are irreversible. However local populations may recover if the occurrence of deaths is low.				

Will impact cause irreplaceable loss or resources?	POSSIBLY – Electrocution from overhead power lines causes bird fatalities which could significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.
Mitigation measures to reduce residual risk or enhance opportunities: - Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area); - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater. Each pylon should be fitted with a safe bird perch; and - Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.	

7.2.4 Disturbance and Displacement

It is expected that some species potentially occurring on the WEF site will be susceptible to displacement during the operational phase, for example smaller passerines such as larks and pipits, and large terrestrial Red Data species such as Ludwig's Bustard, Secretarybird and Southern Black Korhaan. The extent of the impact may extend beyond the WEF site and the duration of the impact will last for the duration of operations. The severity is considered moderate and probable to occur, resulting in a medium significance. Mitigation can restrict the extent of the impact to the site and reduce the probability, resulting in a low significance after mitigation.

Table 16: Impact Rating Table for Disturbance and Displacement for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	L
With Mitigation	M	L	M	Negative	L	L	L
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			POSSIBLE – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the operational activities				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations;							

- The on-site WEF manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Wind Farm, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction;
- Operational phase bird monitoring, in line with applicable guidelines, must be implemented and must include monitoring of all raptor nest sites for breeding success; and
- No turbines should be placed in no-go areas to be identified through pre-construction monitoring, while associated infrastructure should be avoided where possible in these areas.

7.2.5 Disruption of Local Bird Movement Patterns

The extent of this impact would affect bird populations travelling through the area and therefore extend beyond the boundaries of the wind farm and is thus classified as medium. The duration would be for the lifespan of the project (medium). The severity would be moderate, although the probability is predicted to be low and the resulting significance low as well.

The impact is not well understood, and while some mitigation may be possible by avoiding turbine placement in obvious flyways, and by making turbines more visible through lighting, this will not change the significance of this impact.

Table 17: Impact Rating Table for Disruption of Local Bird Movement Patterns for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Disruption of Local Bird Movement Patterns (e.g. barrier effects).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	L	L	L
With Mitigation	M	M	M	Negative	L	L	L
Can the impact be reversed?			POSSIBLY				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Impact is not well understood.				
Can impact be avoided, managed or mitigated?			POSSIBLY				
Mitigation measures to reduce residual risk or enhance opportunities: - The lowest feasible number of turbines should be constructed for the required MW output. Therefore, fewer larger (i.e. with a higher MW output) turbine models should be favoured where possible; - Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species; and - Turbines must not be constructed within any No-Go areas.							

7.3 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Decommissioning Phase

The following potential decommissioning impact may occur on either of the WEF phases. As the resultant impact significance is the same for all three of the WEF phases, only one table is given. The significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.3.1 Disturbance and Displacement

Disturbances and noise from staff and decommissioning activities can impact on certain sensitive species particularly whilst feeding and breeding. This may result in these species being displaced. It may also result in failed breeding attempts if nest sites are disturbed.

The extent of this impact will be restricted to the immediate WEF site (local), and may occur for the duration of the decommissioning phase. The impact is considered to be of moderate severity with a medium probability of occurring in the absence of mitigation, resulting in a medium significance. The severity and probability of the impact can be reduced with mitigation, resulting in a Low impact significance after mitigation.

Table 18: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Decommissioning							
Potential impact description: Disturbance and Displacement of Birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			UNKNOWN				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with decommissioning.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Environmental Management Plan must be implemented, for the decommissioning phase. - Environmental Control Officers to oversee activities and ensure that the site specific EMP is implemented and enforced; - The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.							

7.4 An up to 140 MW WEF consisting of turbines from Highlands Central (Phase 2) WEF and Highlands North (Phase 1) or Highlands South (Phase 3).

As previously discussed, the proposed Highlands development consists of three WEF phases. However, ultimately due to grid connection conditions the proponent may be required to bid two projects into the REIPPP process, with a combined maximum capacity of up to 140 MW.

If the three phases are successful in (separately) obtaining Environmental Authorisation, turbines from the Highlands Central WEF (Phase 2) will be combined with turbines either from Highlands North (Phase 1) **or** Highlands South (Phase 3), depending on meteorological data, for bidding as one project in the REIPPP. A second project (to connect to the second existing HV line on the project site) may also bid, again drawing on turbine locations from one or more of the approved WEF sites.

Therefore, Table 19 shows an assessment of a WEF up to a maximum of 140 MW and utilising turbine positions from all three phases, which is likely to result in less than 40 turbines being constructed. The same impacts as identified and discussed above may occur, and the same mitigations measures are recommended, and therefore separate assessment tables are not given. Instead a summary table of the resultant significance ratings is given.

Table 19: Significance Ratings for the Impacts of the Either the Central WEF and North WEF or the Central WEF and South WEF.

Impact Description	Significance (Without Mitigation)	Significance (With Mitigation)	Confidence
Construction Phase			
Habitat Destruction	Medium	Low	Medium
Disturbance and Displacement	Medium	Low	Medium
Operational Phase			
Collision with wind turbines	High	Medium	Medium
Collision with power lines	Medium	Low	Medium
Electrocution	Medium	Low	High
Disturbance and Displacement	Medium	Low	Low
Disruption of Local Bird Movement Patterns	Low	Low	Low
Decommissioning Phase			
Disturbance and Displacement	Medium	Low	Medium

7.5 Grid Connection for Highlands North (Phase 1) WEF – Construction Phase

7.5.1 Habitat Destruction

Habitat destruction will be limited to the grid connection area (low extent). And the intensity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the intensity and probability of the impact can be reduced to low, changing the significance to low.

Table 20: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands North

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M

GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?			YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – rehabilitation of habitat is possible				
Can impact be avoided, managed or mitigated?			YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths;
- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP;
- Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and
- The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.

7.5.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 21: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands North

Impact Phase: Construction							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.6 Grid Connection for Highlands North (Phase 1) WEF – Operational Phase

7.6.1 Power Line Collisions

The result of this impact is mortality, however due to the relatively short length of the line, excessive mortalities which may affect the viability of a population are not expected and therefore the severity is considered moderate, and restricted to the site. As discussed previously the impact is probable to occur, resulting in a medium significance before mitigation. If mitigation measures are adhered to the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 22: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.				
Mitigation measures to reduce residual risk or enhance opportunities: - Grid infrastructure should not be constructed in No-Go areas; - Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible; - Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this; - Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. - Any mortalities should be reported to the Endangered Wildlife Trust (EWT).							

7.6.2 Electrocution

The impact occurs locally and is restricted to the grid connection area, while it has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 23: Impact Rating Table for Electrocution for Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Bird mortality from electrocution.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H

With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.6.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 24: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.							

7.7 Grid Connection for Highlands North (Phase 1) WEF – Decommissioning Phase

7.7.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a moderate probability of this happening, resulting in a medium significance of this impacts. If mitigation is correctly applied, the extent and probability of the impact can both be reduced to low, resulting in a low significance rating.

Table 25: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M

With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.				

Mitigation measures to reduce residual risk or enhance opportunities:

- An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning;
- ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and
- Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

7.8 Grid Connection for Highlands Central (Phase 2) WEF – Construction Phase

7.8.1 Habitat Destruction

Habitat destruction will be limited to the grid connection area (low extent). And the intensity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the intensity and probability of the impact can be reduced to low, which changes the significance to low.

Table 26: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands Central

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?			YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – rehabilitation of habitat is possible				
Can impact be avoided, managed or mitigated?			YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths;
- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP;
- Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and
- The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.

7.8.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 27: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands Central

Impact Phase: Construction

Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.9 Grid Connection for Highlands Central (Phase 2) WEF – Operational Phase

7.9.1 Power Line Collisions

The result of this impact is mortality, however due to the relatively short length of the line, excessive mortalities which may affect the viability of a population are not expected and therefore the severity is considered moderate, and restricted to the site. As discussed previously the impact is probable to occur, resulting in a medium significance before mitigation. If mitigation measures are adhered to the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 28: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Grid infrastructure should not be constructed in No-Go areas;
- Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible;
- Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this;
- Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans.
- Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations.
- Any mortalities should be reported to the Endangered Wildlife Trust (EWT).

7.9.2 Electrocution

The impact occurs locally and is restricted to the grid connection area, while it has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 29: Impact Rating Table for Electrocution for Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Bird mortality from electrocution.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.9.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 30: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.							

7.10 Grid Connection for Highlands Central (Phase 2) WEF – Decommissioning Phase

7.10.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a moderate probability of this happening, resulting in a medium significance of this impacts. If mitigation is correctly applied, the extent and probability of the impact can both be reduced to low, resulting in a low significance rating.

Table 31: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M

With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.				

Mitigation measures to reduce residual risk or enhance opportunities:

- An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning;
- ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and
- Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

7.11 Grid Connection for Highlands South (Phase 3) WEF – Construction Phase

7.11.1 Habitat Destruction

The severity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the extent and probability of the impact can be reduced to low, changing the significance to low.

Table 32: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands South

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	L	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – rehabilitation of habitat is possible				
Can impact be avoided, managed or mitigated?			YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths;
- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP;
- Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and
- The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.

7.11.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 33: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands South

Impact Phase: Construction

Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.12 Grid Connection for Highlands South (Phase 3) WEF – Operational Phase

7.12.1 Power Line Collisions

The result of this impact is mortality, and due to the relatively long length of the line (for both alternatives), excessive mortalities which may affect the viability of a population beyond the project site are possible. The impact has a high probability of occurring, resulting in a high negative significance before mitigation. If mitigation measures are adhered to the extent and probability of the impact can be reduced, resulting in a medium negative significance rating.

Table 34: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	H	H	M	Negative	H	H	M
With Mitigation	H	M	M	Negative	M	M	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	H	M	Negative	H	H	M
With Mitigation	H	M	M	Negative	M	M	M
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Grid infrastructure should not be constructed in No-Go areas;
- Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible;
- Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this;
- Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans.
- Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations.
- Any mortalities should be reported to the Endangered Wildlife Trust (EWT).

7.12.2 Electrocution

While the impact occurs locally, a number of electrocutions along the line may effect populations beyond the site. The impact has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the extent and probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 35: Impact Rating Table for Electrocution for Grid Connection for Highlands South

Impact Phase: Operation
Potential impact description: Bird mortality from electrocution.
GRID ALTERNATIVE 1

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	M	M	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.12.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 36: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M

With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.							

7.13 Grid Connection for Highlands South (Phase 3) WEF – Decommissioning Phase

7.13.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a high probability of this happening, resulting in a medium significance of this impact. If mitigation is correctly applied, the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 37: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	M	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	M	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.				

Mitigation measures to reduce residual risk or enhance opportunities:

- An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning;
- ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and
- Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

7.14 Assessment of no-go alternative

Should the proposed development not be constructed (i.e. the no-go alternative is realised), the status quo with regards to the current land use is likely to persist in the medium to long term. The bird baseline as described in the report is unlikely to change significantly, apart from changes caused by natural environmental fluctuations (e.g. dry vs wet years). There will be no negative impact on the avifauna of the proposed development site if the no-go alternative is realised.

7.15 Cumulative Impacts

Three operational wind farms are located in the Cookhouse/Bedford area, approximately 47 km east of the proposed Highlands Development. They are the Cookhouse Wind Farm, Nojoli Wind Farm and the Amakhala Emoyeni Wind Farm. Available operational monitoring reports from these wind farms were obtained from BLSA and were reviewed, because impacts arising from these wind farms could act synergistically with impacts from the

proposed development (as well as other proposed developments), potentially negatively affecting some species.

Cookhouse Wind Farm is a 138.6 MW WEF, consisting of 66 turbines and reached its Commercial Operations Date in May 2014. Operational monitoring only commenced almost a year later in March 2015. A total of 41 bird fatalities were recorded on Cookhouse Wind Farm during the first year of monitoring, none of which were Red Data species (IWS, 2016). The most important findings were 2 Lesser Kestrel and 9 Rock Kestrel fatalities. Adjusting the results for biases, IWS (2016) estimated 219 birds were killed using Huso (2012), although there was low confidence in the modelled output. Based on recorded fatality rates, and the bird species recorded as fatalities IWS (2016) did not recommend any management mitigation, but recommended monitoring continue for a second year[14].

The Nojoli Wind Farm (NWF) consists of 44 turbines and operational phase bird and bat monitoring was initiated in early July 2017. The first year is recently completed and a final report is not yet available. The most recent progress report (Smallie and MacEwan, 2018) gives the findings for the monitoring period 4 July 2017 – 31 March 2018 (~9 months). They noted though that 7 of the 9 months, carcass searching did not take place (only activity monitoring of live birds was conducted) due to transport issues for the searchers. Key findings from the two months when searchers were that 12 bird fatalities were recorded, and five fatalities were Cape Vulture. Rock Kestrel and African Harrier Hawk were the other raptor fatalities.

The Amakhala Emoyeni Wind Farm consists of 56 wind turbines and construction of this facility was completed in July 2016. The first year of operational phase bird and bat monitoring was carried out at the Amakhala Emoyeni wind farm between August 2016 and August 2017 (Smallie and MacEwan, 2017). Habitat alteration as a result of the construction of the wind farm was estimated at 0.46% of the total area. A total of 44 bird fatalities from approximately 19 bird species were recorded by formal searching at turbines. These included: three Cape Vultures; one Blue Crane; and 1 Martial Eagle. A fourth Cape Vulture was found incidentally at a turbine, while a fifth mortality of this species resulted from a power line incident. Smallie and MacEwan (2017) estimated that approximately 112 birds were killed at Amakhala Emoyeni Wind Farm during the monitoring period.

Recent discussions with the specialist (per. Com. Jon Smallie), did not reveal any significant additional mortalities at the above WEFs, not described in the reports reviewed. One of the most important findings of this review, is that in the Cookhouse/Bedford area, at least 10 Cape Vultures have suffered mortality between August 2016 and present. The actual number is possibly higher as there have been gaps when monitoring has not been conducted, especially at NWF and Cookhouse Wind Farm.

There is the potential for at least five additional wind farms to be constructed in the Bedford/Cookhouse area in the future namely: 140 MW Msenge Emoyeni Wind Farm (under same EA as Amakhala); Proposed 140 MW Middleton Wind Energy Project; Proposed Golden Valley 1 WEF; Proposed Golden Valley 2 WEF; and Proposed Nxuba Wind Farm. Available bird data from the applicable EIAs and/or monitoring reports at these sites was reviewed and showed a similarity in key issues and key species identified for the operation sites. Generally concerns relate one or more of Cape Vulture, Amur Falcon, Blue Crane, Ludwig's Bustard and Black Harrier.

No bird information could be obtained for the PV sites considered, although their potential presence and impacts on avifauna (which are likely to be low) was noted for the cumulative assessment. The main potential impacts of solar PV facilities on birds is habitat destruction and collision impacts associated with the grid connection lines.

[14]No data is available from the second year, and it could not be confirmed if any additional monitoring has been done.

7.15.1 Cumulative Assessment

The cumulative effect of Proposed Highlands Development along with the actual and predicted impacts of the operational and proposed facilities discussed above, has the potential to affect various bird species at a higher significance than the impacts of the Proposed Highlands Development alone. Key species that may possibly be impacted upon cumulatively include Cape Vulture, Blue Crane, Ludwig's Bustard, Martial Eagle, Amur Falcon, Lesser Kestrel, Rock Kestrel Jackal Buzzard and potentially Verreaux's' Eagle and Black Harrier. Of these, Cape Vulture is of primary concern, as it has suffered collision mortality in the Bedford/Cookhouse area. Even though collisions of Cape Vulture, are not highly likely at Highlands (due to the low abundance and activity of the species on the site), they are possible and even a few mortalities may result in a cumulative impact of high significance.

The cumulative habitat destruction impact for the proposed Highlands development is concluded to be of moderate significance.

The cumulative disturbance and displacement impact for the proposed Highlands development is concluded to be of moderate significance.

Details regarding the routes and lengths of the grid connection power lines for all the projects considered were not all available, and therefore a precautionary approach has been adopted and the cumulative impact of power line collisions (particularly involving Blue Crane and Ludwig's Bustard) is rated as high.

If all operational facilities implement appropriate and effective mitigation as outlined by their respective specialists, and if all mitigation measures outlined in this report are implemented for the proposed Highlands development, the cumulative impact after mitigation is likely to have a moderate significance.

Table 38: Cumulative Impact Rating

Impact Phase: All phases							
Potential impact description: Cumulative impact of all impacts on avifauna							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	H	M	Negative	M	H	M
With Mitigation	M	H	M	Negative	L	M	M
Can the impact be reversed?			PARTIALLY				
Will impact cause irreplaceable loss or resources?			POSSIBLY				
Can impact be avoided, managed or mitigated?			PARTIALLY				
Mitigation measures to reduce residual risk or enhance opportunities: - All mitigation measures listed above and recommended for other projects listed above must be adhered to. - The applicant and/or operational project company should proactively collaborate with other wind farm operators in the broader Somerset East/Cookhouse/Bedfor area (i.e. currently Nojoli, Cookhouse and Amakhala Emoyeni wind farms) with regards to Cape Vulture turbine collision reasrch and mitigation. Data must be shared, and research efforts co-ordinated to reduce vulture mortality in the region, and where applicable and agreed, effort must be made to assist in funding of such research.							

8 CONCLUSION AND IMPACT STATEMENT

Activity and abundance of priority species and red data species were generally found to be moderate to high on the proposed Highlands development site after one year of pre-construction monitoring. Activity was particularly high in summer, coinciding with the arrival of migratory raptors. Activity of other resident Red Data species, e.g. Verreaux's Eagle, Blue Crane and Ludwig's Bustard was relatively constant across the year, at a moderate level. Activity of the non-Red Data raptors, Jackal Buzzard and Rock Kestrel was high to very high throughout the year, and these species are the ones most likely to suffer collision mortality.

Abundances of small passerines were also found to be moderate, with a relatively moderate to high diversity of species recorded, including a number of endemics or near-endemics. However, due to most of these species being relatively common, and the extensive available habitats for this birds on and around the development site, it was predicted that the impacts to these birds was likely to be low.

Verreaux's Eagle were confirmed as breeding on and around the proposed development site, and all nests have been suitably buffered by 3 km, with no turbines proposed within these buffers. Recorded Verreaux's Eagle flight activity was relatively high compared with other priority species recorded, although when compared with the activity of this species on other WEFs in South Africa, the activity levels are moderate. It was confirmed that the Highlands Wind Farm Project site is "*proposed within potentially important Verreaux's Eagle habitat*" and therefore the Verreaux's Eagle monitoring guidelines were applied, resulting in substantial flight data being recorded from 72 hours of monitoring at each VP. All proposed turbines are located outside of high risk areas (e.g. ridge and slope buffers, nest buffers and high recorded flight activity areas) and therefore an additional year of monitoring is not recommended. While it is likely that this species will suffer collision mortality at some stage during operations of the proposed development, the amount and frequency of collisions are not expected to reach a level that would be unsuitable for the regional population. Furthermore, if mortalities are recorded certain mitigation options can be implemented (subject to the results of operational monitoring), that can reduce the levels of mortality.

Two Verreaux's Eagles (preferably one from each active territory) should be fitted with GPS tracking devices (subject to ethical clearance from BLSA ethics committee) at the start of the construction phase. This information would feed into the construction and operational monitoring programme and would assist in determining disturbance and displacement effects (as well as possible collision impacts).

Cape Vulture was only recorded during the final summer season, with an estimated minimum of 8 birds, being responsible for 11 recorded flights. Overall, this represented a very low passage rate, with most activity also being on the northern boundary of the proposed development site (an area that does not have proposed turbine locations in the latest layout). It was concluded that Cape Vulture is only likely to be an occasional visitor to the proposed Development site, and should mortalities occur for this species (which is unlikely but possible), they could be mitigated (or reduced in future) by implementing mitigation such as carcass management strategies and/or shut down on demand strategies. Regarding this species, more concern is around cumulative impacts. If low mortality manifests at the proposed Development, this may be acceptable (at the scale of the development). However, if this low level of mortality coincides with high levels of mortality at the WEFs in the Cookhouse/Bedford area, the cumulative impacts to the regional population could be high. It will be essential, to reduce cumulative effects, that all WEFs in the region implement mitigations and recommendations given by the respective avifaunal specialists, and that there is collaboration and sharing of information between specialists.

Ludwig's Bustard and Blue Crane were relatively widespread and abundant, although they did not fly regularly at turbine risk height. They are therefore more likely to be impacted upon by possible disturbance or through collisions with overhead power lines, associated with either the WEFs or the grid connections. Both of these impacts can be mitigated against. It will be vitally important to ensure all overhead lines are correctly marked with BFD's, and if the shortest routes for the grid connections are used the impacts are likely to be low-moderate and acceptable, although ongoing monitoring of overhead lines during operation will be required to confirm this. It is likely that the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this.

The rated impacts of each WEF phase and Grid Connection separately were found to be acceptable. However, if all phases are granted EA, they will not be constructed as separate WEFs, and not all turbines proposed for each phase would be constructed. Therefore an assessment of a WEF[15] up to a maximum of 140 MW and utilising turbine positions from all three phases (which is likely to result in less than 40 turbines being constructed) was conducted. This assessment found that the impact (post mitigation) of collision is likely to be moderate and the other identified impacts on avifauna are likely to be low. Therefore the construction of a medium sized WEF of less than 40 turbines would be acceptable, if all turbine positions are outside of all the identified avifaunal No-Go areas and all other mitigations and recommendations in this report are implemented. It is noted that based on the rapid pace of technology advancement, less turbines (each with a higher capacity) may be used to meet the required MW output, and wherever feasible this should be encouraged as for birds, fewer larger turbines are preferable than more smaller turbines.

The turbine positions in the assessed layout (as shown in Figure 10) and the final mitigated layout avoid all avifaunal no-go areas and high sensitivity buffers and is acceptable.

Considering the Grid Connections and Associated Infrastructure (e.g. substations):

- The potential impacts of Alternative 1 and Alternative 2 for Phase 1 (North) were found to be the same. Either alternative is acceptable with mitigation.
- The potential impacts of Alternative 1 and Alternative 2 for Phase 2 (Central) were found to be the same. Either alternative is acceptable with mitigation.
- The potential impacts of Alternative 1 and Alternative 2 for Phase 3 (South) were found to be the same. Either alternative is acceptable with mitigation.
- Due to their much longer lengths, either alternative (1 or 2) for Phase 3 (South) are likely to have higher impacts on birds than the grid connection alternatives proposed for Phase1 or Phase 2. Therefore, it is strongly recommended that the substation locations (and associated grid connection options) for either Phase 1 or 2 are used to connect the final project/s to the grid.
- All substation locations are acceptable, subject to mitigations, (however, those proposed for Phases 1 and 2 are preferred as they result in shorter grid connection).

If an Environmental Authorisation (EA) is granted, the following conditions applicable to avifauna should be included:

- All recommendations and proposed mitigation measures in the avifaunal specialist report are to be implemented;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded (or timed to be outside of an applicable breeding season). The walkthrough must also cover the Grid Connection route;

[15] Bid as two separate projects in the REIPP with two separate grid connections.

- During the site walkthrough the specialist must determine the power line spans of the grid connection route that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility.
- Install bird flight diverters as per the instructions of the specialist which may include the need for modified BFDs fitted with solar powered LED lights on certain spans;
- All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area);
- On the WEF if any power line spans connecting turbines are not buried they must be fitted with [Bird Flight Diverters (BFDs)];
- Turbines must not be constructed within any designated No-Go Areas. The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this;
- During the construction phase, an avifaunal specialist must conduct surveys/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites (see point below);
- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and should be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction;
- During construction phase, conduct a search (during spring/summer breeding seasons) for breeding sites of Blue Cranes and monitor any such sites for breeding success/failure during the construction phase;
- Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines;
- Develop and implement a minimum 12 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys and is in line with the applicable South African post-construction monitoring guidelines; and
- If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA, relevant stakeholders and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. This must then be implemented in a concerted effort to reduce the impacts to acceptable levels.

9 REFERENCES

Avian Power Line Interaction Committee (APLIC). 1994. *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*. Edison Electric Institute. Washington D.C.

Arcus Consultancy Services South Africa (Arcus) 2015. Avifaunal Specialist Report Umsinde Emoyeni Wind Energy Facility Phase 1 & 2 and associated electrical Grid Connection Phase 1 & 2 Western Cape and Northern Cape.

Arcus Consultancy Services South Africa 2017. Bird and Bat Feasibility Study for the proposed Highlands Wind Farm, near Somerset East, Eastern Cape Province. Report to WKN-Windcurrent South Africa (Pty).

Barrios, L. & Rodriguez, A. 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. *Journal of Applied Ecology* 41: 72–81

Bellebaum, J., Korner-Nievergelt, F., Dürr, T. & Mammen, U. 2013. Wind turbine fatalities approach a level of concern in a raptor population. *Journal for Nature Conservation* 21: 394–400.

BLSA 2017a. *Wind energy and birds in South Africa: Turbine collision fatalities during the first two years of operational monitoring*. Presentation to the Birds and Renewable Energy Forum, 28 September 2017. BirdLife South Africa, 2017.

BLSA 2017b. BirdLife South Africa. 2017. Verreauxs' Eagle and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation. *Birdlife South Africa Occasional Report Series.* BirdLife South Africa, Johannesburg, South Africa.

Bose, A., Dürr, T., Klenke, R.A. and Henle, K. 2018. Collision sensitive niche profile of the worst affected bird-groups at wind turbine structures in the Federal State of Brandenburg, Germany. *Scientific Reports* 8: 3777

Birdlife International 2018. Species factsheet: *Falco amurensis.* Downloaded from http://www.birdlife.org on 03/08/2018.

Brooks M. 2018. Southern African Bird Atlas Project 2: Full protocol records. Version 1.16. Animal Demography Unit, Department of Zoology, University of Cape Town. Occurrence dataset https://doi.org/10.15468/8x5b7h accessed via GBIF.org on 2018-08-02.

Carrete, M., Sanchez-Zapata, J.A, Benitez, J.R., Lobon, M., Donazar, J.A. 2009. Large scale risk-assessment of wind-farms on population viability of a globally endangered long-lived raptor. *Biological Conservation* 142: 2954-2961.

Dahl, E.L., Bevanger, K., Nyg_ard, T., Røskaft, E. & Stokke, B.G. 2012. Reduced breeding success in white-tailed eagles at Smøla windfarm, western Norway, is caused by mortality and displacement. *Biological Conservation* 145: 79–85.

Davies, R. A. G., and D. G. Allan. 1997. "Black eagle Aquila verreauxii." *The atlas of southern African birds* 1 175-177.

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. *Journal of Applied Ecology* 45: 1695–1703.

Desholm, M. and Kahlert, J. 2005. *Avian collision risk at an offshore wind farm*. Available online: http://rsbl.royalsocietypublishing.org/content/1/3/296.full

Dirksen, S., Spaans, A. L., & van den Winden, J. 1998. Nocturnal collision risks with wind turbines in tidal and semi-offshore areas. In: Ratto, C. F., & Solari, G. (eds.), *Wind Energy and Landscape*: 99-108. Proc. 2nd European and African Conference on Wind Engineering, Balkema, Rotterdam.

Drewitt, A.L. & Langston, R.H.W. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Dwyer, J.F., Landon, M.A. and Mojica, E.K. 2018. Impact of Renewable Energy Sources on Birds of Prey. In: Sarasola, J.H., Grande, J.M. and Negro, J.J. (eds). 2018. *Birds of Prey Biology and conservation in the XXI century*. p 303-321

Erickson, W.P., Johnson, G.D., Strickland, M.D., Young, D.P.Jr., Sernka, K.J. & Good, R.E. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. *National Wind Coordinating Committee Resource Document*. 62 pp.

Frid, A. & Dill, L.M. 2002. Human-caused disturbance stimuli as a form of predation risk. *Conservation Ecology* 6(1): 11

Gargett, Valerie, and Peter J. Mundy. 1990. *The black eagle: a study*. Acorn Books.

Grünkorn, T., Blew, J., Krüger, O., Potiek, A., Reichenbach,M., von Rönn, J., Timmermann, H., Weitekamp, S. and Nehls, G. 2017. A Large Scle, Multispecies Assessment of Avian Mortality Rates at Land-Based Wind Turbines in Northern Germany. Wind Energy and Wildlife Interactions- J. Koppel (ed).

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1: Non-passerines. BirdLife South Africa, Johannesburg.

Hötker, H., Thomsen, K.M. and Jeromin., H. 2006. Impacts on biodiversity of exploitation of renewable energy resources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Bergenhusen.

Hunt, W.G., Jackman, R.E., Hunt, T.L., Driscoll, D.E. & Culp, L. 1998. A population study of golden eagles in the Altamont Pass Wind Resource Area: population trend analysis 1994–1997*. Report to National Renewable Energy Laboratory, Subcontract XAT-6-16459-01*. Predatory Bird Research Group, University of California, Santa Cruz, USA

Huso, M., Som, N., & Ladd, L. 2012. Fatality estimator users guide: US Geological Survey Data Series 729.

IWS, 2016. Cookhouse Wind Farm Operational Bird and Bat Monitoring Year 1 Final Report. Ikululeko Wildlife Services (IWS) in association with Wildskies Ecological Services, May 2016.

Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. Ralston, S. 2015. Bird and Wind-Energy Best-Practice Guidelines. Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa. Third Edition (previous versions 2011 and 2012). BirdLife South Africa and Endangered Wildlife Trust, Johannesburg, South Africa.

Kruckenberg, H. & Jahene, J. 1999. Zum Einfluss eines Windparks auf die Verteilung weidender Bläßgänse im Rheiderland (Landkreis Leer, Niedersachsen). *Natur Landschaft* 74: 420–427

Larsen, J.K. & Madsen, J. 2000. Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. *Landscape Ecology* 15: 755–764

Ledec, G.C., Rapp, K. W. and Aiello, R. G. 2011. Greening the Wind: Environmental and Social Considerations for Wind Power Development in Latin America and Beyond. The World Bank ESMAP Report. 148 pp.

Madders, M. & Whitfield, D.P. 2006. Upland raptors and the assessment of wind farm impacts. *Ibis* 148: 43-56.

Malan, G. 2009. Raptor survey and monitoring – a field guide for African birds of prey. Briza, Pretoria.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Marques, A.T., Batalha, H., Rodrigues, S., Costa, H., Pereira, M.J.R, Fonseca, C., Mascarenhas, M. and Bernardino. 2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. *Biological Conservation* 179: 40-52.

Orloff, S. and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use and mortality in Altamont Pass and Solano County Wind Resource Areas. *Report to the Planning Departments of Alameda, Contra Costa and Solano Counties and the California Energy Commission, Grant No. 990-89-003 to BioSystems Analysis, Inc., Tiburon, CA.*

Pagel, J.E., Kritz, K.J., Millsap, B., Murphy, R.K., Kershner, E., and Covington, S. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. *Journal of Raptor Research*.

Pearce-Higgins, J. W., Stephen, L., Langston, R. H. W., Bainbridge, I. P. and Bullman, R. 2009. The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323–1331.

Pettersson, J., & Stalin, T. 2003. Influence of offshore windmills on migration of birds on southeast coast of Sweden. *Report to GE Wind Energy.*

Percival, S. 2005. Birds and windfarms: what are the real issues? British Birds 98: 194-204.

Ralston Paton, S., Smallie J., Pearson A., and Ramalho R. 2017. Wind energy's 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. *BirdLife South Africa Occasional Report Series No. 2.* BirdLife South Africa, Johannesburg, South Africa

Reichenbach, M. & Steinborn, H. 2006. Windkraft, Vögel, lebensräume – Ergebnisse einer fünfjährigen BACI-Studie zum Einfluss von Windraft anlagen und Habitatparametern auf Wiesenvögel. *Osnabrücker Naturwissenschaftliche Mitteilungen* 32: 243-259Retief, E, Anderson, M., Diamond, M., Smit, H., Jenkins, A. & Brooks, M. (2011) Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures used. *Priority species list updated in 2014 by BLSA.*

Rydell, J., Ottvall, R., Petterrson, J. & Green, M. 2017. *The effects of wind power on birds and bats – an updated synthesis report.* Report by the Swedish Environmental Protection Agency.

Shaw, J.M, Jenkins, A.R., Smallie, J.J & Ryan, P.G. 2010. Modelling power-line collision rosk for the Blue Crane *anthropoids paradiseus* in South Africa. *Ibis* 152: 590-599.

Shaffer, J.A. and Buhl, D.A. 2015. Effects of wind-energy facilities on breeding grassland bird distributions. *Conservation Biology* 00 1-13 DOI: 10.111/cobi.12569

Smales, I. & Muir, S. 2005. Modelled cumulative impacts on the Tasmanian Wedge-tailed Eagle of wind farms across the species range. Biosis Research Pty. Ltd (for Australian Department of the Environment and Heritage.

Smallie, J. 2015. Verreaux's' Eagle *Aquila verreauxii* wind turbine collision fatalities. Wildskie Ecological Services Short Note.

Smallie, J. & MacEwan, K. 2018. Nojoli Wind Farm Eastern Cape. Operational Phase Bird and Bat Monitoring Programme. Progress Report 3. 23 April 2018.

Smallie, J. & MacEwan, K. 2017. Amakhala Emoyeni Wind Farm (AE01), Eastern Cape. Operational phase bird & bat monitoring programme. Year 1 Final Report. September 2017.

Smallwood, K.S. 2013. Comparing bird and bat fatality rate estimates among North American Wind Energy Projects. Wildlife Society Bulletin. 37 (1): 19-22.

Smallwood, K.S. & Thelander, C. 2008. Bird Mortality in the Altamont Pass wind resource area, California. Journal of Wildlife Management. 72(1):215-223

Sovacool, B.K. 2009. Contextualizing avian mortality: A preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity. Energy Policy 37(6): 2241-2248.

Strickland, M.D., Arnett, E.B., Erickson, W.P., Johnson, D.H., Johnson, G.D., Morrison, M.L., Shaffer, J.A. and Warren-Hicks, W. 2011. *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions.* Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA.

Symes C.T. and Woodborne, S. 2010. Migratory connectivity and conservation of the Amur Falcon *Falco amurensis:* a stable isotope perspective. *Bird Conservation International* 20:134-148Tarr, N.M., Rubino, M.J., Costanza, J.K., McKerrow, A.J., Collazo, J.A. and Abt, R.C. 2016. Projected gains and losses of wildlife habitat from bioenergy-induced landscape change. *Global Change Biology Bioenergy* doi: 10.1111 / gcbb.12383

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. *Coordinated waterbird Counts in South Africa, 1992-1997*. Avian Demography Unit, Cape Town.

Taylor, M.R., Peacock, F., and Wanless, R.M. 2015. Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

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. 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

Thelander, C. G., Smallwood, K. S., & Rugge, L. 2003. Bird risk behaviors and fatalities at the Altamont Pass Wind Resource Area. National Renewable Energy Laboratory, Golden, Colorado, USA.

Tome, R., Canario, F., Leitao, H., Pires, N., and Repas, M. 2017. Radar Assisted Shutdown on Demand Ensures Zero Soaring Bird Mortality at a Wind Farm Located in a Migratory Flyway. In Wind Energy and Wildlife Interactions (J. Koppel (ed)).

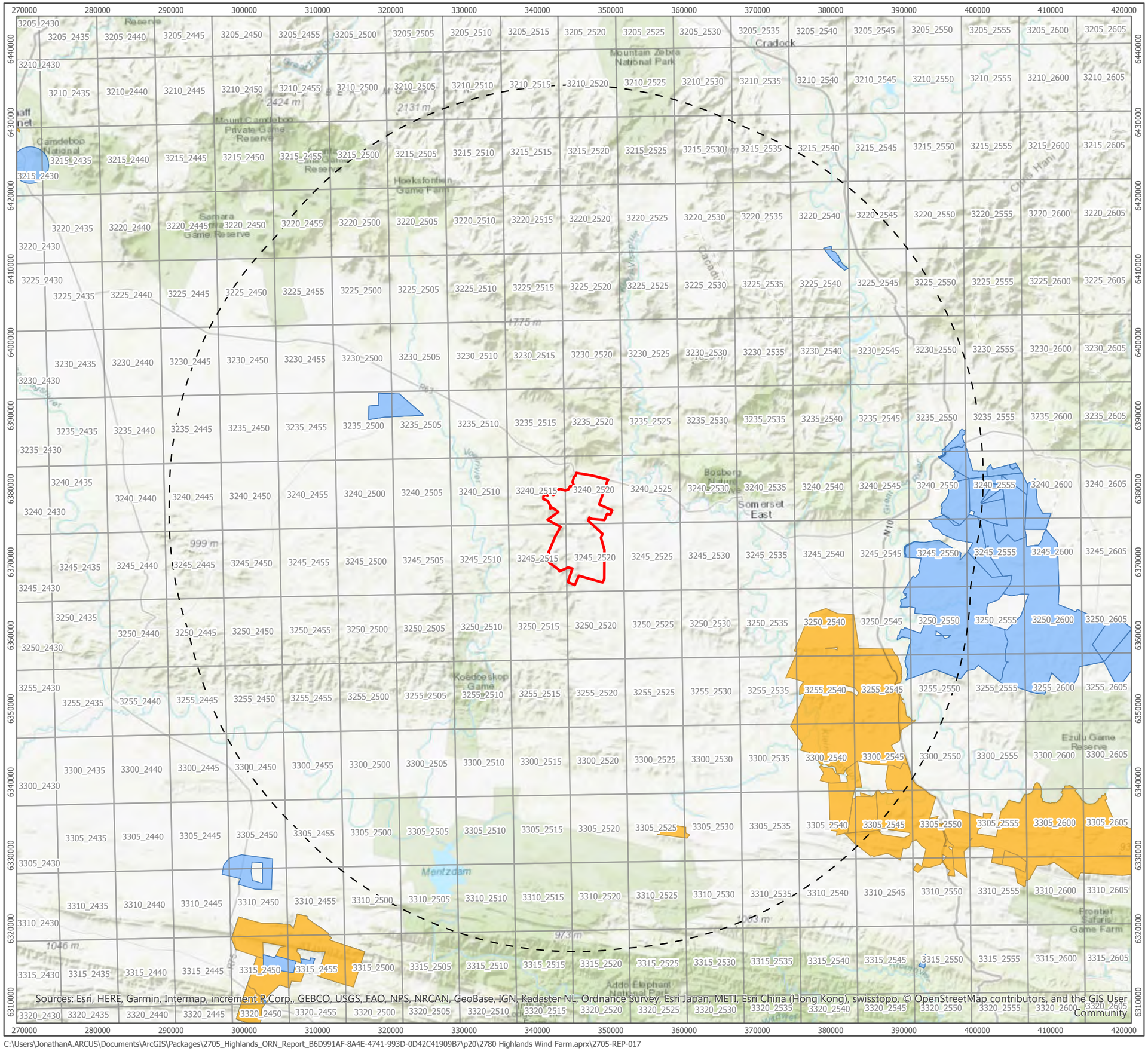
Tulp, I., Schekkerman, H., Larsen, J. K., van der Winden, J., van de Haterd, R. J.W., van Horssen, P., Dirksen, S., & Spaans, A. L. 1999. Nocturnal flight activity of sea ducks near the windfarm Tunø Knob in the Kattegat. IBN-DLO Report No. 99.30.

van Rooyen, C.S. 2004. The Management of Wildlife Interactions with over-headlines. In The fundamentals and practice of Over-head Line Maintenance (132 kV and above), pp 217-245. Eskom Technology, Services International, Johannesburg.

van Rooyen, C.S. and Ledger, J.A. 1999. Birds and utility structures: Developments in southern Africa. *Ferrer, M. & G.. FM Janns. (eds.) Birds and Power lines. Quercus: Madrid, Spain*, pp.205-230.

Vasilakis, D.P., Whitfield, D.P. and Vassiliki, K. 2017. A balanced solution to the cumulative threat of industrialized wind farm development on cinereous vultures (Aegypius monachus) in south-eastern Europe. *PLoS ONE* 12(2): e0172685. Doi: 10.371/journal.pone.0172685

Whitfield, D.P. (2009) Collision Avoidance of Golden Eagles at Wind Farms under the 'Band' Collision Risk Model. Report to Scottish Natural Heritage. Natural Research Ltd, Banchory, UK.



ARCUS

- 50 km buffer of development
- Development Boundary
- SABAP2 Pentad

Environmental Applications - Status

- Approved
- In process

1:500 000 Scale @ A3

0 10 20 km

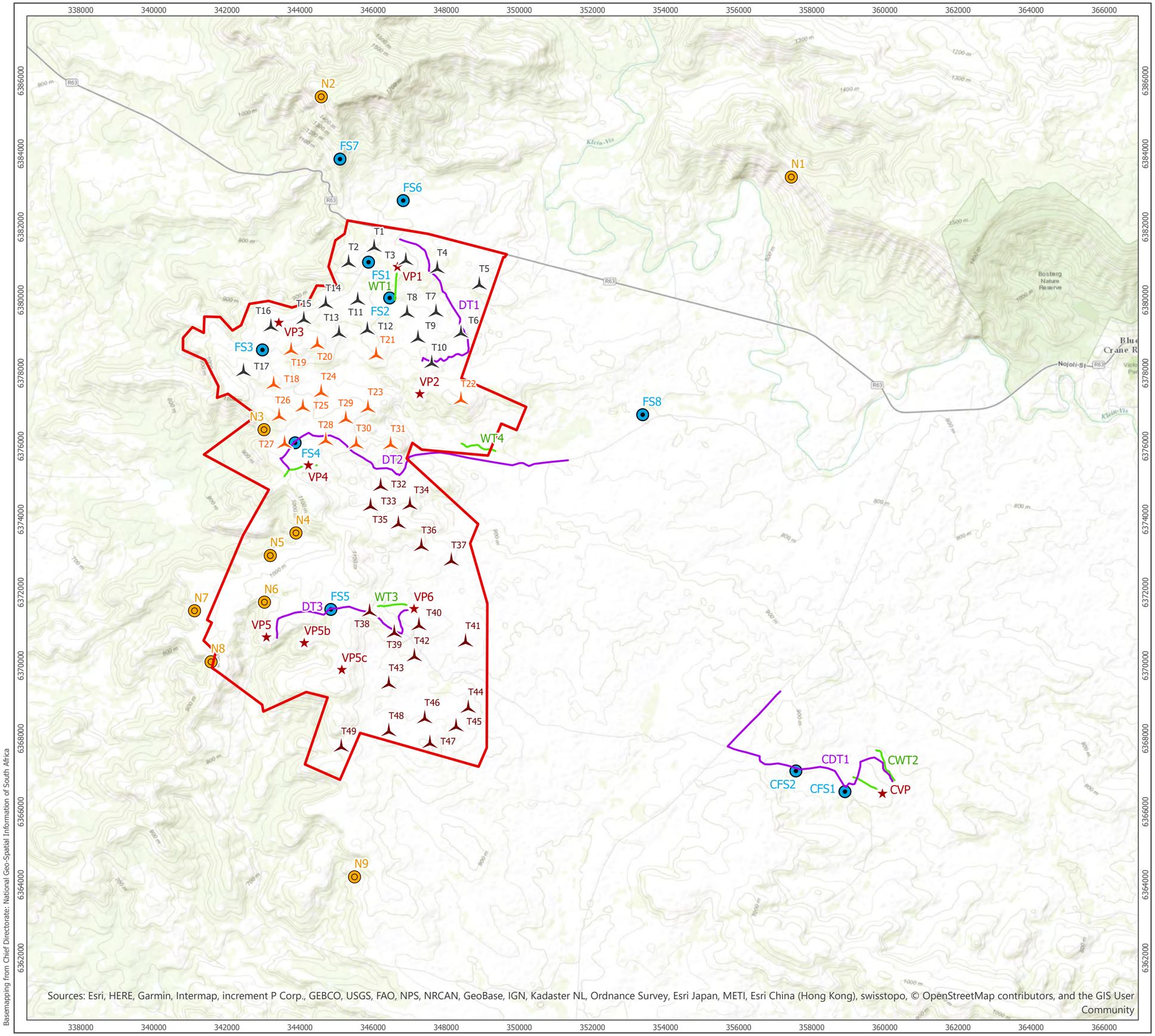
NORTH

Produced By: SC	Ref: 2705-REP-017
Checked By: AP	Date: 06/08/2018

Project Location and SABAP Grid Squares
Figure 1

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

C:\Users\JonathanA.ARCUS\Documents\ArcGIS\Packages\2705_Highlands_ORN_Report_B6D991AF-8A4E-4741-993D-0D42C41909B7\p20\2780 Highlands Wind Farm.aprx\2705-REP-017



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Development Boundary
- Highlands Central Proposed Layout
- Highlands North Proposed Layout
- Highlands South Proposed Layout
- Vantage Point Location
- Driven Transect Route
- Walked Transect Route
- Focal Sites
- Nest Sites

1:100,000 Scale @ A3

0 2 4 km

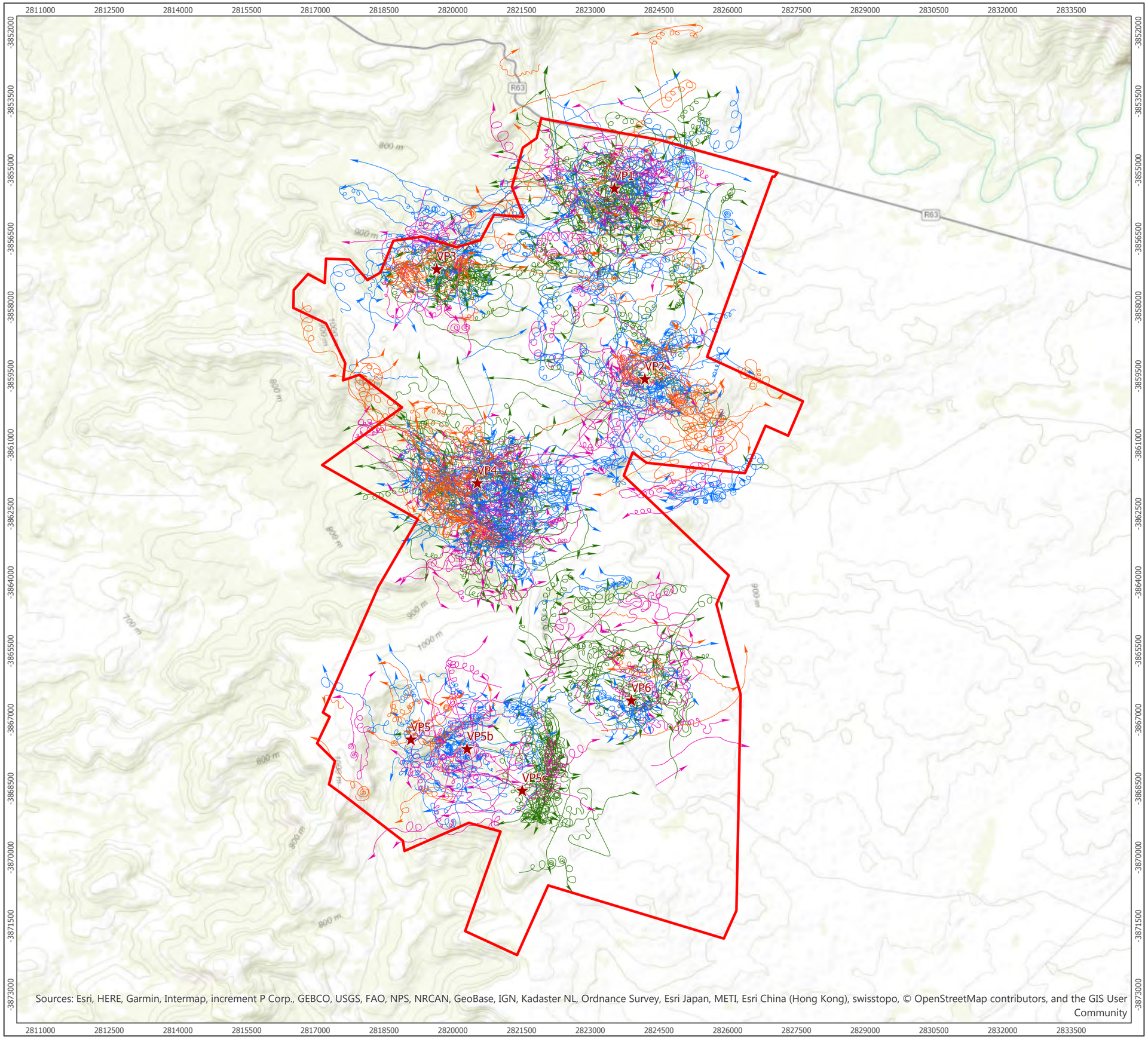
NORTH

Produced By: SC	Ref: 2705-REP-017
Checked By: AP	Date: 06/09/2018

Project and Control Site Survey Locations
Figure 2

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-018



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

ARCUS

- Development Boundary
- ★ Vantage Point Location

Flights

- Autumn
- Winter
- Spring
- Summer

1:80 000 Scale @ A3

0 1 2 km

NORTH

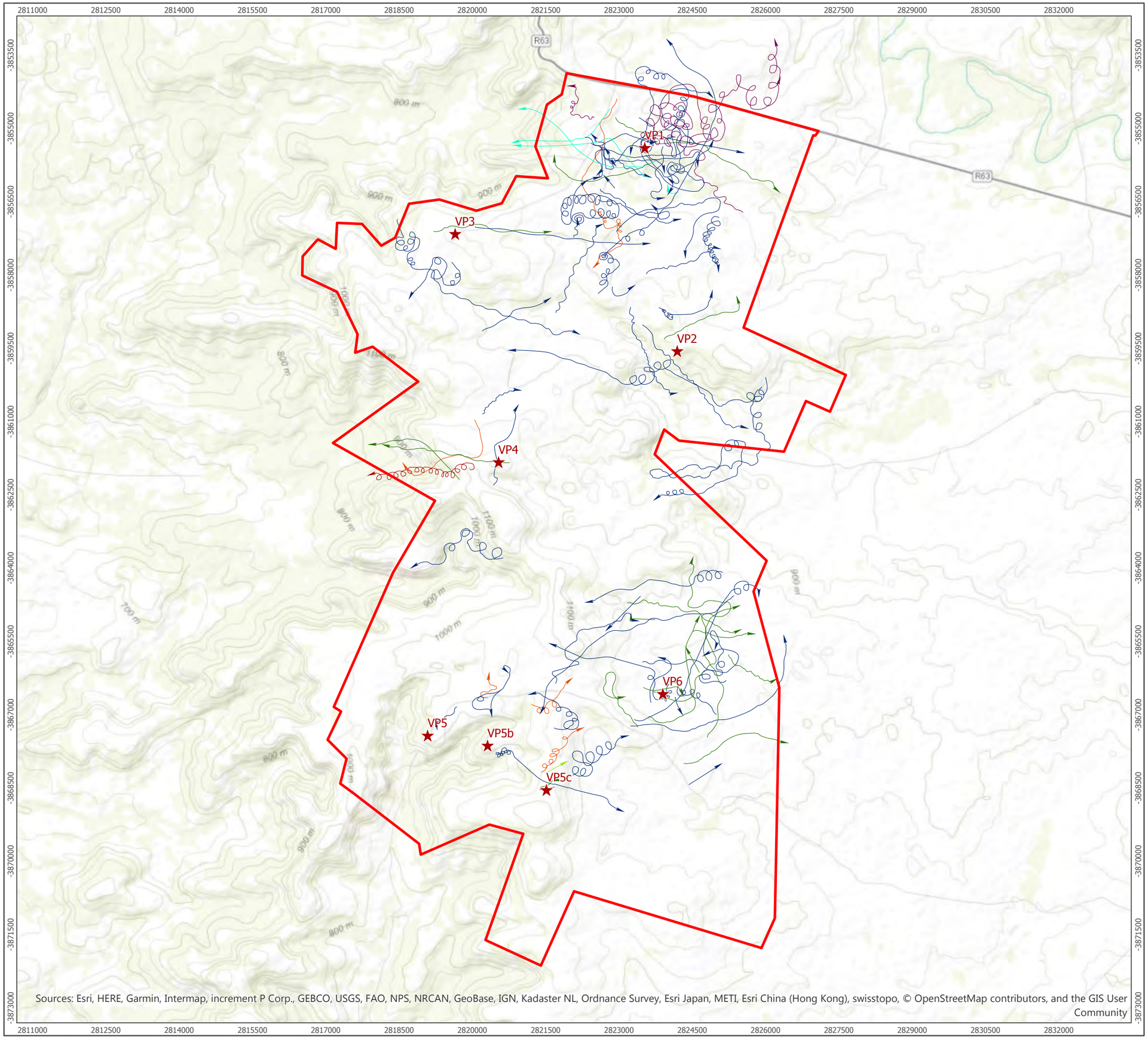
Produced By: JA	Ref: 2705-REP-019
Checked By: AP	Date: 24/08/2018

All Priority Species and Raptor Flights

Figure 3

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

Z:\GIS\Projects\2705 Highlands WEF\2705 Highlands WEF\2705 Highlands WEF.aprx\Bird Fig 03



ARCUS

- Development Boundary
- Vantage Point Location

Flights

- Blue Crane
- Denham's Bustard
- Kori Bustard
- Ludwig's Bustard
- Black Stork
- White Stork
- Secretarybird

1:75 000 Scale @ A3

0 1 2 km

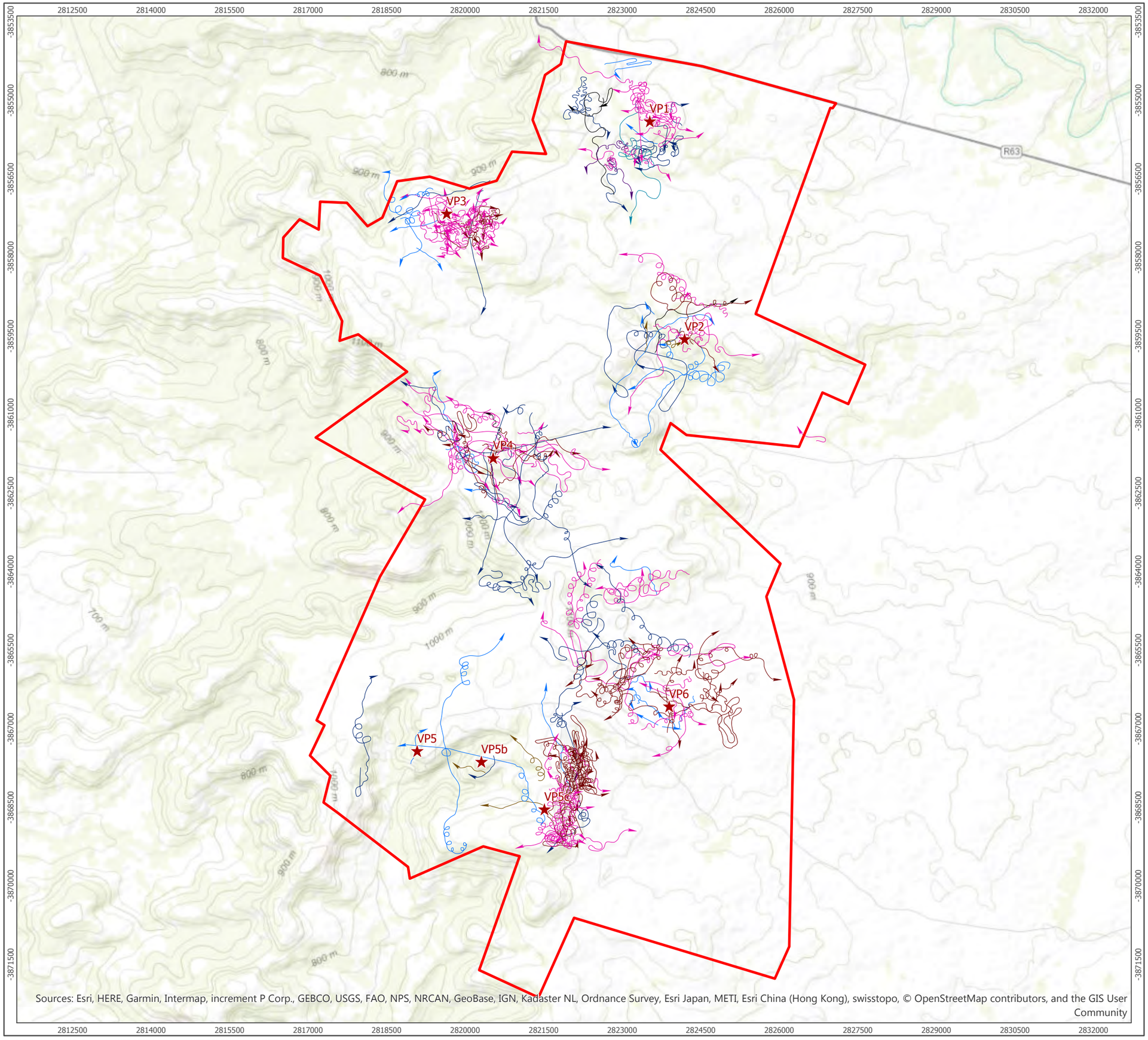
NORTH

Produced By: JA	Ref: 2705-REP-020
Checked By: AP	Date: 24/08/2018

Crane, Bustard, Stork and Secretarybird Flights
Figure 4

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

Z:\GIS\Projects\2705 Highlands WEF\2705 Highlands WEF\2705 Highlands WEF.aprx\Bird Fig 04



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

ARCUS

- Development Boundary
- Vantage Point Location

Flights

- African Harrier Hawk
- Black Harrier
- Lesser Kestrel
- Unidentified Kestrel
- Amur Falcon
- Lanner Falcon
- Pale Chanting Goshawk
- Steppe Buzzard

1:70 000 Scale @ A3

0 1 2 km

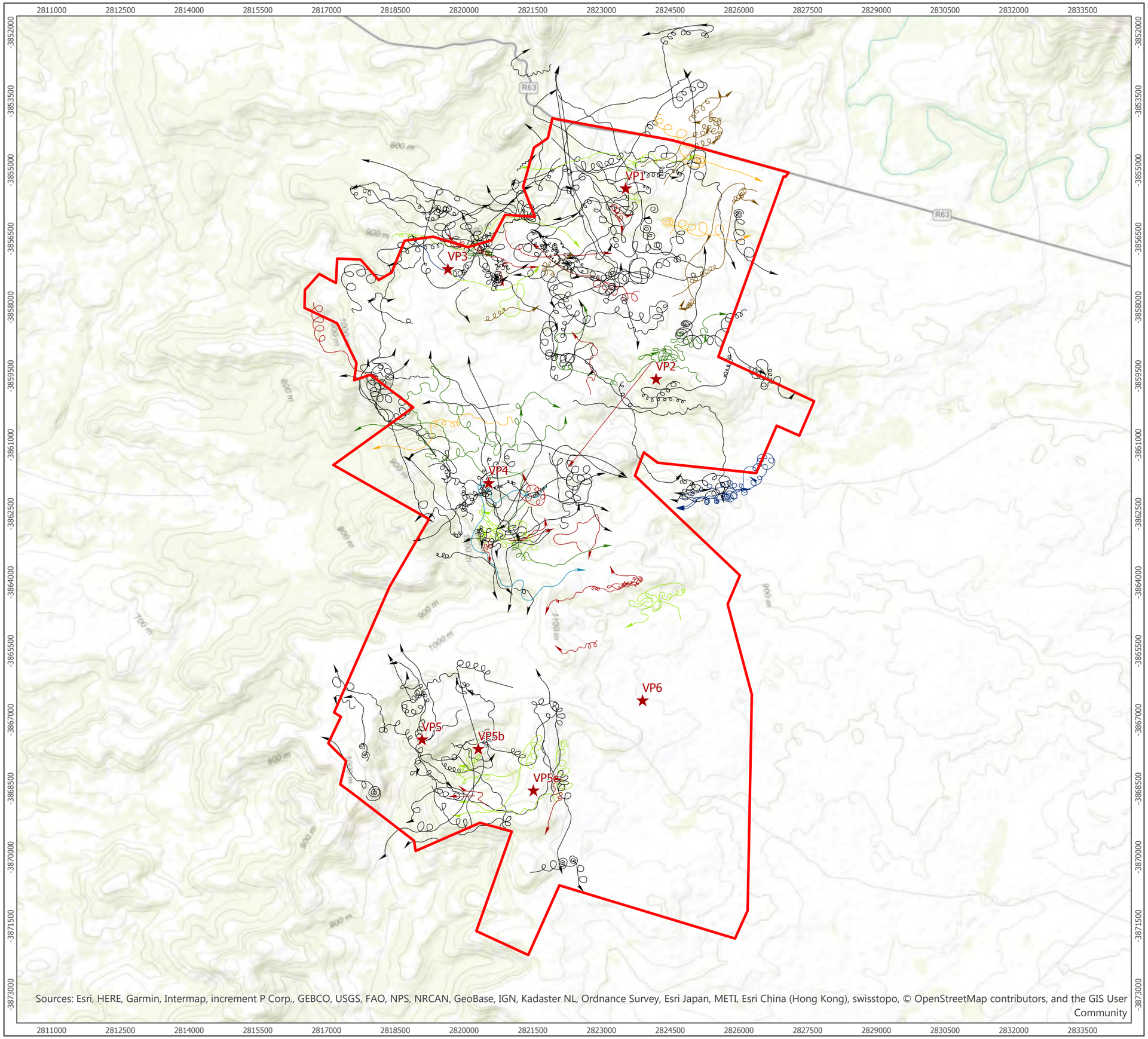
NORTH

Produced By: JA	Ref: 2705-REP-022
Checked By: AP	Date: 24/08/2018

Selected Raptor Flights A
Figure 5

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

Z:\GIS\Projects\2705 Highlands WEF\2705 Highlands WEF\2705 Highlands WEF.aprx\Bird Fig 05



ARCUS

- Development Boundary
- ★ Vantage Point Location

Flights

- African Fish Eagle
- Black-chested Snake Eagle
- Booted Eagle
- Brown Snake Eagle
- Martial Eagle
- Verreaux's Eagle
- Cape Vulture
- Unidentified Raptor

1:80 000 Scale @ A3

0 1 2 km

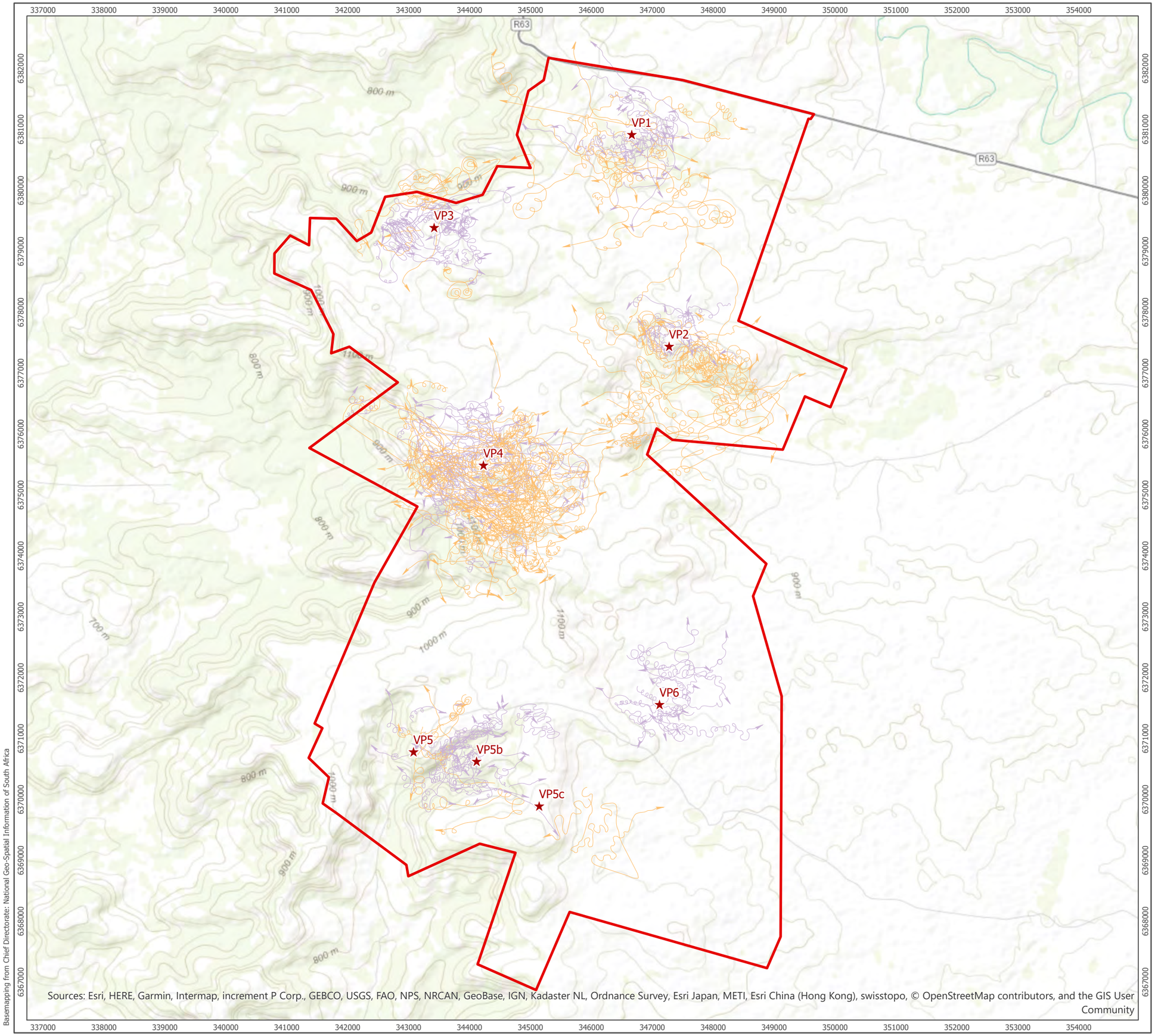
NORTH

Produced By: JA	Ref: 2705-REP-023
Checked By: AP	Date: 24/08/2018

Selected Raptor Flights B
Figure 6

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

Z:\GIS\Projects\2705 Highlands WEF\2705 Highlands WEF\2705 Highlands WEF.aprx\Bird Fig06



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-021

ARCUS

Development Boundary

Vantage Point Location

Target Species Flights

Jackal Buzzard

Rock Kestrel

1:60,000 Scale @ A3

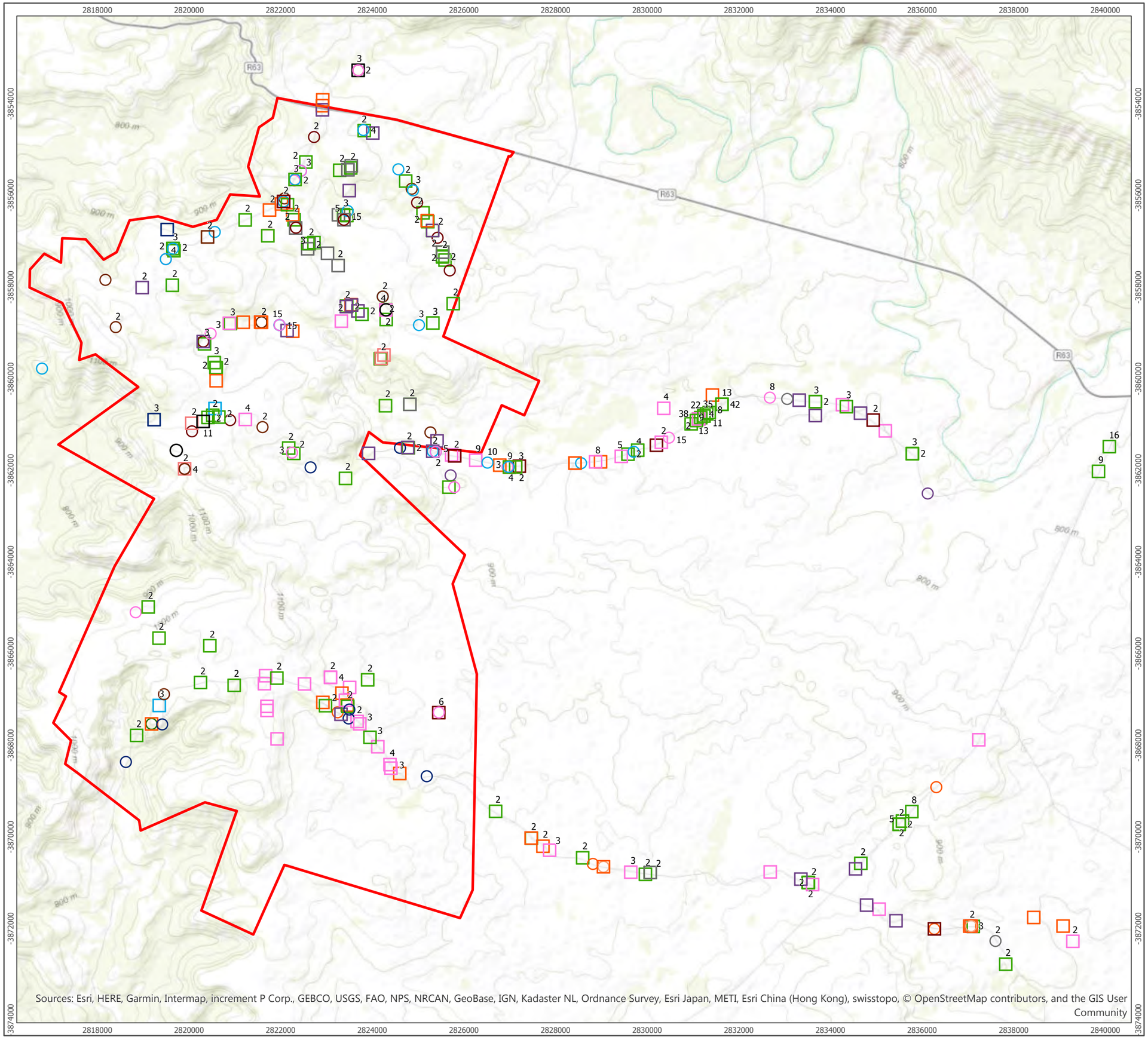
0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-021
Checked By: AP	Date: 29/08/2018

Rock Kestrel and Jackal Buzzard Flights
Figure 7

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment



ARCUS

- Development Boundary
- African Harrier Hawk
- African Rock Pipit
- Amur Falcon
- Black-chested Snake Eagle
- Black-shouldered Kite
- Blue Crane
- Denham's Bustard
- Grey-winged Francolin
- Jackal Buzzard
- Kori Bustard
- Lesser Kestrel
- Ludwig's Bustard
- Martial Eagle
- Pale Chanting Goshawk
- Secretarybird
- Southern Black Korhaan
- Spotted Eagle-Owl
- Steppe Buzzard
- Unidentified Kestrel
- Unidentified Raptor
- Verreaux's Eagle
- White Stork

1:80 000 Scale @ A3

0 1 2 km

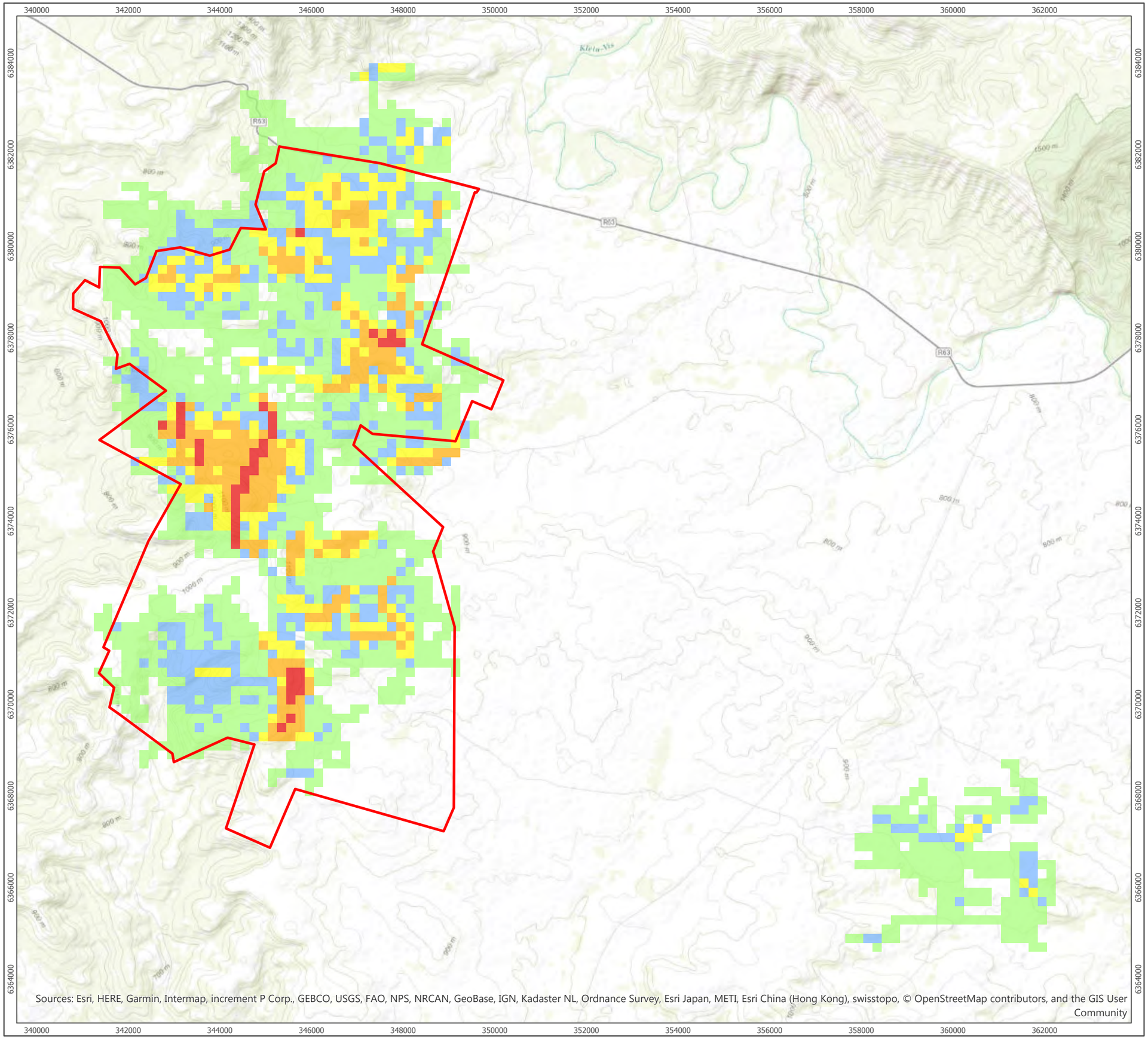
NORTH

Produced By: JA	Ref: 2705-REP-024
Checked By: AP	Date: 27/07/2018

Priority Species Incidental and Driven Transect Records
Figure 8

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

Z:\GIS\Projects\2705 Highlands WEF\2705 Highlands WEF\2705 Highlands WEF.aprx\Bird Fig 08



ARCUS

Development Boundary

GCSS Score

- Low (< 500)
- Medium (500 - 1250)
- Medium-High (1250 - 2500)
- High (2500 - 10000)
- Very High (> 10000)

1:80 000 Scale @ A3

0 1 2 km

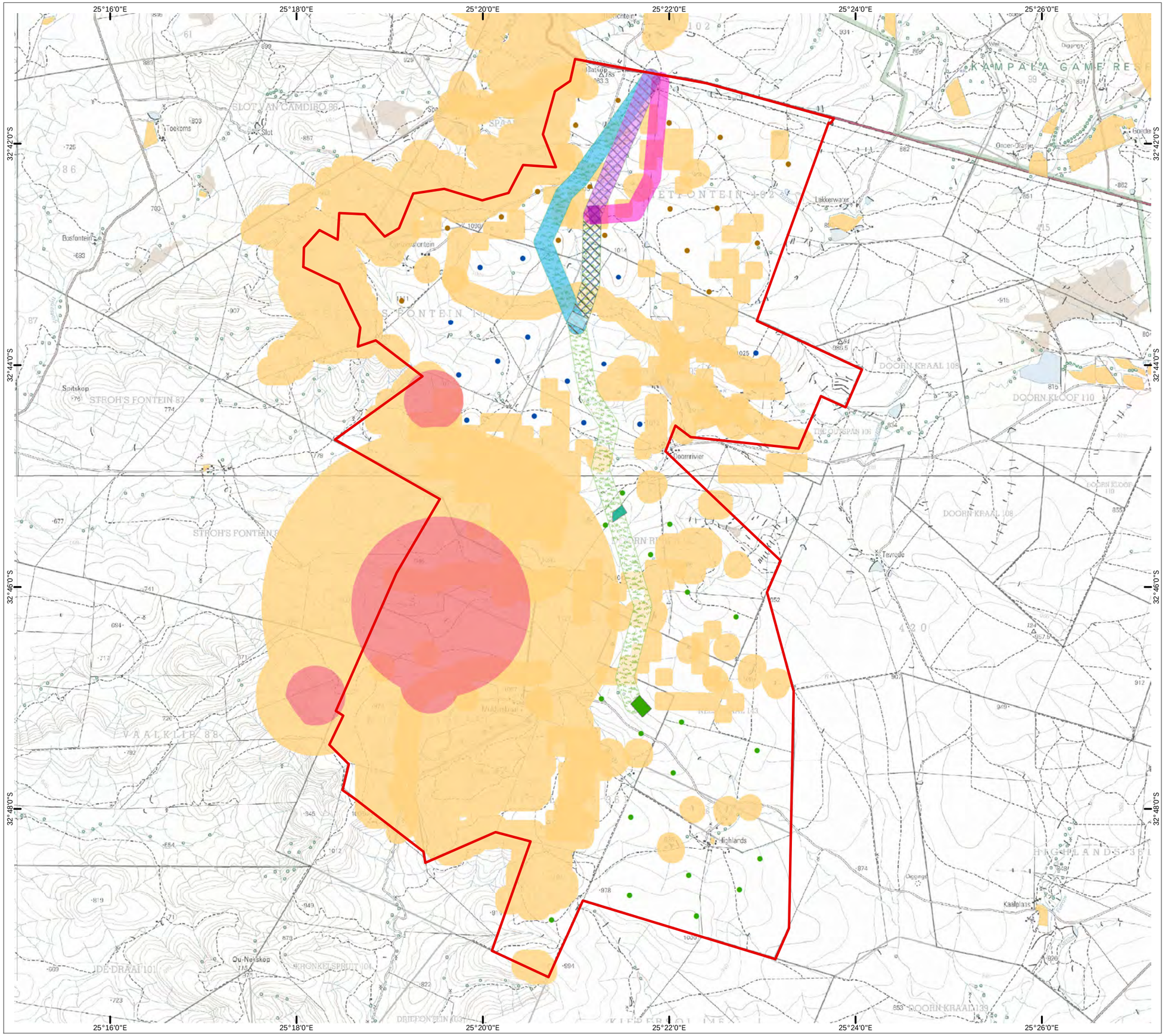
NORTH

Produced By: SC	Ref: 2705-REP-026
Checked By: AP	Date: 06/08/2018

Flight Sensitivity
Figure 9

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

C:\Users\JonathanA.ARCUS\Documents\ArcGIS\Packages\2705_Highlands_ORN_Report_B6D991AF-8A4E-4741-993D-0D42C41909B7\p20\2780 Highlands Wind Farm.aprx\2705-REP-024



Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Proposed Development Area
- No Go for Turbines Only
- No Go for all infrastructure
- Substation A
- North WEF Proposed Turbine Position
- North WEF Grid Alternative 1
- North WEF Grid Alternative 2
- Central WEF Proposed Turbine Position
- Substation B
- Central WEF Grid Alternative 1
- Central WEF Grid Alternative 2
- South WEF Proposed Turbine Position
- Substation C2
- Substation C1
- South WEF Grid Alternatives

1:72,642 Scale @ A3

N

0 1.5 3 km

Produced: AA Reviewed: SC Approved: AB	Ref: 2705/REP/025 Date: 08/08/2018

Combined Avifaunal Sensitivity
Figure 10

Highlands Wind Energy Facility
Pre-construction Bird Monitoring
Final Report and Impact Assessment

APPENDIX I: PRE-CONSTRUCTION MONITORING SEASONAL BIRD LIST

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Apalis, Bar-throated	*Apalis thoracica*				x	x	x	x	x	x	x	
Avocet, Pied	*Recurvirostra avosetta*				x						x	
Barbet, Acacia Pied	*Tricholaema leucomelas*				x	x	x	x	x	x	x	x
Barbet, Black-collared	*Lybius torquatus*						x					
Batis, Chinspot	*Batis molitor*				x	x	x	x	x	x	x	x
Batis, Pririt	*Batis pririt*				x	x	x		x			
Bokmakierie	*Telophorus zeylonus*				x	x	x	x	x	x	x	x
Boubou, Southern	*Laniarius ferrugineus*						x		x	x	x	
Bulbul, African Red-eyed	*Pycnonotus nigricans*				x	x	x	x	x	x	x	
Bulbul, Cape	*Pycnonotus capensis*		x				x	x	x	x		
Bulbul, Dark-capped	*Pycnonotus tricolor*				x		x					
Bunting, Cape	*Emberiza capensis*				x	x	x	x	x	x	x	x
Bunting, Cinnamon-breasted	*Emberiza tahapisi*				x	x		x	x	x		
Bunting, Golden-breasted	*Emberiza flaviventris*				x	x	x	x	x			
Bunting, Lark-like	*Emberiza impetuani*				x	x						
Bustard, Denham's	*Neotis denhami*	VU		300							x	
Bustard, Kori	*Ardeotis kori*	NT		260	x	x	x	x		x	x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Bustard, Ludwig's	*Neotis ludwigii*	EN		320	x	x	x	x	x	x	x	x
Buzzard, Jackal	*Buteo rufofuscus*		x	250	x		x	x	x	x	x	
Buzzard, Steppe	*Buteo buteo*			210					x	x	x	x
Canary, Black-headed	*Serinus alario*		x						x	x	x	
Canary, Brimstone	*Crithagra sulphurata*						x					
Canary, Cape	*Serinus canicollis*				x	x	x		x	x		
Canary, White-throated	*Crithagra albogularis*				x	x	x	x	x	x	x	
Canary, Yellow	*Crithagra flaviventris*				x	x	x	x	x	x	x	x
Canary, Yellow-fronted	*Crithagra mozambica*					x	x	x	x	x		
Chat, Ant-eating	*Myrmecocichla formicivora*				x	x	x	x	x	x	x	x
Chat, Familiar	*Cercomela familiaris*				x	x	x	x	x	x	x	x
Chat, Sickle-winged	*Cercomela sinuata*		x		x	x	x		x	x		
Cisticola, Cloud	*Cisticola textrix*		x						x	x	x	
Cisticola, Grey-backed	*Cisticola subruficapilla*				x	x	x	x	x	x	x	x
Cisticola, Zitting	*Cisticola juncidis*				x							
Cormorant, Reed	*Phalacrocorax africanus*				x	x		x				
Cormorant, White-breasted	*Phalacrocorax lucidus*				x	x					x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Crane, Blue	*Anthropoides paradiseus*	NT		320	x	x	x	x	x	x	x	x
Crombec, Long-billed	*Sylvietta rufescens*				x	x	x		x	x		
Crow, Cape	*Corvus capensis*				x	x	x	x	x	x	x	
Crow, Pied	*Corvus albus*				x	x	x	x	x	x	x	x
Cuckoo, Diederik	*Chrysococcyx caprius*								x	x	x	x
Cuckoo, Great Spotted	*Clamator glandarius*							x	x	x		
Cuckoo, Klaas's	*Chrysococcyx klaas*					x				x		
Dove, Cape Turtle	*Streptopelia capicola*				x	x	x	x	x	x	x	x
Dove, Laughing	*Streptopelia senegalensis*				x	x	x		x	x	x	x
Dove, Red-eyed	*Streptopelia semitorquata*				x	x			x	x	x	
Dove, Rock	*Columba livia*				x							
Drongo, Fork-tailed	*Dicrurus adsimilis*				x	x	x	x	x	x	x	x
Duck, Yellow-billed	*Anas undulata*				x	x	x	x	x	x	x	x
Eagle, African Fish	*Haliaeetus vocifer*			290	x		x		x		x	
Eagle, Black-chested Snake	*Circaetus pectoralis*			230			x				x	
Eagle, Booted	*Hieraaetus pennatus*			230			x		x		x	x
Eagle, Brown Snake	*Circaetus cinereus*			180							x	
Eagle, Martial	*Polemaetus bellicosus*	EN		350	x	x	x	x				

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Eagle, Verreauxs'	*Aquila verreauxii*	VU		360	x	x	x		x	x	x	
Falcon, Amur	*Falco amurensis*			210							x	x
Falcon, Lanner	*Falco biarmicus*	VU		300							x	
Firefinch, African	*Lagonosticta rubricata*						x					
Fiscal, Common	*Lanius collaris*				x	x	x	x	x	x	x	x
Flycatcher, Fairy	*Stenostira scita*		x				x					
Flycatcher, Fiscal	*Sigelus silens*		x		x	x	x	x	x	x	x	x
Francolin, Grey-winged	*Scleroptila africana*		x	190	x				x		x	
Goose, Egyptian	*Alopochen aegyptiaca*				x	x	x	x	x	x	x	x
Goose, Spur-winged	*Plectropterus gambensis*				x		x					
Goshawk, Gabar	*Melierax gabar*				x		x					
Goshawk, Pale Chanting	*Melierax canorus*			200	x	x	x	x	x	x	x	x
Grebe, Little	*Tachybaptus ruficollis*				x	x			x			
Greenbul, Sombre	*Andropadus importunus*				x		x		x	x	x	x
Greenshank, Common	*Tringa nebularia*										x	
Guineafowl, Helmeted	*Numida meleagris*				x		x	x	x	x	x	
Hamerkop	*Scopus umbretta*				x	x	x	x				
Harrier, Black	*Circus maurus*	EN	x	345	x		x					
Hawk, African Harrier-	*Polyboroides typus*			190	x		x	x	x		x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Heron, Black-headed	*Ardea melanocephala*				x	x	x		x	x		
Heron, Grey	*Ardea cinerea*				x		x		x		x	
Honeyguide, Greater	*Indicator indicator*								x	x		
Hoopoe, African	*Upupa africana*				x	x	x	x	x	x	x	x
Ibis, African Sacred	*Threskiornis aethiopicus*				x				x	x	x	
Ibis, Hadeda	*Bostrychia hagedash*				x	x	x	x	x	x	x	x
Kestrel, Lesser	*Falco naumanni*			214							x	
Kestrel, Rock	*Falco rupicolus*				x	x	x		x		x	x
Kingfisher, Brown-hooded	*Halcyon albiventris*				x		x		x		x	
Korhaan, Southern Black	*Afrotis afra*	VU	x	270	x		x	x	x	x	x	
Lapwing, Blacksmith	*Vanellus armatus*				x	x	x	x	x	x	x	
Lapwing, Crowned	*Vanellus coronatus*				x	x	x	x	x	x	x	x
Lark, Eastern Clapper	*Mirafra fasciolata*				x	x	x	x	x	x	x	x
Lark, Karoo Long-billed	*Certhilauda subcoronata*				x		x	x	x	x		
Lark, Large-billed	*Galerida magnirostris*		x		x	x	x	x	x	x	x	
Lark, Red-capped	*Calandrella cinerea*				x				x			
Lark, Rufous-naped	*Mirafra africana*						x	x	x	x	x	x
Lark, Spike-heeled	*Chersomanes albofasciata*				x	x	x	x	x	x	x	x

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Longclaw, Cape	*Macronyx capensis*				x		x		x	x	x	
Martin, Rock	*Hirundo fuligula*				x	x	x	x	x	x	x	x
Mousebird, Red-faced	*Urocolius indicus*				x	x	x		x	x	x	x
Mousebird, Speckled	*Colius striatus*				x	x	x	x	x	x		
Neddicky	*Cisticola fulvicapilla*				x	x	x	x	x	x	x	x
Oriole, Black-headed	*Oriolus larvatus*				x	x	x		x	x		
Ostrich, Common	*Struthio camelus*										x	
Owl, Spotted Eagle-	*Bubo africanus*			170	x							
Penduline-tit, Cape	*Anthoscopus minutus*				x	x		x	x	x		x
Petronia, Yellow-throated	*Gymnoris superciliaris*				x	x	x		x	x		
Pigeon, Speckled	*Columba guinea*				x	x	x	x	x	x	x	x
Pipit, African	*Anthus cinnamomeus*				x	x	x	x	x	x	x	x
Pipit, African Rock	*Anthus crenatus*	NT	x	200			x		x		x	
Pipit, Long-billed	*Anthus similis*							x				
Pipit, Plain-backed	*Anthus leucophrys*				x			x	x	x		
Plover, Three-banded	*Charadrius tricollaris*				x	x	x	x	x	x	x	
Prinia, Karoo	*Prinia maculosa*		x		x		x	x	x	x	x	x
Quail, Common	*Coturnix coturnix*				x		x		x		x	
Quail-finch, African	*Ortygospiza fuscocrissa*								x	x		
Quelea, Red-billed	*Quelea quelea*					x	x		x			
Raven, White-necked	*Corvus albicollis*				x	x	x	x	x	x	x	x

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Robin, Karoo Scrub	*Erythropygia coryphoeus*				x	x	x	x	x	x	x	x
Robin, White-browed Scrub	*Erythropygia leucophrys*				x		x		x			
Robin-chat, Cape	*Cossypha caffra*				x	x	x	x	x	x	x	x
Sandgrouse, Namaqua	*Pterocles namaqua*					x			x			
Secretarybird	*Sagittarius serpentarius*	VU		320	x		x		x	x	x	x
Seedeater, Streaky-headed	*Crithagra gularis*				x	x	x	x	x	x	x	x
Shelduck, South African	*Tadorna cana*				x	x	x		x		x	
Sparrow, Cape	*Passer melanurus*				x	x	x	x	x	x	x	x
Sparrow, Southern Grey-headed	*Passer diffusus*					x	x		x	x		
Spoonbill, African	*Platalea alba*				x	x	x	x	x	x	x	
Starling, Cape Glossy	*Lamprotornis nitens*				x	x	x	x	x	x	x	
Starling, Common	*Sturnus vulgaris*				x				x			
Starling, Pied	*Lamprotornis bicolor*		x		x	x	x	x	x	x	x	x
Starling, Red-winged	*Onychognathus morio*				x	x	x		x	x	x	x
Starling, Wattled	*Creatophora cinerea*								x			
Stilt, Black-winged	*Himantopus himantopus*				x	x	x	x	x			
Stint, Little	*Calidris minuta*										x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Stonechat, African	*Saxicola torquatus*				x	x	x	x	x	x	x	x
Stork, Black	*Ciconia nigra*	VU		330			x					
Stork, White	*Ciconia ciconia*			220							x	
Sunbird, Amethyst	*Chalcomitra amethystina*					x			x			
Sunbird, Dusky	*Cinnyris fuscus*				x				x			
Sunbird, Greater Double-collared	*Cinnyris afer*		x		x				x	x		
Sunbird, Malachite	*Nectarinia famosa*				x	x	x	x	x	x	x	x
Sunbird, Southern Double-collared	*Cinnyris chalybeus*		x		x	x	x		x	x		x
Swallow, Barn	*Hirundo rustica*				x				x	x	x	
Swallow, Greater Striped	*Cecropis cucullata*				x				x	x	x	x
Swallow, Pearl-breasted	*Hirundo dimidiata*								x			
Swallow, White-throated	*Hirundo albigularis*								x		x	x
Swift, African Black	*Apus barbatus*								x		x	
Swift, Alpine	*Tachymarptis melba*				x		x		x	x	x	x
Swift, Little	*Apus affinis*										x	
Swift, White-rumped	*Apus caffer*								x			
Teal, Cape	*Anas capensis*				x	x			x		x	
Thick-knee, Spotted	*Burhinus capensis*				x		x		x		x	x
Thrush, Cape Rock	*Monticola rupestris*		x		x		x		x			

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Thrush, Karoo	*Turdus smithi*		x					x				
Thrush, Olive	*Turdus olivaceus*					x			x	x		
Thrush, Short-toed Rock	*Monticola brevipes*						x					
Tinkerbird, Red-fronted	*Pogoniulus pusillus*							x	x	x		
Tit, Grey	*Parus afer*		x		x	x	x	x	x	x	x	
Tit, Southern Black	*Parus niger*				x	x	x		x			
Tit-Babbler, Chestnut-vented	*Sylvia subcaerulea*				x	x	x	x	x	x	x	
Turaco, Knysna	*Tauraco corythaix*		x		x							
Vulture, Cape	*Gyps coprotheres*	EN		405							x	
Wagtail, Cape	*Motacilla capensis*				x	x	x	x	x	x	x	x
Warbler, Rufous-eared	*Malcorus pectoralis*				x	x	x	x	x	x	x	x
Warbler, Willow	*Phylloscopus trochilus*										x	
Waxbill, Common	*Estrilda astrild*					x		x	x			
Weaver, Cape	*Ploceus capensis*		x		x			x	x	x	x	
Wheatear, Mountain	*Oenanthe monticola*						x		x			
White-eye, Cape	*Zosterops capensis*		x		x	x	x		x	x	x	x
Whydah, Pin-tailed	*Vidua macroura*								x	x	x	
Wood-hoopoe, Green	*Phoeniculus purpureus*				x		x		x			
Woodpecker, Cardinal	*Dendropicos fuscescens*				x	x	x	x		x	x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Woodpecker, Ground	*Geocolaptes olivaceus*		x						x		x	
Wryneck, Red-throated	*Jynx ruficollis*				x				x		x	

APPENDIX II: SPECIALIST DECLARATION AND CV

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Highlands Wind Energy Facilities and associated infrastructure including grid connection infrastructure

Specialist:	Arcus Consultancy Services South Africa (Pty) Ltd		
Contact person:	Andrew Pearson		
Postal address:	Office 220, Cube Workspace, Long Street cnr Hans Strijdom Avenue, Cape Town		
Postal code:	8001	Cell:	0725580080
Telephone:	0214121529	Fax:	
E-mail:	andrewp@arcusconsulting.co.za		
Professional affiliation(s) (if any)	SACNASP		

Project Consultant:	Arcus Consultancy Services South Africa (Pty) Ltd		
Contact person:	Anja Albertyn		
Postal address:	Office 220, Cube Workspace, Long Street cnr Hans Strijdom Avenue, Cape Town		
Postal code:	8001	Cell:	0762658933
Telephone:	0214121529	Fax:	
E-mail:	highlands@arcusconsulting.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, Andrew Pearson , declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Arcus Consultancy Services South Africa (Pty) Ltd

Name of company (if applicable):

29/08/2018

Date:

CURRICULUM VITAE

Andrew Pearson

Ecology Specialist (Avifauna)

Email: andrewp@arcusconsulting.co.za Tel: +27 (0) 21 412 1529

Specialisms

- Avifauna Impact Assessment
- Ecology
- Project Management
- Pre-construction Avifauna Monitoring
- Construction Phase and Operational Phase Avifauna Monitoring
- Survey Design and Management
- Environmental Management Process

Summary of Experience

Andrew is an Avifauna Specialist with over ten years of environmental management experience. He has worked as an avifaunal specialist for seven years. Andrew has gained a strong level of experience in avifauna assessments across a multitude of sectors, including various powerline assessments and walk-downs. To date, Andrew has provided avifaunal specialist services on over 40 solar, power line and wind farm projects in Southern Africa. Andrew provides specialist input into the design of projects and environmental management plans, assesses environmental due diligence and compliance with international environmental policies (World Bank, IFC, Equator Principles) and peer reviews avifaunal specialist reports. Andrew is a professional natural scientist registered with SACNASP, and is a selected member of the Birds and Renewable Energy Specialist Group (BARESG). Andrew has been bird watching for 27 years, has worked as a birding field guide in 2006 and 2007, and attended bird identification training at the Lawson's Birding Academy in 2007.

Professional History

January 2014 to Present - Avifauna Specialist, Arcus Consultancy Services Ltd:

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Design of high quality bird surveys in line with applicable guidance and legal requirements;
- Avifaunal and environmental due diligence and feasibility studies;
- Design and implementation of operational carcass search programme including the training and management of locally based observers; and
- Specialist raptor nest surveys.

March 2011 to December 2013 - Environmental Impact Assessment & Avifaunal Specialist, Endangered Wildlife Trust

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Extensive work in the Wind Energy Sector, often in partnership with Eskom, to reduce possible impacts on birds and bats;
- 12 month Bird Monitoring on WEF sites - compilation of monitoring protocol, recruitment, management and co-ordination of observers, on-site bird observation and compilation of final monitoring reports; and
- Presentations and Environmental Training.

January 2008 to March 2011 - Group Environmental Manager, Basil Read (Pty) Ltd

- Environmental management of roads and civil construction projects;
- Implementation and certification of an ISO 14001:2004 Environmental Management System;
- Group Internal Environmental Audits;
- Compilation of EMPs and Environmental site inspections;
- Assistance in ENV authorisations and applications;
- Environmental Awareness Training; and
- Compilation of Group Carbon Footprint.

February 2006 to January 2008 - Game Ranger and Walking Guide, CC Africa (now *&BEYOND*), Phinda Private Game Reserve

- Game drives and walks in a Big 5 reserve;
- Hosting guests and sharing environmental and wildlife knowledge; and

CURRICULUM VITAE

- Environmental management, waste management.

Qualifications and Professional Interests

- **University of Stellenbosch, 2005.**
  Bachelor of Science (Hons.): Conservation Ecology.
- August 2010 - Hazard Identification and Risk Assessment (HIRA) Course, IRCA Global.
- April 2010 - SAMTRAC, NOSA, East Rand Office.
- April 2009 - Green Star Accredited Professional Exam, (GBCSA), PROMETRIC.
- May 2008 - Environmental Auditing: ISO 14001:2004, Lead Auditors' Course (SAACTA approved), Centre for Environmental Management at North West University (NWU), Potchestroom.
- February 2008 - Environmental Law for Managers, Centre for Environmental Management at NWU.
- February 2008 - Implementing Environmental Management Systems - ISO 14001:2004, Centre for Environmental Management at NWU.
- August 2007 - Bird Identification Course, Lawson's Birding Academy, Intensive training in Makuleke, Kruger National Park.

Professional Membership

- South African Council for Natural Scientific Professions (SACNASP), "Ecological Science". Professional Natural Scientist (Pr. Sci. Nat.), Reg. no 400423/11.

Recent Conferences and Seminars

- Windaba 2013, 2014, 2015, 2016, 2017 and 2018; Solar Indaba 2013; Africa Utility Week 2014, 2015, 2016, 2017 and 2018.
- IAIA SA National Conference 2011, 2013 and 2016.
- March 2011 Endangered Wildlife Trust (EWT) Wildlife and Energy Symposium.

Additional Skills

- Liaison with farmers including fluency in Afrikaans.
- ArcGIS, Google GEO Tools and Google Earth.
- Computer Skills: Office 2013 including Microsoft Word, Excel, Outlook and PowerPoint.
- Field work skills involving various sampling methods, data capturing & analysis.
- Excellent knowledge of fauna (especially birds) and flora.
- 4x4 driving skills.

Project Experience

- **Due Diligence**
  Due Diligence of bird work conducted at the Kangnas WEF (ERM); Due Diligence of Bird Work conducted at the Excelsior WEF (ERM); Due Diligence of Bird Work conducted at the Golden Valley WEF (ERM); Due Diligence of Bird Work at the Roggeveld Wind Farm (IBIS Consulting).

- **Peer Review**
  Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm (Globeleq South Africa Management Services (Pty) Ltd); Review and design mitigation strategies for birds at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers).

- **Feasibility Studies**
  Highlands WEF Feasibility, Feasibility for a WEF site near Indwe, Feasibility for a WEF site near Sutterheim, Feasibility for a WEF site near Aberdeen, Feasibility for a WEF site near Poffadder, Feasibility for a WEF site near Putsonderwater, Feasibility for a WEF site near Kenhardt, Feasibility for a WEF site near DeAar (all WKN Windcurrent SA (Pty) Ltd); Prieska WEF Bird Feasibility; Langeberg WEF Bird Feasibility (both juwi Renewable Energies (Pty) Ltd).

- **Pre-Construction Monitoring and/or Impact Assessment (including amendments) - Wind Energy Facility (WEF) Projects:**
  Kouga WEF; Aberdeen WEF; Hidden Valley WEF (i.e Great Karoo WEF, Soetwater WEF); Middleton WEF; Springfontein WEF, Moorreesburg WEF; Grassridge WEF; Grassridge II WEF; Ukomeleza WEF; Chaba WEF; Waainek WEF; Vryheid WEF; Kouga Western Cluster WEF; Hopefield WEF; Spitskop East WEF; Spitskop West WEF; DNA Elliot WEF;

Confidential WEF near Elliot; Umsinde Emoyeni WEF; Komsberg East WEF; Komsberg West WEF; Gouda WEF; ZRN WEF; Sonop WEF; Universal WEF; Confidential WEF near Touws River; Kap Vley WEF; Highlands WEF; Putsonderwater WEF; and Haga Haga WEF

- **Operational Monitoring - WEF Projects:**
  Hopefield WEF; Gouda WEF; Aurora West Coast 1 WEF.

- **Impact Assessment - Powerline Projects:**
  St Francis Bay Kouga 66kV; Ncwane Okuku 88kV; Vulcan Ekangala 132kV; Merapi Everest 400kV; Mathibestad Majaneng 132kV; Majaneng Themba Main-Babelegi 132kV; Ngoma Pandamatenga 400kV (ZIZABONA Phase 2); Estancia Thuli 132kV; Estancia Zamokuhle 132kV; Gumeni Bosloop 132kV; Mbumbu Tsakani 132kV; Normandie Heyshope 132kV; Mookodi Integration Project; Wildebees Bethal 132kV; Zaaifontein Mathondwane 88kV; Hlabisa Nongoma 88kV; Mandeni Gingindlovu 132kV; Tabor Nzhelele 400kV; Leksand St James 88kV; Emondlo St James 88kV; Randfontein Mine 132kV; Droogfontein CSP 132kV; Mtubatuba St Lucia 132kV; Ndumo Gezisa 132kV; Ermelo Uitkoms 88kV; TCTA Spring Grove 88kV; Springfontein 132kV.

- **Pre-construction Monitoring and/or Impact Assessment - Concentrated Solar Power (CSP) Plants and Solar Photovoltaic (PV) Plants:**
  Humansrus 100MW CSP; Arriesfontein 100MW CSP; Arriesfontein 225MW PV; Eenzaamheid PV; Vaal Dam PV; Mokopole PV; Kalkaar CSP and PV; Droogfontein PV; Bokpoort II CSP; Metsimatala CSP; Redstone CSP Solar PV Extension; Robben Island PV Plant.

- **Other:**
  Expansion of Hendrina Power Station Ash Disposal Facilities; Expansion of Majuba Power Station Ash Disposal Facilities; Expansion of Tutuka Power Station Ash Disposal Facilities; Eskom Distribution Cedarville Upgrade; Eskom Limpopo Operating Unit (LOU) Head Office, Polokwane; and Trekoskraal Housing Development.

Arcus Consulting Services
Office 211 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

3 August 2018

RE: AVIFAUNAL PEER REVIEW OF THE AVIFAUNAL IMPACT ASSESSMENT REPORT FOR THE HIGHLANDS WIND FARM PROJECT.

To whom it may concern,

WildSkies Ecological Services (Pty) Ltd was appointed by Arcus to conduct a peer review of the study entitled: "Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report".

The terms of reference for this review are below. We have studied the report and engaged verbally with the author Andrew Pearson on any minor points of clarification. Our findings are as follows, reported on relative to each of the terms of reference.

1. If the specialist is qualified and experienced enough to have authored the report

The avifaunal specialist (Andrew Pearson) is certainly qualified and sufficiently experienced to conduct this assessment. Mr Pearson has >5 years avifaunal consulting experience, at least two years of which involved Andrew working closely with me whilst we were both employed by the Endangered Wildlife Trust. Andrew is a competent and very thorough avifaunal specialist.

2. Is the report in line with the applicable guidelines.

The report is in line with the applicable guidelines. The applicable guidelines are the:

- "BirdLife South Africa/Endangered Wildlife Trust Birds and Wind-Energy Best-Practice Guidelines – Best practice guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa, Third Edition, 2015" by Jenkins, van Rooyen, Smallie, Harrison, Diamond, Smit-Robinson and Ralston; and

C: 082 444 8919 | F: 086 6155654 | Email: jon@wildskies.co.za | W: www.wildskies.co.za
36 Utrecht Avenue, Bonnie Doon, East London, 5241
WildSkies Ecological Services (Pty) Ltd | Reg: 2011/131435/07 | VAT: 4340260779

- The "Verreaux's Eagle and Wind Farms: Guidelines for impact assessment, monitoring and mitigation" by BirdLife South Africa (2017).

This study conforms to both sets of guidelines.

3. If the effort was suitable and efficient etc.

Overall, the survey scope is suitable and adequate. More specific feedback is provided relative to each of the main forms of data collection prescribed by Jenkins *et al* (2015):

- Vantage Points. The coverage of the developable area is adequate.
- Walked transects. While the number of walked transects conducted on site is relatively low in our view for a site of this size, it is acceptable as the four transect used cover all important bird habitats (of which there are relatively few on the site). The relatively low geographic coverage is offset somewhat by repeating transects twice in each season.
- Drive transects. The number and length of transects are acceptable. The repetition of each transect twice in each season is excellent.
- Incidental observations. It is not possible to evaluate this in terms of effort as it is site specific.
- Focal sites. This is determined by need so not possible to evaluate this.
- Nest surveys. The study has conducted a very thorough survey of available nesting substrate on site, and provides high confidence in the status quo with respect to sensitive species breeding.

4. Agreement with methodology and presentation of findings

We confirm that we agree with the methodology and presentation of findings.

5. Based on the data if you are in agreement with the impact ratings and findings of the report etc

Overall, the impact ratings and findings are acceptable in our view. The various options of either north, south or central phases alone or a combination thereof does make for complex reading. In some cases the significance of impacts does not increase for a consequent increase in number of turbines, but we understand that this probably due to the categorical approach to impact rating, whereby the increase may not be sufficient to warrant an increase from Medium to High for example. The impact criteria used (Hacking, 2001) calculates the significance as a category either low/med/high, based on various factors including severity, duration, extent and probability. While an increase in number of turbines may change one or two of these factors, this does not always result in a step up in category regarding the significance, for example from Medium to High.

6. Additional suggestions if any

We have the following suggestions:

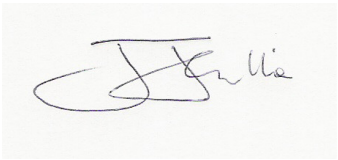
- We support the recommendation in the 'Conclusion' that two Verreaux's Eagles be fitted with GPS trackers, but recommend this also be repeated elsewhere in the report under mitigation measures so that it is not missed by anyone extracting listed mitigation from the tables.

7. Agreement that the work was conducted fairly and independently

Our impression is that the work was conducted both fairly and independently.

Thank-you for the opportunity to review this work. Please don't hesitate to contact us if you have any further questions.

Kind regards



Jon Smallie

C: 082 444 8919 | F: 086 6155654 | Email: jon@wildskies.co.za | W: www.wildskies.co.za
36 Utrecht Avenue, Bonnie Doon, East London, 5241
WildSkies Ecological Services (Pty) Ltd | Reg: 2011/131435/07 | VAT: 4340260779