Latrodex Wind Farm

Latrodex (Pty) Ltd

Avifaunal Impact Assessment

April 2021 – full report

February 2022 – updated only for amended turbine model & grid connection

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Experience: 20 years of conservation & consulting
Curriculum vitae attached – Appendix 6.

I, Jon Smallie, as the appointed avifaunal specialist, hereby declare/affirm the correctness of the information provided in this report, and that I meet the general requirements to be independent and have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and I am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).

April 2021

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*;	Appendix 6
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Attached
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 & 2
an indication of the quality and age of base data used for the specialist report;	Section 1 & 2
a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1 & 2
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1 & 2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1 & 2
(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;	Section 1 & 2
(g) an identification of any areas to be avoided, including buffers;	Section 2.9
(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;	Section 2.9
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.10
(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;	Section 4 & 5
(k) any mitigation measures for inclusion in the EMPr;	Section 4
(l) any conditions for inclusion in the environmental authorisation;	Section 4
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 4
(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;	Section 5
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(p) any other information requested by the competent authority	N/A
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.	

Executive summary

Wild Coast Abalones (WCA) is proposing to develop a wind farm approximately 1km north of Marshstrand in the Eastern Cape. The facility will consist of 5 turbines of 3MW installed capacity each. In accordance with the best practice guidelines for wind energy and birds (Jenkins *et al*, 2015) WCA conducted twelve months of pre-construction bird monitoring on site in order to gather the data necessary to conduct an avifaunal impact assessment. WildSkies Ecological Services was contracted by EOH-CES for this purpose.

We make the following conclusions regarding the avifaunal community and potential impacts of the Latrodex Wind Farm:

- At a national level the proposed site is Low sensitivity in our judgement. On site itself, no sensitive areas exist on the proposed footprint, the only sensitivities being off site to the north and site.
- We classified two bird species as being at high risk for this assessment. These are: Jackal Buzzard, and Yellow-billed Kite.
- We calculated crude predicted bird species fatality rates through turbine collision. These are very low in our view (0.4156 fatalities per annum of all priority species collectively, including most importantly 0.2124 Jackal Buzzard fatalities per annum).

We make the following findings with respect to impact significance for avifauna, according to the formal impact assessment methods provided by CES.

Impact	Pre-mitigation	Post-mitigation
Construction Phase		
Habitat destruction	Low Negative	Low Negative
Disturbance	Low Negative	Low Negative
Operational Phase		
Disturbance	Low Negative	Low Negative
Displacement	Low Negative	Low Negative
Turbine collisions	Low Negative	Low Negative
Power line Collision & Electrocution	Moderate Negative	Low Negative
Decommissioning Phase		
Disturbance	Low Negative	Low Negative

We recommend the following mitigation measures be applied to manage and reduce the significance of impacts on birds:

- No changes to the current turbine positions should be made without consulting the specialist.

- A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- A post construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled.
- Given that the impact of bird collision with turbines could occur once the wind farm is operational and require mitigation, we recommend strongly that an appropriate mitigation budget be provided for by the Applicant. At this stage it is not possible to determine what mitigation may be appropriate, and in the time between writing this report and the mitigation need arising (likely several years) new mitigation methods may be developed. However if such a need arises and suitable mitigation is identified it cannot be argued by the wind farm operator that mitigation was not budgeted for. Mitigation could cost the operator either in the form of additional costs or lost productivity as a result of changes to turbine operations. We have suggested a budget for this aspect in this report. It is also important that the developer be aware that mitigation measures may require the installation of equipment on turbines, or possibly the painting of blades. Potential technical and warrantee challenges should be noted where possible throughout the planning process so that they do not prevent the implementation of reasonable mitigation if required.
- Internal power line must be placed underground.
- Overhead conductors or earth wires on the grid connection power line should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.
- The pole/pylon design on the grid connection power line must be a bird friendly design.
- A post construction monitoring programme in accordance with the latest available version of the best practice guidelines at the time must be implemented for a minimum of two years, but longer if impacts on Red Listed species occur. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels.

It is our professional opinion that if the recommendations contained in this report are adhered to, this project should be allowed to proceed.

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1. Introduction

Wild Coast Abalones (WCA) is proposing to develop a wind farm approximately 1km north of Marshstrand in the Eastern Cape. The facility will consist of 5 turbines of 3MW installed capacity each. In accordance with the best practice guidelines for wind energy and birds (Jenkins *et al*, 2015) WCA conducted twelve months of pre-construction bird monitoring on site in order to gather the data necessary to conduct an avifaunal impact assessment. WildSkies Ecological Services was contracted by EOH-CES for this purpose. This assessment was completed in April 2021. In February 2022 a minor update was made to change the turbine model from 2MW to 3MW and to include the grid connection. No further data collection, field work or consultation of available information sources was conducted for this update.

The layout of the project is shown in Figure 1.

Figure 1. The layout of the Latrodex Wind Farm (LWF). Turbine positions are shown as 1,2,3,4 & 5.

1.1 Project description

The 15MW wind farm will consist of 5 x 3MW wind turbines. The proposed turbine model has a hub height of 80 to 105m and a rotor diameter of 90m. This means that all inclusive rotor swept area for our assessment will extend from 35 to 150m above the ground.

The wind turbine is made up of a tower, a nacelle and rotor blades. When the wind blows, the rotor blades rotate. The generator then converts the movement into electricity, which can then be transmitted for use. The energy created is considered renewable as it is a non-consumptive use of a natural resource.

Other infrastructure associated with the proposed WEF will be:

- Concrete foundations to support the wind towers;
- Access roads to each turbine;
- Underground cables connecting each turbine to the other and to the mini substation;
- Control room and maintenance facilities; and
- An onsite mini substation to facilitate interconnection of the WEF with the Wild Coast Abalone Facility and/or Eskom grid.
- A grid connection power line of less than 33kV to the existing Rivermouth Substation at Morgan Bay.

1.2 Background to wind farms & birds

The first documented interaction between birds and wind farms was that of birds killed through collisions with turbines, dating back to the 1970s. Certain sites in particular, such as Altamont Pass – California, and Tarifa – Spain, killed many birds and focused attention on the issue. However as the research developed it appears that sites such as these are the exception rather than the rule, with most facilities causing much lower fatality rates (Kingsley & Whittam, 2005; Rydell *et al* 2012; Rydell *et al*, 2017; Ralston-Paton *et al* 2017; Perold *et al*, 2020). Impacts have so far proven to differ significantly between sites (Bose *et al.* 2018; Ralston-Paton *et al.* 2017; Thaxter *et al*. 2017).

With time it became apparent that there are actually four ways in which birds can be affected by wind farms: 1) collisions – which are a direct mortality factor; 2) habitat alteration or destruction (less direct); 3) disturbance – particularly whilst breeding; and 4) displacement/barrier effects (various authors including Rydell *et al* 2012; Rydell *et al*, 2017). Whilst the impacts of habitat alteration and disturbance are probably fairly similar to that associated with other forms of development, collision and displacement/barrier effects are unique to wind energy.

Associated infrastructure such as overhead power lines also have the potential to impact on birds. For example they pose a collision and possibly electrocution threat to certain bird species.

1.2.1. Collision of birds with turbine blades

Without doubt the impact of bird collision with turbines has received the most attention to date amongst researchers, operators, conservationists, and the public (Dwyer *et al.* 2018; Bose *et al.* 2018; Thaxter *et al.* 2017; Vasiliakis *et al.* 2017, Ralston Paton *et al*. 2017). The two most common measures for collision fatality data used to date are, the number of birds killed per turbine per year, and number of birds killed per megawatt installed per year. Rydell *et al* (2012) reviewed studies from 31 wind farms in Europe and

28 in North America and found a range between 0 and 60 birds killed per turbine per year, with a median of 2.3. European average bird fatality rates were much higher at 6.5 birds per turbine per year compared to the 1.6 for North America. These figures include an adjustment for detection (the efficiency with which monitors detect carcasses in different conditions) and scavenger bias (the rate at which birds are removed by scavengers between searches). These are important biases which must be accounted for in any study of mortality.

In South Africa, Ralston-Paton, Smallie, Pearson & Ramalho (2017) reviewed the results of operational phase bird monitoring at 8 wind farms ranging in size from 9 to 66 turbines and totalling 294 turbines (or 625MW). Turbine hub height ranged from 80 to 115m (mean of 87.8m) and rotor diameter from 88 to 113m (mean of 102.4m). The estimated fatality rate at the wind farms (adjusted for detection rates and scavenger removal) ranged from 2.06 to 8.95 birds per turbine per year. The mean fatality rate was 4.1 birds per turbine per year. This places South Africa within the range of fatality rates that have been reported for North America and Europe.

The composition of the South African bird turbine collision fatalities by family group was as follows: Unknown 5%; Waterfowl 3%; Water birds other 2%; Cormorants & Darters 1%; Shorebirds, Lapwings and gulls 2%; Large terrestrial birds 2%; Gamebirds 4%; Flufftails & coots 2%; Songbirds 26%; Swifts, swallows & martins 12%; Pigeons & doves 2%; Barbets, mousebirds & cuckoo's 1%; Ravens & crows 1%; Owls 1%; and Diurnal raptors 36%. Threatened species killed by turbine collision included Verreaux's Eagle *Aquila verreauxii* (5 - Vulnerable), Martial Eagle *Polemaetus bellicosus* (2 - Endangered), Black Harrier *Circus maurus* (5 - Endangered), and Blue Crane *Grus paradisea* (3 – Near-threatened). Although not Red Listed, a large number of Jackal Buzzard *Buteo rufofuscus* fatalities (24) were also reported.

Ralston-Paton *et al's* review included the first year of operational monitoring at the first 8 facilities. A more recent review was conducted by Perold *et al* (2020) of the bird fatality data across 20 operational wind farms between 2014 and 2018. The overall adjusted fatality rate was 4.6 birds/turbine/year. Thirty families and 130 bird species were affected. Diurnal raptors were killed most often (36% of carcasses, 23 species) followed by passerines (30%, 49 species), waterbirds (11%, 24 species), swifts (9%, six species), large terrestrial birds (5%, 10 species), pigeons (4%, six species) and other near passerines (1%, seven species). The species of most conservation concern killed include endangered Cape Vultures and Black Harriers, both of which are endemic to southern Africa.

1.2.2. Loss or alteration of habitat during construction

During the construction of wind farms and associated infrastructure, 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 (including associated battery storage facility), development of laydown areas and turbine bases. This 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). The area of land directly affected by a wind farm and associated infrastructure is often relatively small when compared with the extent of the site. Typically, actual habitat loss is between 2 and 5 % of the total development area (Drewitt & Langston 2006). As a result, in most cases habitat destruction or alteration in its simplest form (removal of natural vegetation) is unlikely to be of great significance for many bird species. However, fragmentation of habitat can be an important factor for some smaller bird species. Construction and operation of a wind farm results in an influx of human activity to areas often previously relatively uninhabited (Kuvlesky *et al* 2007), which is not necessarily the case at the Latrodex site since it is close to other human activities and already subject to high disturbance levels. Birds are aerial species, spending much of their time above the ground. It is therefore important to consider this when assessing the amount of habitat destroyed.

Ralston-Paton *et al* (2017) did not review habitat destruction or alteration. From our own work to date, we have recorded a range of habitat destruction on 6 wind farms from 0.6 to 4% (mean of 2.4%) of the total site area (defined by a polygon drawn around the outermost turbines and other infrastructure) and 6.9 to 48.1ha (mean of 27.8ha) of aerial space.

1.2.3. Disturbance of birds

Activities associated with construction of wind farms (including: heavy machinery, earth moving, vehicle and staff traffic) can disturb birds in the receiving environment (Dwyer *et al*, 2018; Tarr *et al*. 2016; Ledec *et al.* 2011). Disturbance effects can occur at differing levels and have variable levels of effect on bird species, depending on their sensitivity to disturbance and whether they are breeding or not. For smaller bird species, with smaller territories, disturbance may be absolute and the birds may be forced to move away and find alternative territories, with secondary impacts such as increased competition. For larger bird species, many of which are typically the subject of concern for wind farms, larger territories mean that they are less likely to be entirely displaced from their territory. For these birds, disturbance is probably likely to be significant only when breeding. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of the nest site.

Ralston-Paton *et al* (2017) found no conclusive evidence of disturbance of birds at the sites reviewed. It may be premature to draw this conclusion after only one year as effects are likely to vary with time (Stewart *et al*, 2007) and statistical analysis was not as in depth as desired. At this stage in the industry, a simplistic view of disturbance has been applied whereby the presence or absence of active breeding at breeding sites of key species is used as the basis for findings.

1.2.4. Displacement & barrier effects

A barrier effect occurs when a wind energy facility acts as a barrier for birds in flight, which then avoid the obstacle and fly around it. This can reduce the collision risk, but will also increase the distance that the bird must fly. This has consequences for the birds' energy balance. Obviously the scale of this effect can vary hugely and depends on the scale of the facility, the species territory and movement patterns and the species reaction. Displacement occurs when birds leave an area due to the disturbance or habitat destruction that has taken place there (Dwyer *et al*, 2018).

Ralston-Paton *et al* (2017) reported that little conclusive evidence for displacement of any species was reported for the 8 wind farms in South Africa, although once again this is an early and possibly simplistic conclusion.

1.2.5. Associated infrastructure

Infrastructure associated with wind energy facilities also has the potential to impact on birds, in some cases more than the turbines themselves. Overhead power lines pose a collision and possible electrocution threat to certain bird species (depending on the pole top configuration). Furthermore, the construction and maintenance of the power lines will result in some disturbance and habitat destruction. New access roads, substations (including associated battery storage facility) and offices constructed will also have a disturbance and habitat destruction impact.

Collision with power lines is one of the biggest single threats facing birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are also considered threatened in southern Africa. The Red List species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions.

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). The larger bird species (such as eagles) are most affected since they are most capable of bridging critical clearances on hardware.

Ralston-Paton *et al* (2017) did not review power line impacts at the 8 sites.

1.2.6. Mitigation

Potential mitigation measures for bird turbine collision include: increasing turbine visibility (for example through painting turbine blades; restriction of turbine operation during high risk periods; automated turbine shutdown on demand; human based turbine shutdown on demand; bird deterrents – both audible and visual; habitat management; habitat management; and offsets). Most of these suggested mitigation measures are largely untested in South Africa. For any mitigation to be undertaken during operation, budget will need to be available. This report strongly recommends that the wind farm operator make provision for a mitigation contingency budget so that if issues are encountered during operation, the best-suited and proven mitigation at that point in time can be implemented. This is discussed further in Section 4.

Mitigation for habitat destruction consists typically of avoiding sensitive habitats during layout planning. A certain amount of habitat destruction is unavoidable.

For disturbance, mitigation takes the form of allowing sufficient spatial and temporal protection for breeding sites of sensitive species.

Mitigation of power line impacts is relatively well understood and effective, and is described in more detail later in this report.

The primary means of mitigating bird impacts therefore remains correct siting, both of the entire facility, and of the individual turbines themselves.

1.2.7. Contextualising wind energy impacts on birds

Several authors have compared causes of mortality of birds (American Bird Conservancy, 2012; Sibley Guides, 2012; National Shooting Sports Foundation 2012; Drewitt & Langston 2008) in order to contextualise possible mortality at wind farms. In most of these studies, apart from habitat destruction which is the number one threat to birds (although not a direct mortality factor) the top killers are collision with building windows and cats. Overhead power lines rank fairly high up, and wind turbines only far lower down the ranking. These studies typically cite absolute number of deaths and rarely acknowledge the numerous biases in this data. For example a bird that collides with a high-rise building window falls to a pavement and is found by a passer-by, whereas a bird colliding with a wind turbine falls to the ground which is covered in vegetation and seldom passed by anyone. Other biases include: the number of windows; kilometres of power line; or cats which are available to cause the demise of a bird, compared to the number of wind turbines. Biases aside the most important short coming of these studies is a failure to recognise the difference in species affected by the different infrastructure. Species such as those of concern at wind farms, and particularly Red List species in South Africa are unlikely to frequent tall buildings or to be caught by cats. Since many of these bird species are already struggling to maintain sustainable populations, we should be striving to avoid all additional, new and preventable impacts on these species, and not permitting these impacts simply because they are smaller than those anthropogenic impacts already in existence.

1.3 Relevant legislation & conventions

The legislation relevant to this specialist field and development include the following:

The *Convention on Biological Diversity (CBD):* dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory to this convention and should therefore abide by its’ principles.

An important principle encompassed by the CBD is the *precautionary principle* which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will *not* occur lies with the proponent of the activity posing the threat.

The *Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention):* aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is 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. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.

The *Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA):* is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.

The *National Environmental Management – Biodiversity Act - Threatened or Protected Species list (TOPS).*

The Provincial Nature Conservation Ordinance (*Nature Conservation Ordinance 19 of 1974*) identifies very few bird species as endangered, none of which are relevant to this study. Protected status is accorded to all wild bird species, except for a list of approximately 12 small passerine species, all corvids (crows and ravens) and all Mousebirds.

The *Civil Aviation Authority* has certain requirements regarding the visibility of wind turbines to aircraft. It is our understanding that these may preclude certain mitigation measures for bird collisions, such as the painting of turbine blades in different colours.

The *National Environmental Management Act*, No. 107 of 1998 (NEMA as amended): An Environmental Authorisation is required for Listed Activities in Regulations pursuant to NEMA The avifaunal assessment feeds into the Scoping and EIA process to inform whether the project can proceed or not.

The Department of Environmental Affairs *“Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24 (5)(a) and (h) and 44 of the National*

Environment Management Act, 1998, when applying for environmental authorisation". These procedures and the accompanying guideline are applicable to this proposed project.

2. Methodology

2.1 Terms of reference

The best practice guidelines for birds and wind energy (Jenkins *et al*, 2015) state the following:

"It is therefore recommended that these guidelines be applied to all WEFs that require environmental authorisation for electricity generation. The extent of monitoring required (for example number of vantage points and transects) would, however, be influenced by the size of the project. For smaller facilities (fewer turbines), an avifaunal specialist must therefore be consulted to determine the scope of the assessment necessary. In these cases, the level of monitoring required should be dictated by the complexity and sensitivity of the receiving environment (e.g. conservation Priority of species potentially affected). "

We believe that the scope of monitoring employed at the Latrodex site is suitable for the size and sensitivity of the project.

We have conducted this assessment according to typical terms of reference for a study of this type. These include:

- Specialists shall undertake all necessary data collection and fieldwork necessary to assess the project and meet the requirements of Appendix 6 to the EIA Regulations (as amended) including, but not limited to:
- A detailed baseline description of the receiving environment in and surrounding the site, including a description of key no go areas or features or other sensitive areas to be avoided.
- A description of all methodology and processes used to source information, collect baseline data, generate models and the age or season when the data was collected. A description of any assumptions made and any uncertainties or gaps in knowledge.
- A description of relevant legal matters, policies, standards and guidelines.
- A list of potentially significant environmental impacts that may arise in the construction, operation and decommissioning phases of the project, including cumulative impacts
- A detailed impact assessment of each impact including:
- A pre-mitigation and post-mitigation impact assessment description which will be summarised using the supplied table.
- A list of essential mitigation measures and management interventions

- A cumulative impact assessment. The cumulative impact of the proposed wind farm should be assessed (and any other wind farms in 30km – of which there are presently none).
- An assessment of the "No go" alternative.
- A summary table of all the impacts must be included and must show the post-mitigation significance ratings.
- Specialist to provide a discussion on the overall impact and a reasoned opinion as to whether the proposed activity or portions of the activity can be authorised. Provide additional recommendations regarding avoidance, management, or mitigation measures for consideration in a layout revision or inclusion into the EMPr (i.e. monitoring requirements).
- Any other information the specialist believes to be important, including recommendations that should be included as conditions in the Environmental Authorisation.

More detail on the aims of the specific data collection activities is provided below under the relevant sections.

2.2 National Environmental Screening Tool

We consulted the Department of Environment Forestry and Fisheries (DEFF) Screening tool for Latrodex Wind Farm site. The screening tool identified the site as Low sensitivity from an avifaunal perspective – under the 'Avian Theme'. Under the 'Animal Theme' – which was classed as High sensitivity, the following bird species are noted: African Marsh-Harrier *Circus ranivorus*; Denham's Bustard *Neotis denhamii*; Knysna Woodpecker *Campethera notata*; Mangrove Kingfisher *Halcyon senegaloides*; and Knysna Warbler *Bradypterus sylvaticus*.

Our own work confirms that the site is of Low sensitivity for avifauna – see Section 3.5. Of the above listed species we confirmed only Denham's Bustard on site. The remaining species could possibly occur close to site but not on site itself due to a lack of suitable habitat. One exception is Knysna Warbler which has suitable habitat on site. We did not record this species ourselves but do think there is a possibility of it occurring on site from time to time.

As per the Government Notice 320, gazetted on 20 March 2020, this project is not subject to an avifaunal assessment protocol (since it is onshore wind of <20MW).

2.3 General approach

The general approach to this study was as follows:

- A preliminary site survey was conducted on site by the specialist in June 2019. This was done by driving and walking as much of the site as possible.

- A pre-construction bird monitoring programme was designed for the site by the specialist and implemented by the specialist between June 2019 and June 2020. Each seasonal site visit consisted of 2 consecutive days on site by the specialist, to record data on bird species and abundance on and near site. These seasonal site visits covered: summer (when summer migrants are present); winter (when raptors breed); spring (when summer migrants are arriving on site and many species start to breed; and autumn (when summer migrants are leaving and many raptors are preparing to breed). We believe this sampling is sufficient to capture data representative of conditions on site. Pre-construction bird monitoring complies with the general best practice guidelines (Jenkins *et al*, 2015). The detailed methods employed by this pre-construction monitoring are described in Section 2.6.

2.4 Data sources consulted for this study

Various existing data sources have been used in the design and implementation of this study, including the following:

- The pre-construction bird monitoring raw data and progress reports.
- The data captured by specialist site visits.
- The Southern African Bird Atlas Project data (SABAP1 - Harrison *et al*, 1997) for the relevant quarter degree squares covering the site, and the Southern African Bird Atlas Project 2 data, available at the pentad level (http://sabap2.adu.org.za/v1/index.php)(accessed at www.mybirdpatch.adu.org.za))
- The conservation status of all relevant bird species was determined using Taylor *et al* (2015) & IUCN 2021.
- The vegetation classification of South Africa (Mucina & Rutherford, 2006) was consulted in order to determine which vegetation types occur on site.
- Aerial photography from the Surveyor General was used for planning purposes.
- The 'Avian Wind Farm Sensitivity Map: Criteria and procedures used (Retief *et al,* 2011, update 2014).
- The Important Bird & Biodiversity Areas programme was consulted (Marnewick *et al*, 2015). The closest IBA is approximately 70km north-west of site (Amatole Katberg Mountain IBA). This was judged to be too far to be relevant.
- Two review reports entitled "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 Wind Farms in South Africa" (Ralston-Paton, Smallie, Pearson, & Ramalho, 2017) and "On a collision course? The large diversity of birds killed by wind turbines in South Africa" (Perold, Ralston-Paton & Ryan 2020) were consulted extensively.

- Coordinated Avifaunal Road count data for the area (accessed at www.car.adu.org.za) was consulted. The closest route is approximately 40km to the north-west of site and too far to be relevant.
- Coordinated Wetland bird count data (CWAC) was consulted to obtain information on waterbird abundance in the area. The closest CWAC site is approximately 80km south-west of site.
- The "Best practice guidelines for assessing and monitoring the impact of wind energy facilities on birds in southern Africa" Unpublished guidelines by BirdLife South Africa & Endangered Wildlife Trust (Jenkins *et al*, 2015).
- The Latrodex site does not fall within in a Renewable Energy Development Zone 1 or 2 (www.redz.csir.co.za) or within one of the Transmission Grid Corridors.
- Available published literature on wind energy – bird interactions .
- The EIA and avifaunal reports for the proposed Haga Haga Wind Farm (Terramanzi, 2018; Arcus, 2018) was consulted for background information and for the cumulative impact assessment.

2.5 Explanation of terminology used

The following terms are used in this study:

Red Listed – regionally	The latest regional conservation status for the species as per Taylor *et al,* 2015
Red Listed – globally	The latest global conservation status for the species as per IUCN (2019)
Priority Species	Priority species in this context are those that this study focuses on in more detail
Endemic/near	Southern African endemics as taken from BirdLife South Africa Checklist 2018
kV	Kilovolt (1000 volts)
EN	Endangered
VU	Vulnerable
NT	Near-threatened
LC	Least concern

2.6 Baseline data collection

The following sections describe the formal data collection activities on site. Figure 2 shows the layout of these monitoring activities on site and on the control site.

2.6.1. Sample counts of small terrestrial species

Although not traditionally the focus of wind farm–bird studies and literature, small terrestrial birds are an important component of this programme. Due to the rarity of many of our threatened bird species, it is anticipated that statistically significant trends in abundance and density may be difficult to observe for these species. More common, similar species could provide early evidence for trends and point towards the need for more detailed future study. Given the large spatial scale of most wind farms, these smaller species may also be particularly vulnerable to displacement and habitat level effects. Sampling these species is aimed at establishing indices of abundance for small terrestrial birds in the study area. These counts should be done when conditions are optimal. In this case this means the times when birds are most active and vocal, i.e. early mornings. Six walked transects (WT) of approximately 500m length each were established on the site. These were each counted once on each site visit. For more details see Jenkins *et al*, 2015.

2.6.2. Counts of large terrestrial species & raptors

This is a very similar data collection technique to that above, the aim being to establish indices of abundance for large terrestrial species and raptors. These species are relatively easily detected from a vehicle, hence vehicle based (VT) transects are conducted in order to determine the number of birds of relevant species in the study area. Detection of these large species is less dependent on their activity levels and calls, so these counts can be done later in the day. One VT was established on suitable roads in the area, of approximately 5.3km length (Figure 2). This transect was counted twice on each site visit. For more detail on exact methods of conducting Vehicle transects see Jenkins *et al* (2015).

2.6.3. Focal site surveys & monitoring

Three farm dams were identified as Focal Sites and were visited in each season to count water fowl present. The location of these Focal Sites is shown in Figure 2.

We are aware that Southern Ground Hornbill *Bucorvus leadbeteri* occurs in the wider area (within 50km of the site, Terramanzi, 2018, Arcus 2018). Apart from visually surveying the site and surrounds for the species, pre-dawn listening surveys were conducted on all mornings on site to detect any groups of birds calling (calls can be heard up to 2km if conditions are right).

2.6.4. Incidental observations

This monitoring programme comprised a significant amount of field time on site by the specialist. In addition to the other more formal data collection all incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) within the broader study area were carefully plotted and documented. Where patterns in these observations are identified additional focal site surveys were undertaken.

2.6.4. Direct observation of bird flight on site

The aim of direct observation is to record bird flight activity on site. An understanding of this flight behaviour will help explain any future interactions between birds and the wind farm. Spatial patterns in bird flight movement may also be detected, which will allow for input into turbine placement and further optimisation of the layout. One Vantage Point was established and data on relevant bird species is collected at this site during each site visit (see Figure 2). A total of 12 hours of data was collected at the Vantage Point in each season (in accordance with best practice guidelines – Jenkins *et al,* 2015). This VP provided coverage of a reasonable and representative proportion of the entire study area. The VP was identified using GIS (Geographic Information Systems), and then fine-tuned during the project setup, based on access and other information. Since the VP aims at capturing both usage and behavioural data, it was positioned on high ground to maximise visibility. The survey radius for VP counts was 2 kilometres (although large birds are sometimes recorded further). VP counts were conducted by the specialist, recording birds 360° around the VP. Data should be collected during representative conditions, so the sessions were spread throughout the day, with the VP being counted over 'early to mid-morning', 'mid-morning to early afternoon', and 'mid-afternoon to evening'. A total of 12hrs of observation was collected at the vantage point in each season. For more detail on exact criteria recorded for each flying bird observed, see Jenkins *et al* (2015).

One of the most important attributes of any bird flight event is its height above ground, since this will determine its risk of collision with turbine blades. Since it is possible that the turbine model (and hence the exact height of the rotor swept zone) could still change on this project, actual flight height was estimated rather than assigning flight height to broad bands (such as proposed by Jenkins *et al* 2015). This 'raw' data will allow flexibility in assigning to classes later on depending on final turbine specifications.

It is not practical to record all bird species flying by this method, the method focuses rather on the physically large species and particularly Red Listed or otherwise important species.

2.6.5. Control site

Due to the very small proposed facility, no control site was monitored in this case.

The layout of the above described activities is presented in Figure 2.

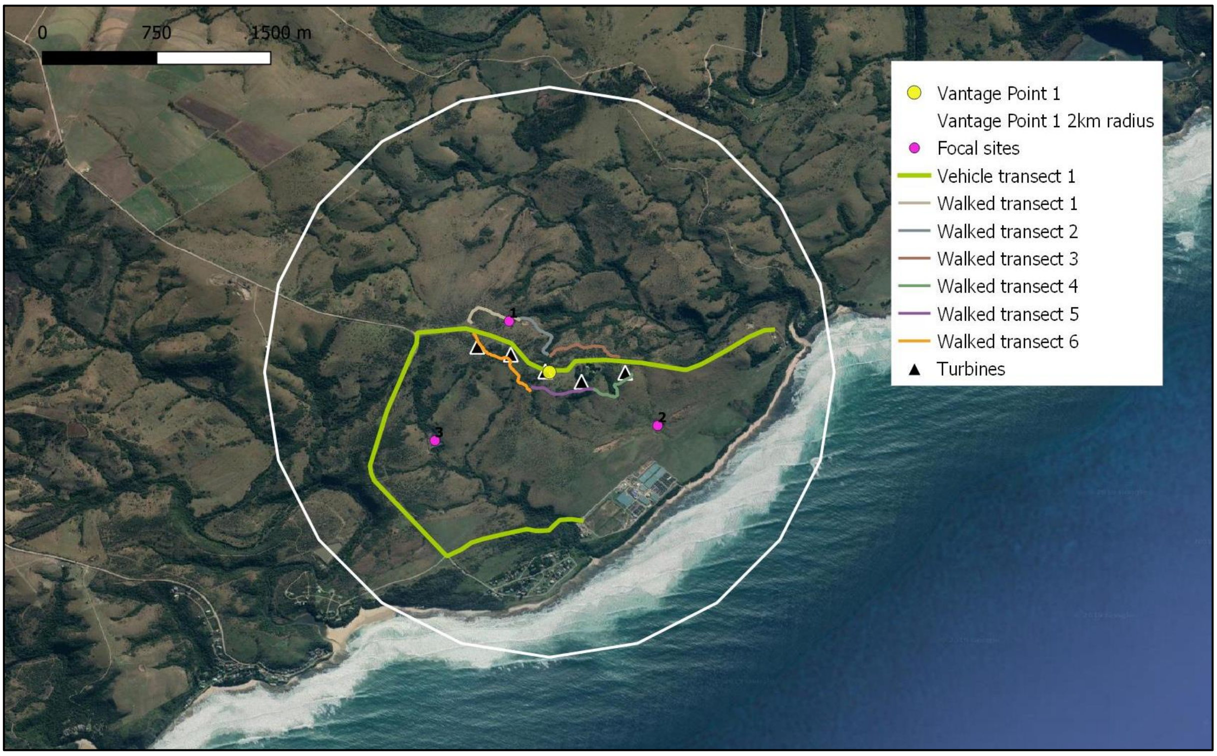

Figure 2. The layout of the pre-construction bird monitoring activities on the Latrodex Wind Farm site.

2.7 Bird species risk assessment & prioritisation

For the purposes of impact assessment it was necessary to focus in on which species are most important or vulnerable as it is not possible to effectively assess the risk to all species observed on site in detail. In terms of identifying the priority species for this impact assessment the following steps were followed:

1. <u>Identification of theoretical high risk species</u>. This was done at the beginning of pre-construction bird monitoring through considering: Jordan & Smallie (2010) who summarise which taxonomic groups of birds have been found to be vulnerable to collision with wind turbines in the USA, UK, EU, Australia and Canada; Ralston-Paton, Smallie, Pearson & Ramalho (2017) who summarise experience with bird-turbine fatalities to date in South Africa; and the document entitled "Avian Wind Farm Sensitivity Map for South Africa: Criteria and procedures used" (Retief, Diamond, Anderson, Smit, Jenkins & Brooks, 2011, updated 2014) which classified all bird species theoretically in terms of their risk of interaction with wind energy; and the regional conservation status (Taylor *et al*, 2015). The identified priority species tend to all be physically large species because the direct mortality impact of wind farms (turbine collisions) is most important for these species and the regionally Red Listed bird species in the study area are almost all large species. This does not mean to say that impacts on smaller species are not important. However priority has been given to those species for which the implications of fatalities or other impacts are greater. Priority was also given to regionally and globally Red Listed or otherwise important species.
2. <u>Identification of final priority bird species</u>. This was done by examining the data collected at the

Latrodex Wind Farm site (Section 3.6) for all four seasons. Pre-construction monitoring on site confirmed which bird species actually use the site and to what extent.

2.8 Avifaunal Impact Assessment

Each of the potential impacts of the proposed development was assessed according to a prescribed methodology and criteria presented in Appendix 5.

2.9 Avifaunal sensitivity mapping

Avifaunal sensitivity mapping for the site was conducted by identifying and describing the spatial constraints (No go areas, set back distances, buffer distances etc.). These should inform the project design and layout.

2.10 Limitations & assumptions

Certain biases and challenges are inherent in the methods that have been employed to collect data in this programme. It is not possible to discuss all of them here, and some will only become evident with time and operational phase data, but the following are some of the key points:

- The presence of the monitor/specialist on site is certain to have an effect on the birds itself. For example during walked transects, certain bird species will flush more easily than others (and therefore be detected), certain species may sit undetected, certain species may flee, and yet others may be inquisitive and approach the observers. Likewise with the vantage point counts, it is extremely unlikely that two observers sitting in position for hours at a time will have no effect on bird flight. Some species may avoid the vantage point position, because there are people there, and others may approach out of curiosity. In almost all data collection methods large bird species will be more easily detected, and their position in the landscape more easily estimated. This is particularly relevant at the vantage points where a large eagle may be visible several kilometres away, but a smaller kestrel perhaps only within 800 metres. A particularly important challenge is that of estimating the height at which birds fly above the ground. With no reference points against which to judge, it is exceptionally difficult and subjective. It is for this reason that the flight height data has been treated cautiously by this report, and much of the analysis conducted using flights of all height. With time, and data from multiple sites it will be possible to tease out these relationships and establish indices or measures of these biases.

- The questions that one can ask of the data collected by this programme are almost endless. Most of these questions however become far more informative once post construction data has been collected and effects can be observed. For this reason some of the analysis in this report is relatively crude. The raw data has however been collected and will be stored until such time as more detailed analysis is possible and necessary.

- An overarching limitation is that since it is the early days for wind energy in South Africa we have multiple and often quite different goals for this monitoring. This means that this programme has not been as focused as it would possibly be for a project being developed a few years into the future, but rather to inform the taking of a responsible decision regarding project acceptability. Collecting diverse and substantial amounts of data is obviously an advantage on some levels, but perhaps may also dilute the focus.

- Spotting and identifying birds whilst walking is a significant challenge, particularly when only fleeting glimpses of birds are obtained. As such, there is variability between observers' ability and hence the data obtained. The above data is therefore by necessity subjective to some extent. In order to control for this subjectivity, the same specialist conducted all the monitoring for the full duration of the project, and it is hoped this can be maintained for the post construction phase. Despite this subjectivity, and a number of assumptions that line transects rely on (for more details see Bibby *et al*, 2000), this field method returns the greatest amount of data per unit effort (Bibby *et al*, 2000) and was therefore deemed appropriate for the purposes of this programme. Likewise, in an attempt to maximise the returns from available resources, the walked transects were located close to the Vantage Point. This systematic selection may result in some as yet unknown bias in the data but it has numerous logistical benefits.

- No thresholds for fatality rates for priority species have been established in South Africa to date. This means that impact assessments such as this one need to make subjective judgements on the acceptability of the estimated predicted fatalities for each species.

3. Baseline description

3.1 Vegetation & habitat

The Latrodex Wind Farm site and its surrounds are comprised entirely of 'Albany Coastal Belt' (Mucina & Rutherford, 2006). A small strip of 'Albany Dune Strandveld' exists right on the coast but the project will not enter this area (Figure 3). Albany Coastal Belt is a 'Least Threatened' vegetation type that is classified as 'Poorly protected'.

The relevance of this vegetation type description to avifauna is that the habitat on site is functionally coastal thicket where not transformed. This determines the bird species which can make use of the site. Effectively, a number of bird micro habitats are available to birds in the area including: man made dams;

wetlands; grassland/pasture; exotic trees; and thicket (see Figure 4). The bird species utilising these micro habitats have been described in Section 3.7.

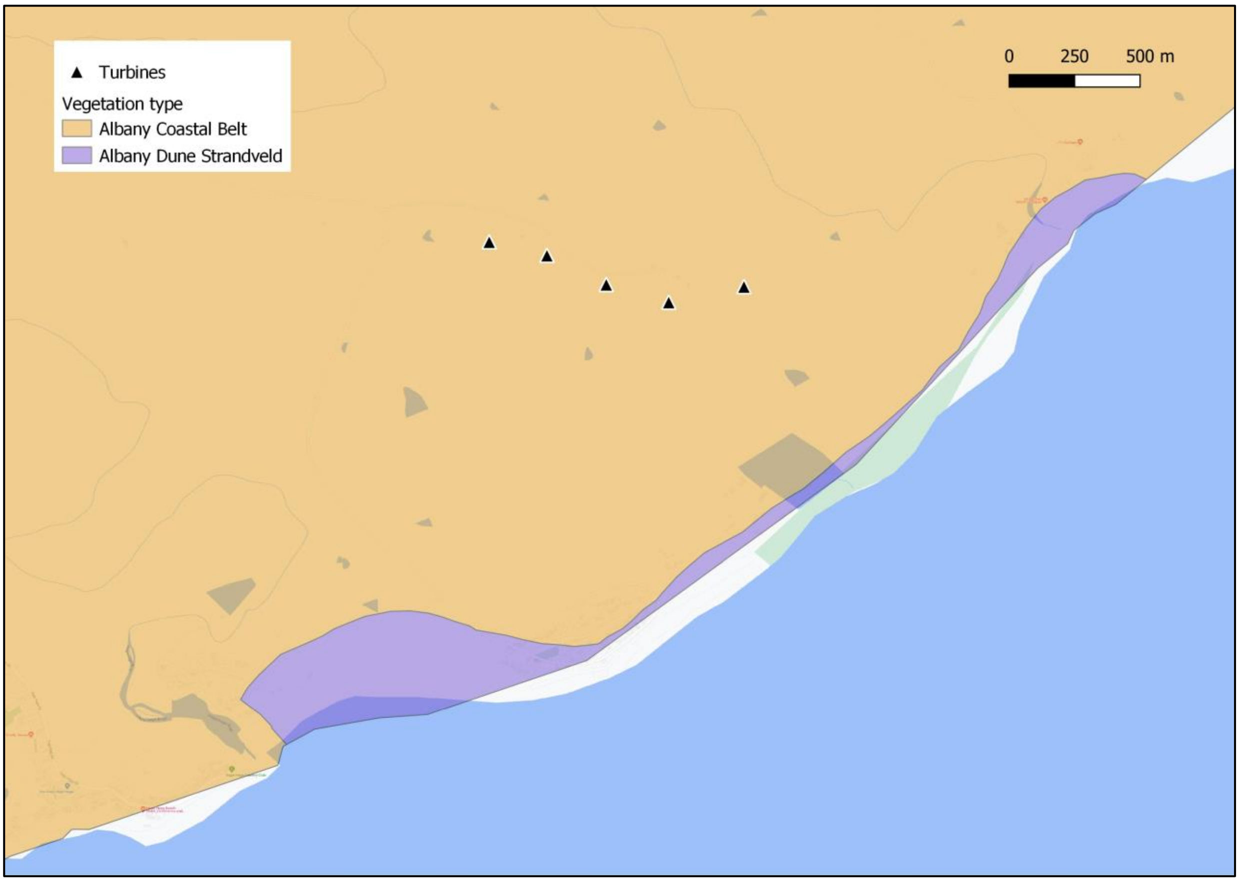

Figure 3. Vegetation type on site.

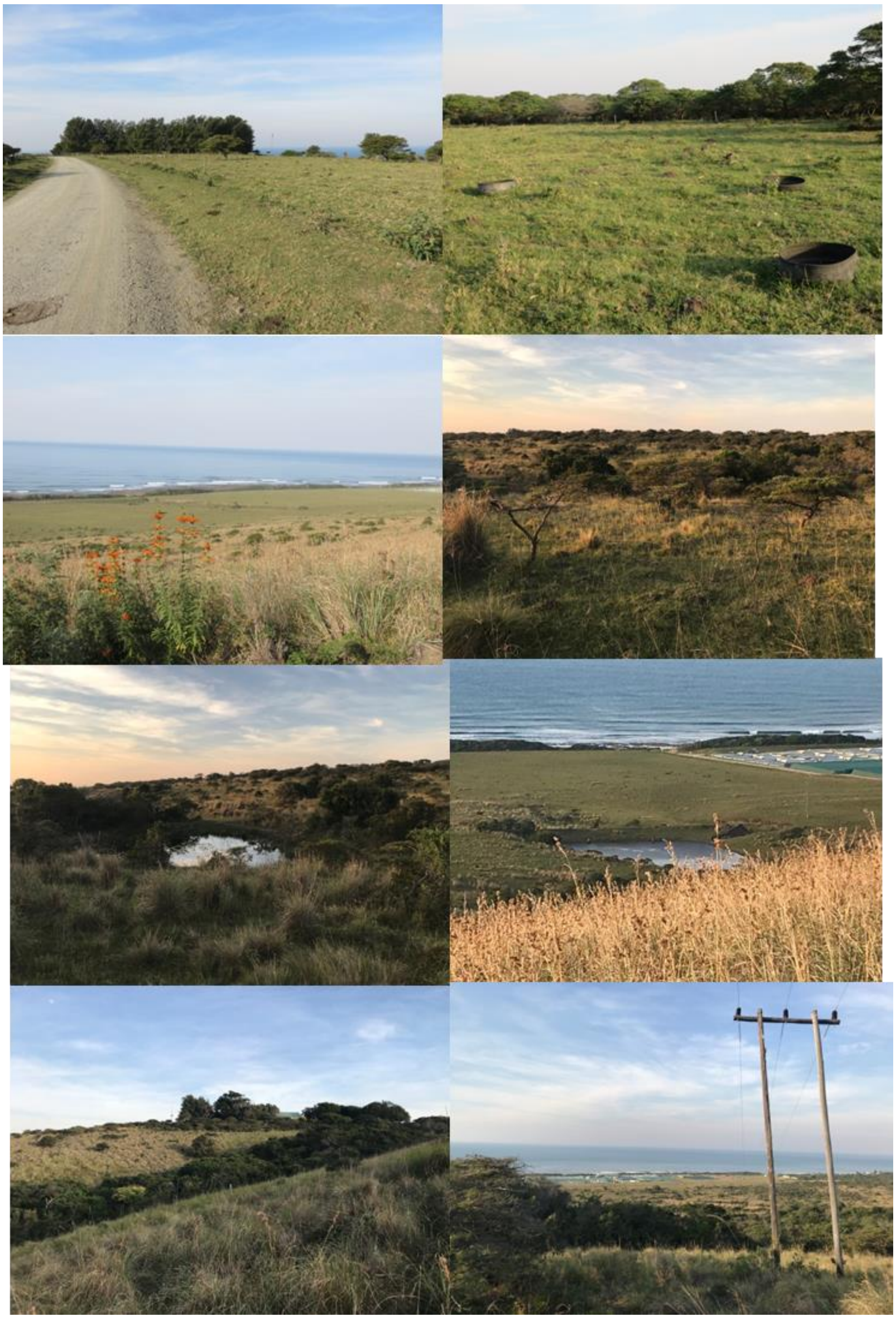

Figure 4. Typical micro-habitats available to birds in the Latrodex Wind Farm study area.

3.2 Southern African Bird Atlas Project data

Up to approximately 316 bird species were recorded in the broader area by the first and second Southern Africa Bird Atlas Projects (www.sabap2.adu.org.za). These birds were not necessarily recorded on the Latrodex site itself but are an indication of which species could occur on site if conditions and habitats are right. Of the 316 species approximately 73 are classified in the top 200 at risk species by Retief *et al* (2014). Nine species are regionally Endangered, twelve are Vulnerable, and 6 are Near-threatened (Taylor *et al*, 2015). Twenty-five endemic or near endemics are included in these species (Table 6).

In reality, many of the above species will not occur on the site itself, due to available habitat and disturbance levels. Our own data collected on site itself is described below in Section 3.3. and the likelihood of key species occurring on site is summarised in Section 3.4.

3.3 Pre-construction bird monitoring data

3.6.1. Small terrestrial bird species

A total of 52 small bird species were recorded on the 6 Walked Transects conducted on the Latrodex Wind Farm site. This includes 441 individual birds from 256 records. In summer 30 species were recorded, autumn 28 species, winter 25 species, and spring 23 species. None of these species are regionally Red Listed. Table 1 presents the number of birds, number of records, and number of birds per kilometre of transect for each species – for the full year. The seasonal breakdown of these data is presented in Appendix 1. The index of birds per kilometre is relatively crude. However, since this will be used primarily to compare the effects of the facility on these species post construction, this index is considered adequate at this stage. If more complex analysis is required during post construction monitoring in order to demonstrate effects, the raw data is available for this purpose.

The most abundant species on the site were not surprisingly all species already known to be common in the area, such as: Dark-capped Bulbul *Pycnonotus tricolor*; Sombre Greenbul *Andropadus importunus*; and Black-bellied Starling *Notopholia corrusca*. Of the species listed by the online screening tool we confirmed only Denham's Bustard on site. The remaining species could possibly occur close to site but not on site itself due to a lack of suitable habitat. One exception is Knysna Warbler which has suitable habitat on site. We did not record this species ourselves but do think there is a possibility of it occurring on site from time to time.

3.6.2. Large terrestrial species & raptors

A total of 3 large terrestrial and raptor species were recorded across the drive transects totalling 44 kilometres for the year (or 11km per season). This included 8 individual birds from 7 records. The three species recorded were: Jackal Buzzard; African Fish-Eagle *Haliaeetus vocifer* and Yellow-billed Kite *Milvus migrans*. These data are shown in Table 2 (the full seasonal data set is in Appendix 2). None of the 3 species are regionally Red Listed. The most abundant species recorded by this method to date was the Jackal Buzzard, which was also recorded in all four seasons. African Fish-Eagle was recorded only in winter and summer. Yellow-billed Kite was recorded only in spring (it is a summer migrant to our area).

3.6.3. Focal Site surveys

Very few water fowl were recorded at the three Focal Sites (all dams) through the four seasons. No records were made in winter and spring. In summer 2 Egyptian Goose *Alopochen aegyptiaca* were recorded at FS1, and two Egyptian Goose and 2 Blacksmith Lapwing *Vanellus melanopterus* at FS3.

No records were made of Southern Ground hornbill in the area, either visually or audibly.

3.6.4. Incidental Observations of target bird species

Only two target bird species were recorded on the site as Incidental Observations: Jackal Buzzard; and African Fish-Eagle (Table 3). Jackal Buzzard was by far the most abundant species recorded by this method. Neither of the species recorded by this method are regionally Red Listed. Since these data are not the product of systematic data collection methods, they should be used cautiously and are not discussed further here.

We recorded a total of 94 bird species on site (considering all data collection methods), 42 in winter, 52 in spring 45 in summer, and 50 in autumn (Appendix 4).

Table 1. Bird data from walked transects on the Latrodex Wind Farm site.

	Transect length		**12.304**	
	# species		**52**	
Common name	**Taxonomic name**	**Birds**	**Rec**	**Birds/km**
Dark-capped Bulbul	*Pycnonotus tricolor*	50	28	4.06
Sombre Greenbul	*Andropadus importunus*	41	28	3.33
Black-bellied Starling	*Notopholia corrusca*	30	12	2.44
Red-winged Starling	*Onychognathus morio*	29	6	2.36
Spur-winged Goose	*Plectropterus gambensis*	21	2	1.71
Hadeda Ibis	*Bostrychia hagedash*	18	4	1.46
Southern Boubou	*Laniarius ferrugineus*	18	15	1.46
Barn Swallow	*Hirundo rustica*	17	6	1.38
Black-crowned Tchagra	*Tchagra senegalus*	15	11	1.22
Red-fronted Tinkerbird	*Pogoniulus pusillus*	14	12	1.14
Wailing Cisticola	*Cisticola lais*	12	9	0.98
Lazy Cisticola	*Cisticola aberrans*	11	9	0.89
African Olive Pigeon	*Columba arquatrix*	9	2	0.73
Bar-throated Apalis	*Apalis thoracica*	9	8	0.73
Black-headed Oriole	*Oriolus larvatus*	9	9	0.73
Green-backed Camaroptera	*Camaroptera brachyura*	9	9	0.73
Black-collared Barbet	*Lybius torquatus*	8	5	0.65
Chinspot Batis	*Batis molitor*	8	8	0.65
Spotted Thick-knee	*Burhinus capensis*	8	1	0.65
Fork-tailed Drongo	*Dicrurus adsimilis*	7	4	0.57
Lesser-striped Swallow	*Cecropis abyssinica*	7	2	0.57
Brimstone Canary	*Crithagra sulphurata*	6	2	0.49
Green Wood Hoopoe	*Phoeniculus purpureus*	6	2	0.49
Amethyst Sunbird	*Chalcomitra amethystina*	5	3	0.41
Ring-necked Dove	*Streptopelia capicola*	5	4	0.41
Crowned Hornbill	*Lophoceros alboterminatus*	5	3	0.41

Southern Black Tit	*Melaniparus niger*	5	2	0.41
Brown-hooded Kingfisher	*Halcyon albiventris*	4	4	0.33
Common Starling	*Sturnus vulgaris*	4	1	0.33
Greater Double-collared Sunbird	*Cinnyris afer*	4	3	0.33
Rufous-naped Lark	*Mirafra africana*	4	4	0.33
Trumpeter Hornbill	*Bycanistes bucinator*	4	3	0.33
White-browed Scrub Robin	*Cercotrichas leucophrys*	4	3	0.33
Yellow-fronted Canary	*Crithagra mozambica*	4	5	0.33
Grey-backed Cisticola	*Cisticola subruficapilla*	3	3	0.24
Southern Masked Weaver	*Ploceus velatus*	3	2	0.24
Red-necked Spurfowl	*Pternistis afer*	3	2	0.24
African Hoopoe	*Upupa africana*	2	2	0.16
Egyptian Goose	*Alopochen aegyptiaca*	2	1	0.16
Knysna Turaco	*Tauraco corythaix*	2	2	0.16
Red-eyed Dove	*Streptopelia semitorquata*	2	2	0.16
Southern Fiscal	*Lanius collaris*	2	2	0.16
Speckled Mousebird	*Colius striatus*	2	2	0.16
Southern Grey-headed Sparrow	*Passer diffusus*	2	1	0.16
Burchell's Coucal	*Centropus burchellii*	1	1	0.08
Cape Longclaw	*Macronyx capensis*	1	1	0.08
Cape Weaver	*Ploceus capensis*	1	1	0.08
Cardinal Woodpecker	*Dendropicos fuscescens*	1	1	0.08
Diderick Cuckoo	*Chrysococcyx caprius*	1	1	0.08
Pearl-breasted Swallow	*Hirundo dimidiata*	1	1	0.08
Red-collared Widowbird	*Euplectes ardens*	1	1	0.08
Tawny-flanked Prinia	*Prinia subflava*	1	1	0.08

Table 2. Large terrestrial & raptor species recorded on drive transects at the Latrodex Wind Farm site.

	Transect length		**44**	
	# species		**3**	
Common name	**Taxonomic name**	**Birds**	**Rec**	**Birds/km**
Jackal Buzzard	*Buteo rufofuscus*	4	4	0.09
African Fish-Eagle	*Haliaeetus vocifer*	3	2	0.07
Yellow-billed Kite	*Milvus migrans*	1	1	0.02

Table 3. Summary of Incidental Observations of relevant species on the Latrodex Wind Farm site.

		Full year		**Winter**		**Spring**		**Summer**		**Autumn**	
Common name	**Taxonomic name**	**Birds**	**Rec**	**Birds**	**Rec**	**Birds**	**Rec**	**Birds**	**Rec**	**Birds**	**Rec**
Jackal Buzzard	*Buteo rufofuscus*	9	8	0	0	2	2	2	2	5	4
African Fish-Eagle	*Haliaeetus vocifer*	1	1	0	0	0	0	1	1	0	0

3.6.5. *Bird flight activity on site*

A total of 12 sessions of bird flight observation were completed, of 4 hours each, totalling 48 hours of observation at Vantage Points across the site in the four seasons. In total, 69 records were made of 95 individual birds flying on site. This included 11 target bird species. These data are shown in Table 4 (summarised for the full year) and in Appendix 3 (full dataset). A single Lanner Falcon was recorded flying four times during autumn, and a single Denham's Bustard in winter.

Two of the 11 recorded species are regionally Red Listed (Taylor *et al*, 2015): Lanner Falcon *Falco biarmicus* (Vulnerable); and Denham's Bustard *Neotis denhamii* (Vulnerable).

The most frequent flying species on site was Jackal Buzzard, a resident near the site. Forty-four records were made of 46 individual birds, across all four seasons. Jackal Buzzard flights made up 63% of all flight records. Spur-winged Goose *Plectropterus gambensis* was recorded flying only once, in a flock of 19 birds. Yellow-billed Kite was recorded only in spring and summer (it is a summer migrant to our area), and Lanner Falcon was recorded only in autumn. African Fish-Eagle was recorded flying three times, and Denham's Bustard once (a single bird).

Table 4. Summary bird flight data collected on site.

	# species		11		
Common name	**Taxonomic name**	**Conservation status**	**Birds**	**Rec**	**Birds/hr**
		All species	**95**	**69**	**1.98**
Jackal Buzzard	*Buteo rufofuscus*		46	44	0.96
Spur-winged Goose	*Plectropterus gambensis*		19	1	0.40
Yellow-billed Kite	*Milvus parasitus*		9	9	0.19
Lanner Falcon	*Falco biarmicus*	VU	4	4	0.08
Egyptian Goose	*Alopochen aegyptiaca*		4	2	0.08
African Spoonbill	*Platalea alba*		4	1	0.08
Black-headed Heron	*Ardea melanocephala*		3	2	0.06
African Fish-Eagle	*Haliaaetus vocifer*		3	3	0.06
Hamerkop	*Scopus umbretta*		1	1	0.02
Denham's Bustard	*Neotis denhamii*	VU	1	1	0.02
Common Buzzard	*Buteo buteo*		1	1	0.02

The mean flight height above ground for each species is presented in Table 5. Seeven of the eleven species flew predominantly below the rotor zone (35m to 125m above the ground). The remaining species flew mostly at 35m and above and within the expected rotor swept area. Based on the data collected to date, these species are likely to at higher risk of collision with turbines once operational, although many other factors (mostly not well understood) influence collision risk.

Table 5. Mean recorded flight height for target bird species on site.

Common name	Taxonomic name	Conservation status	Mean flight height
Jackal Buzzard	*Buteo rufofuscus*		35.6
Spur-winged Goose	*Plectropterus gambensis*		20

Yellow-billed Kite	*Milvus parasitus*		30.6
Lanner Falcon	*Falco biarmicus*	VU	50
Egyptian Goose	*Alopochen aegyptiaca*		12.5
African Spoonbill	*Platalea alba*		30
Black-headed Heron	*Ardea melanocephala*		5
African Fish-Eagle	*Haliaaetus vocifer*		40
Hamerkop	*Scopus umbretta*		70
Denham's Bustard	*Neotis denhamii*	VU	30
Common Buzzard	*Buteo buteo*		20

3.6.6. Estimating turbine collision fatality rates

We estimated crude fatality rates for priority bird species using flight data collected to date. Crude turbine collision fatality rates were calculated for each species in order to estimate how many birds the proposed Latrodex Wind Farm could kill once operational. This was based on the species' passage rates (number of birds recorded flying per hour) recorded on site. Generally speaking, we expect those species which fly more often to be more susceptible to turbine collision. In order to calculate crude passage rates for each species, we assumed that the 2-kilometer radius around vantage points was approximately equal to the maximum distance over which sightings were made, and that the coverage was approximately circular. This meant that at the vantage point an area of 12.57km² was sampled ($A = \pi r^2$). Secondly, we assumed that the area of the wind farm directly presenting a collision risk is described by the area of each turbine's rotor zone multiplied by the number of turbines. We assumed a turbine model with a rotor swept area of 6 361.73m² (turbines with rotor diameter of 90 meters) and the current preliminary layout of 5 turbines. This equates to a wind farm collision risk area of 31 808.65m² (5 x 6361.73m²). Thirdly, we assumed that the survey area around each of the vantage points was a representative sample of the area in which built turbines will operate. Fourthly we assumed that species passage rates calculated from our moniotoring data can be reasonably extrapolated to annual passage rates (by multiplying hourly passage rates by 12 x 365 in the case of resident diurnal species (12 daylight hours) and 12 x 365 x 0.5 in the case of migrants (present in the study area for only 6 months). We also assumed a 98% avoidance rate for these birds, i.e. 2% of birds passing through the rotor zone would collide with blades (as recommended by Scottish Natural Heritage guidance for species for which no established avoidance rate is available, www.project-gpwind.eu). Finally, we used all recorded flights of all heights above ground for this analysis, since all flight represents some risk, particularly given that species flight behaviour may change once wind turbines are operational, and that estimation of bird height above ground is subjective.

We believe that the estimated fatality rates calculated represent a worst-case scenario, for the following reasons: (i) flights of all heights above ground were included, whereas in reality some flights would be below or above rotor zone, (ii) no consideration is given to actual turbine locations relative to actual flight path positions and (iii) a relatively conservative avoidance rate of 98% was used. Although the calculations we have made are not a Collision Risk Model (CRM-Scottish Natural Heritage), some of the principles and assumptions made are similar. In South Africa, one of the main reasons CRM is not often used is that we have not established accurate species-specific avoidance rates yet, and the model is particularly sensitive to these avoidance rates. For example, if a 99% avoidance rate were to be used, it would halve the estimated number of fatalities calculated as described below. Our confidence in these estimates is therefore low, but the exercise is worthwhile nonetheless.

Table 6 summarises the estimated fatality rates based the monitoring data collected. The total number of priority bird species (11 priority species) fatalities per annum is 0.4156. Jackal Buzzard is arguably the most important species of concern at this site. The estimated fatality rates for this species is 0.2124 birds per annum across the facility. These fatality rates are all very low in our view and unlikely to constitute a significant threat to these species.

Table 6. Crudely estimated species fatality rates.

Common name	Scientific name	# flights	Birds/hr at VP	Birds/yr at VP	Birds/yr through rotor zone	Ann. Fat. rate (98% avoidance)
	All species	95	1.9792	8212.50	20.78	0.4156
Jackal Buzzard	*Buteo rufofuscus*	46	0.9583	4197.50	10.62	0.2124
Spur-winged Goose	*Plectropterus gambensis*	19	0.3958	1733.75	4.39	0.0877
Yellow-billed Kite	*Milvus parasitus*	9	0.1875	410.63	1.04	0.0208
Lanner Falcon	*Falco biarmicus*	4	0.0833	365.00	0.92	0.0185
Egyptian Goose	*Alopochen aegyptiaca*	4	0.0833	365.00	0.92	0.0185
African Spoonbill	*Platalea alba*	4	0.0833	365.00	0.92	0.0185
Black-headed Heron	*Ardea melanocephala*	3	0.0625	273.75	0.69	0.0139
African Fish-Eagle	*Haliaaetus vocifer*	3	0.0625	273.75	0.69	0.0139
Hamerkop	*Scopus umbretta*	1	0.0208	91.25	0.23	0.0046
Denham's Bustard	*Neotis denhamii*	1	0.0208	91.25	0.23	0.0046
Common Buzzard	*Buteo buteo*	1	0.0208	45.63	0.12	0.0023

3.6.7. Spatial location of flight records

The spatial location of all target bird species flight records per season can be seen below in Figure 5. In general, the majority of recorded flights are not in the areas proposed for turbines, but rather on the northern or southern slopes.

Figure 6 presents the fight paths for the recorded species individually. The dominance of Jackal Buzzard flights is striking, particularly to the immediate north of site.

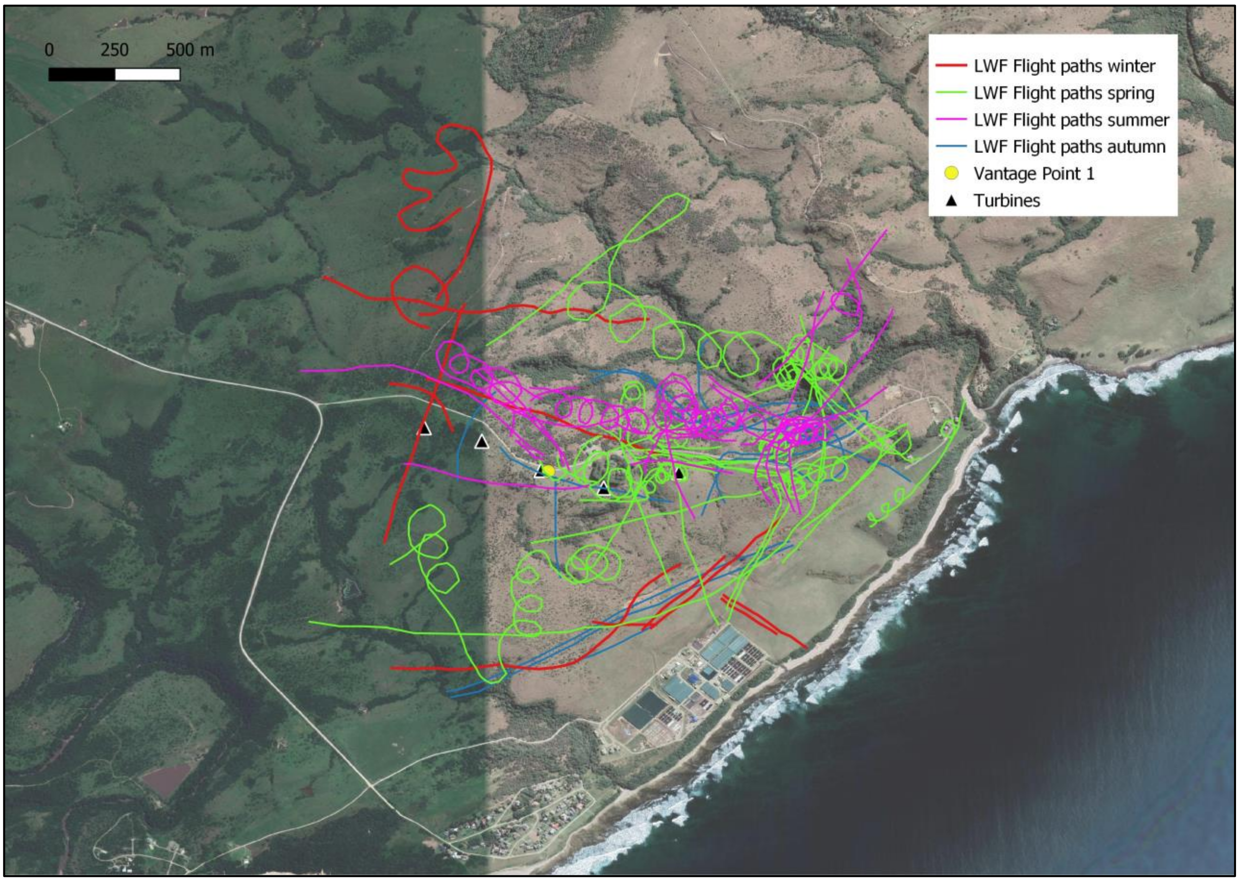

Figure 5. Target bird species flight paths at Latrodex Wind Farm (all species, four seasons).

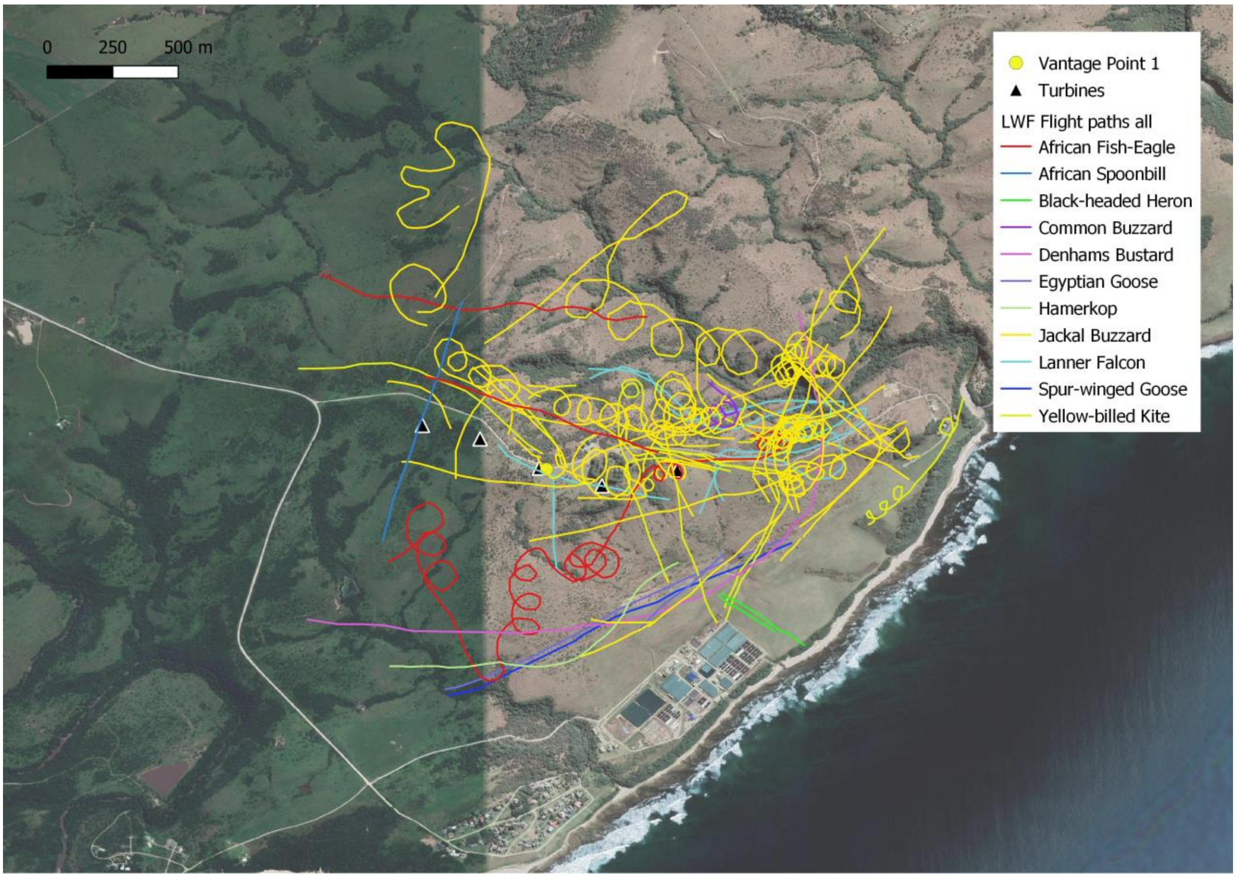

Figure 6. Individual species flight paths at Latrodex Wind Farm (Full year).

3.4 Summary of species information & assessment of risk

Appendix 4 presents a full inclusive bird species list for the site, based on the SABAP1 and SABAP2 data for the area, and including species which we actually recorded on the site itself. However as described elsewhere many of these species do not occur on the site itself or have a low likelihood of occurring there. Note importantly that we have excluded sea birds from the species lists as the turbines will in our view be too far removed from the coast in terms of distance, habitat (woodland) and elevation (ont op a ridge and well above the coastal plain).

Table 7 presents the seasonal presence of each species on the site and a qualitative assessment of the risk of each type of impact (pre-mitigation) occurring for each of the priority species if the proposed wind farm is built. This assessment has been made on the basis of the data collected on site during this programme, reported on in Section 3.3. The proposed facility could pose risk to avifauna in 5 main ways: collision with turbines; collision with or electrocution on power lines; habitat destruction during construction; disturbance during construction and operation; and displacement from the site once operational. A discussion of each species at Medium or High risk follows Table 6.

Note: In this context, risk does not equal significance. Risk to a species as described in this section can be High, but if that species is not Red Listed it is possible that the significance of impacts on the species could ultimately be Moderate (see Section 4).

Table 7. Final priority species for the Latrodex Wind Farm site.

Full Name	RD (Regional, Global)	Endemism	Retief	SAB AP1	SAB AP2	Wi	Sp	Su	Au	Likelihood of occurring on site	Latrodex WF risk	Habitat destruction	Disturbance	Displacement	Collision with turbines	Collision & electrocution on power lines
Black Harrier	EN, EN	NE	6	1						Unlikely						
Cape Vulture	EN, EN		1	1						*Unlikely						
Grey Crowned Crane	EN, EN		15	1	1	1	1	1		Possible	Low**				√	√
Yellow-billed Stork	EN, LC		9	1						Unlikely						
African Marsh Harrier	EN, LC		24	1	1					Possible	Low				√	√
Mangrove Kingfisher	EN, LC				1					Unlikely						
Cape Parrot	EN, VU	E	71	1						Unlikely						
Martial Eagle	EN, VU		4	1						Possible	Low				√	√
Southern Ground-Hornbill	EN, VU		17	1	1					Unlikely						
Gurney’s Sugarbird	LC, NT	NE	174		1					Possible	Low	√	√	√		
Forest Buzzard	LC, NT	SLS	100	1	1					Possible	Low				√	√
Red Knot	LC, NT			1						Unlikely						
Curlew Sandpiper	LC, NT			1						Unlikely						
Half-collared Kingfisher	NT, LC		107	1	1					Unlikely						
European Roller	NT, LC		132	1						Possible	Low	√	√	√		
Knysna Woodpecker	NT, NT	E	110	1	1					Possible	Low	√	√	√		
Chestnut-banded Plover	NT, NT		57	1						Unlikely						
Eurasian Curlew	NT, NT			1	1					Unlikely						
Blue Crane	NT, VU		11	1						Unlikely						
Verreaux's Eagle	VU, LC		3	1						Unlikely						
Great White Pelican	VU, LC		7	1						Unlikely						
Black Stork	VU, LC		8	1						Unlikely						
Lanner Falcon	VU, LC		23	1	1				1	Confirmed	Medium		√	√	√	√
African Grass Owl	VU, LC		32	1						Unlikely						

Caspian Tern	VU, LC		50	1	1					Possible	Low				√	√
Striped Flufftail	VU, LC		85	1						Possible	Low	√	√	√	√	
White-backed Night Heron	VU, LC		138	1						Unlikely						
African Finfoot	VU, LC			1						Unlikely						
Denham's Bustard	VU, NT		21	1	1		1			Confirmed	Low	√	√	√	√	√
Crowned Eagle	VU, NT		26	1	1					Possible	Low				√	√
Secretarybird	VU, VU		12	1						Possible	Low				√	√
African Fish Eagle			29	1	1	1	1			Confirmed	Medium				√	√
Knysna Warbler	VU, VU		78							Possible	Low	√				
Jackal Buzzard		NE	44	1	1	1	1	1	1	Confirmed	High	√	√	√	√	√
Booted Eagle			55	1	1					Unlikely						
Western Osprey			58	1	1					Possible	Low				√	√
White Stork			61	1						Possible	Low				√	√
Yellow-billed Kite			62***	1	1		1			Confirmed	High				√	√
Amur Falcon			68	1	1					Possible	Low				√	√
Common (Steppe) Buzzard			69	1	1			1		Confirmed	Low				√	√
Marsh Owl			80	1						Possible	Low				√	√
African Harrier-Hawk			83	1	1					Possible	Low				√	√
Long-crested Eagle			84	1	1					Possible	Low				√	√
Brown Snake Eagle			91	1						Unlikely						
Black-winged Kite			94	1	1					Possible	Low				√	√
Black-winged Lapwing			97	1	1					Possible	Low				√	√
Spotted Eagle-Owl			98	1	1					Possible	Low				√	√

*In our view the proposed site is too close to the coast, too thickly wooded and too disturbed to present attractive Cape Vulture habitat.

**Grey Crowned Crane was recorded approximately 10km from site, and may visit the small wetland close to the coast near site but will not frequent the site itself as no attractive habitat (arable lands or wetlands) exist on site.

***Yellow-billed Kite was not scored by this exercise so we assign the same score as for Black Kite.

EN=Endangered; VU=Vulnerable; NT=Near-threatened; LC=Least Concern; Su=Summer; Au=Autumn; Wi=Winter;Sp=Spring

Jackal Buzzard

The Jackal Buzzard is a fairly common species throughout South Africa and on this site. It is a generalist in terms of habitat, although does favour shorter vegetation. It hunts mostly in flight, meaning that a large proportion of its time is spent flying, and thereby at some risk of collision with vertical obstacles. Early observations on constructed wind farms under monitoring indicate that this species is highly susceptible to collision with turbines (pers obs; Ralston-Paton *et al,* 2017). On the Latrodex site the species has been recorded flying frequently, particularly over the valley off the site to the north. We suspect that the birds may have a nest in that valley. We conclude that this species is at High risk. Due to its relatively common status this anticipated risk does not carry as much significance as it would if the species were Red Listed. However concern is growing for this species based on the number being killed at operational wind farms in SA.

Yellow-billed Kite

Yellow-billed Kite is a common intra-African migrant species, present in South Africa approximately August to March. It is a habitat generalist and feeds on a wide range of prey, including scavenging. It forages in flight, meaning it spends considerable amount of time at risk of collision with obstacle such as turbines. We recorded the species quite frequently on the site during spring andsummer and consider it to be at High risk of collision with turbines once built.

African Fish-Eagle

Although not Red Listed, this is a species to consider important for this assessment. It has proven susceptible to wind turbine collision elsewhere (Ralston-Paton *et al* 2017) and was recorded a few times on the Latrodex site. We believe a pair to be resident on the Haga Haga river approximately 2km to the south-west of the site. We conclude that this species will be at Medium risk at the Latrodex site.

Lanner Falcon

Lanner Falcon is classified as Vulnerable regionally and Near-threatened globally (Taylor *et al*, 2015; IUCN 2021). The regional population is estimated at less than 10 000 mature birds (Taylor *et al,* 2015). Wind turbine collision fatalities have been reported for the species (Perold *et al,* 2020). We recorded the species in autumn on the Latrodex site and judge the species to be at High risk of collision with turbines if the proposed wind farm becomes operational.

3.5 Avifaunal sensitivity of the site

The "Avian Wind Farm Sensitivity map for South Africa (Retief *et al,* 2011), the Important Bird & Biodiversity Areas programme data (IBA - Marnewick *et al*, 2015), and the Renewable Energy Development Zones programme were consulted to determine the sensitivity of the Latrodex Wind Farm site in national terms. Figure 7 shows that the site falls in a medium sensitivity category in terms of avifauna (darker colours indicate higher risk). We note that the Latrodex Wind Farm site does not fall in or close to a Renewable Energy Development Zone 2 (www.redz.csir.co.za) or one of the Transmission Grid corridors identified. The REDZ are areas that are being strategically identified for potential wind energy development in future.

Based on these above factors we conclude that the site is in an area of Low sensitivity at a national level.

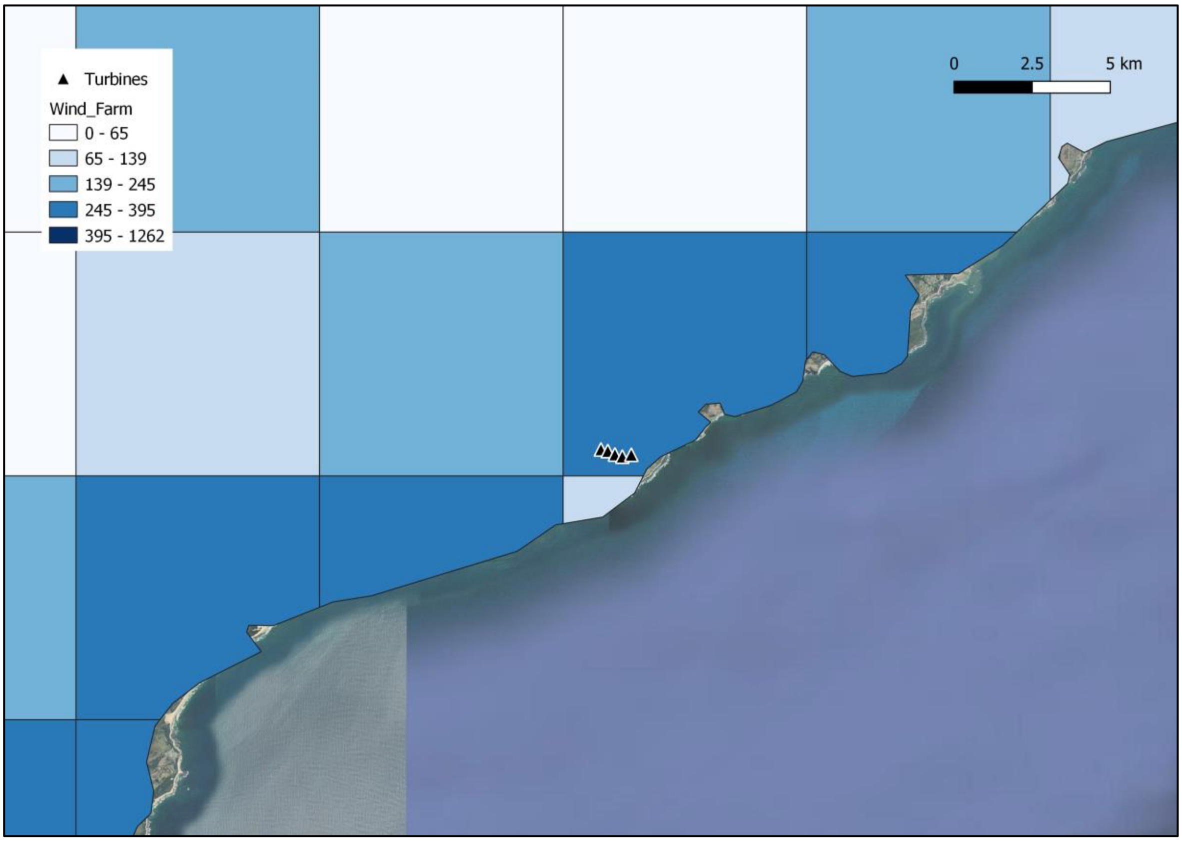

Figure 7. The position of the Latrodex Wind Farm relative to various factors.

The on-site avifaunal sensitivity was assessed through identifying sensitive habitats. There are no sensitive habitats on the proposed site itself. To the north of the proposed turbine locations is a small valley/drainage line which is sensitive and should not be intruded on. To the south is open grassland, some wetlands and dams on the coastal plain – and these areas should also not be intruded on by turbines – although we note that the grid connection may need to pass through this area. Provided that no changes to the layouts are made there is no value in mapping these off site sensitive areas.

3.6 Existing avifaunal-wind energy impacts in the area

There are currently no operational or authorised wind farms in the area of study. No wind energy related impacts on birds have occurred in this area to date. There are however several Eskom distribution power lines in existence on and near site – which have almost certainly impacted on birds in the past.

4. Impact assessment

The potential impacts of the proposed project on avifauna have been assessed in Table 7 according to the standard criteria provided by CES (see Appendix 5).

4.1 Construction Phase Impacts

4.1.1. Habitat destruction

Based on the relatively small surface area altered for the construction of a wind farm, the partially impacted nature of the vegetation on the proposed turbine locations, and their proximity to existing anthropogenic impacts, we judge the impact of habitat destruction to be of Low Negative significance. This will remain at Low Negative significance after the following measures.

<u>Mitigation</u>

- No changes to the current turbine positions should be made without consulting the specialist.
- A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

4.1.2. Disturbance of birds during construction

The impact of disturbance on the general avifaunal community on site is likely to be fairly limited since we have found no sensitive or priority bird species breeding sites on site. We therefore judge the impact of disturbance of birds during construction to be of Low Negative significance pre-mitigation. The following mitigation is proposed and the impact will remain at Low Negative thereafter.

<u>Mitigation</u>

- No changes to the current turbine positions should be made without consulting the specialist.

- An avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.

4.2 Operational Phase Impacts

4.2.1. Disturbance of birds during operations

The indications from operational wind farms are that this impact is of fairly low importance. For the proposed site we consider this impact to be of Low Negative significance provided that the mitigation described above (Section 4.1) is implemented effectively.

<u>Mitigation</u>

- None required.

4.2.2. Displacement of birds during operational phase

As for disturbance above, the indications from operational wind farms are that this impact may be of low importance. At Latrodex Wind Farm we consider this impact to be of Low Negative significance with the mitigation measures already recommended above.

<u>Mitigation</u>

- None required

4.2.3. Turbine collision fatalities

The risk of turbine collision is high for two species: Jackal Buzzard; and Yellow-billed Kite. This is due to their frequent flight activity and the fact that some of these flights pass through proposed turbine areas (unlike some of the other recorded species which flew mostly off site). Since these two species are not regionally Red Listed, we conclude that overall this impact will be of Low Negative significance.

<u>Mitigation</u>

- No changes to the current turbine positions should be made without consulting the specialist.
- A post construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled.
- Given that the impact of bird collision with turbines could occur once the wind farm is operational and require mitigation, we recommend strongly that an appropriate mitigation

budget be provided for by the Applicant. At this stage it is not possible to determine what mitigation may be appropriate, and in the time between writing this report and the mitigation need arising (likely several years) new mitigation methods may be developed. However if such a need arises and suitable mitigation is identified it cannot be argued by the wind farm operator that mitigation was not budgeted for. Mitigation could cost the operator either in the form of additional costs or lost productivity as a result of changes to turbine operations.

- It is also important that the Applicant be aware that mitigation measures may require the installation of equipment on turbines, or possibly the painting of blades. Potential technical and warrantee challenges should be noted where possible throughout the planning process so that they do not prevent the implementation of reasonable mitigation if required.
- Post construction monitoring should inform an adaptive management programme to mitigate any identified impacts to acceptable levels. We recommend that all turbines are searched for collision fatalities every week once operational.

4.2.4. Collision & electrocution on overhead power line and in substation/switching station

The impact of bird collision and electrocution with power lines is likely to be of Moderate significance and require mitigation. In particular it is essential that the length of overhead power line is kept to an absolute minimum. All internal power cables connecting turbines to the onsite substation should be underground. The overhead power line to connect to the grid will need to be routed optimally, have anti bird collision line marking devices installed on all spans, and be a bird friendly pylon design.

4.3 Decommissioning Phase Impacts

4.3.1. Disturbance of birds

This impact is of Low Negative significance pre and post-mitigation.

<u>Mitigation</u>

- All decommissioning activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.

Table 8. Formal assessment of impacts (see Appendix 5 for criteria – supplied by CES)

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Impact: Habitat destruction during construction									
Turbines, roads, hard stands and other components	During construction vegetation is altered or removed for the project footprint. This destroys avifauna habitat, makes it less useful to birds, or less attractive to sensitive species.	Permanent	Localised	Slight	Probable	**LOW NEGATIVE**	Very difficult	A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase. All construction activities should be strictly managed according to generally accepted environmental best practice standards, to avoid any unnecessary impact on the receiving environment. All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.	**LOW NEGATIVE**
Impact: Disturbance of birds during construction									
Turbines, roads, hard stands and other components	Birds are disturbed by construction or operations activities & their survival or reproduction is compromised. Most applicable with breeding sensitive bird species.	Short term	Study area	Slight	Possible	**LOW NEGATIVE**	Moderate	An avifaunal walk down should be conducted to confirm final layout and identify any sensitive species breeding on site that may arise between the conclusion of the EIA process and the construction phase. All construction activities should be strictly managed according to generally accepted environmental best practice standards, to avoid any unnecessary impact on the receiving environment.	**LOW NEGATIVE**
Impact: Disturbance of birds during operations									

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Turbines, roads, hard stands and other components	Birds are disturbed by construction or operations activities & their survival or reproduction is compromised. Most applicable with breeding sensitive bird species.	Short term	Study area	Slight	Possible	LOW NEGATIVE	Moderate	None required	LOW NEGATIVE
Impact: Displacement of birds during operations									
Turbines, roads, hard stands and other components	Birds are displaced from the wind farm area by the operational activities & their survival or reproduction is compromised. Most applicable with breeding sensitive bird species.	Long term	Study area	Slight	Possible	LOW NEGATIVE	Moderate	None required	LOW NEGATIVE
Impact: Collision of birds with turbines during operations									

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Turbines	Birds in flight collide with turbines and are killed	Long term	Study area	Moderate	Possible	**LOW NEGATIVE**	Moderate	No changes to the current turbine positions should be made without consulting the specialist. A post construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled. We recommend strongly that an appropriate mitigation budget be provided for by the Applicant. It is also important that the Applicant be aware that mitigation measures may require the installation of equipment on turbines, or possibly the painting of blades. Potential technical and warrantee challenges should be noted where possible throughout the planning process so that they do not prevent the implementation of reasonable mitigation if required. Post construction monitoring should inform an adaptive management programme to mitigate any identified impacts to acceptable levels. We recommend that all turbines are searched for collision fatalities every week once operational.	**LOW NEGATIVE**
Impact: Collision & electrocution of birds on overhead power lines during operations									

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGA-TION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Overhead grid connecton power line	Birds in flight collide with overhead cables	Long term	Study area	Moderate	Probable	**MODERATE NEGATIVE**	Low – birds are killed	It is essential that the length of overhead power line is kept to an absolute minimum. The overhead power line will need to be routed optimally, have anti bird collision line marking devices installed on all spans.	**LOW NEGATIVE**
Overhead grid connection power line	Birds perched on pylons bridge clearances between phases and/or earth and are electrocuted.	Long term	Study area	Moderate	Probable	**MODERATE NEGATIVE**	Low – birds are killed	It is essential that the length of overhead power line is kept to an absolute minimum. The overhead power line will need to be routed optimally, and be a bird friendly pylon design.	**LOW NEGATIVE**
Impact: Disturbance of birds during decommissioning									
Turbines, roads, hard stands and other components	Birds are disturbed by decommissioning activities & their survival or reproduction is compromised. Most applicable with breeding sensitive bird species.	Short term	Study area	Slight	Possible	**LOW NEGATIVE**	Moderate	None required	**LOW NEGATIVE**

4.4 Cumulative Impacts

A cumulative impact, in relation to an activity, means the past, current and reasonable foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonable foreseeable impacts eventuating from similar or diverse activities (as defined by NEMA EIA Reg 1).

The cumulative impacts of wind energy on avifauna in the project area have been assessed according to the guidance in the DEA (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria); and the IFC guidelines (Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets". Specifically, the steps to be undertaken in the cumulative impact assessment section of the study will be as follows:

1. Define and assess the impacts of the Latrodex Wind Farm project.
2. Identify and obtain details for all operational and authorised overhead power lines and wind farms (within 30km radius of the proposed site).
3. Identify impacts of the proposed project which are also likely or already exist at the other projects.
4. Obtain reports and data for other projects.
5. As far as possible quantify the effect of all projects on key bird species local populations (will need to be defined and estimated).
6. Express the likely impacts associated with the proposed wind farm project as a proportion of the overall impacts on key species.
7. A reasoned overall opinion will be expressed on the suitability of the proposed development against the above background (i.e. whether the receiving environment can afford to accommodate additional similar impacts). This will include a cumulative impact assessment statement.
8. The decision making process with respect to the above will be clearly documented in the report.

There are no other wind farms planned, operational or authorised within a 30km radius of the proposed Latrodex Wind Farm according to the DEA Online Screening Tool. However we are aware of a proposed Haga Haga Wind Farm within 30km of the Latrodex site, although we are not sure of the status of this project. We are also aware of the authorised Great Kei Wind Farm approximately 30km from the Latrodex site, and the operational Chaba Wind Farm approximately 35km from the Latrodex site. The most relevant site is therefore the proposed Haga Haga Wind Farm. This project consists of up to 42 turbines with a hub height of 134m and a rotor diameter 150m.

We believe that the Latrodex Wind Farm (with only 5 turbines of hub height 80m and rotor 90m) makes a very small contribution to the impacts on avifauna relative to these other much larger commercial scale facilities. In addition most of the priority bird species relevant to the Haga Haga Wind Farm project will not occur on the Latrodex site due to its small size and lack of many of the relevant micro habitats.

4.5 Impacts of No-Go Alternative & Comparison of alternatives

The No-Go option would result in no wind farm and associated infrastructure being built on site. As a result none of the impacts on birds described in Section 4.1 to 4.4 would take place. The significance of impacts of the No-Go option on avifauna would therefore be Negligible. On these grounds there is no need for a detailed assessment of this alternative.

Three alternative routes were provided for assessment for the overhead grid connection (<33kV) power line. These are shown in Figure 8. This power line will be approximately 6.8 to 8.6km long, depending on which alternative is used. We did not conduct field work in the proposed area since the proposed grid connection was a recent addition to the project. However on a deskop level we can make the following findings:

- The red route is likely fatally flawed due to its proximity to the Double Mouth area and the reserve itself. We are aware that there is an existing line in this area, but this was likely built before thorough EIA, and the same mistake should not be repeated with the new line.
- The green and pink routes are both acceptable based on our current knowledge of the area.
- The pink route would be preferred as it is shorter with consequently less risk to birds.

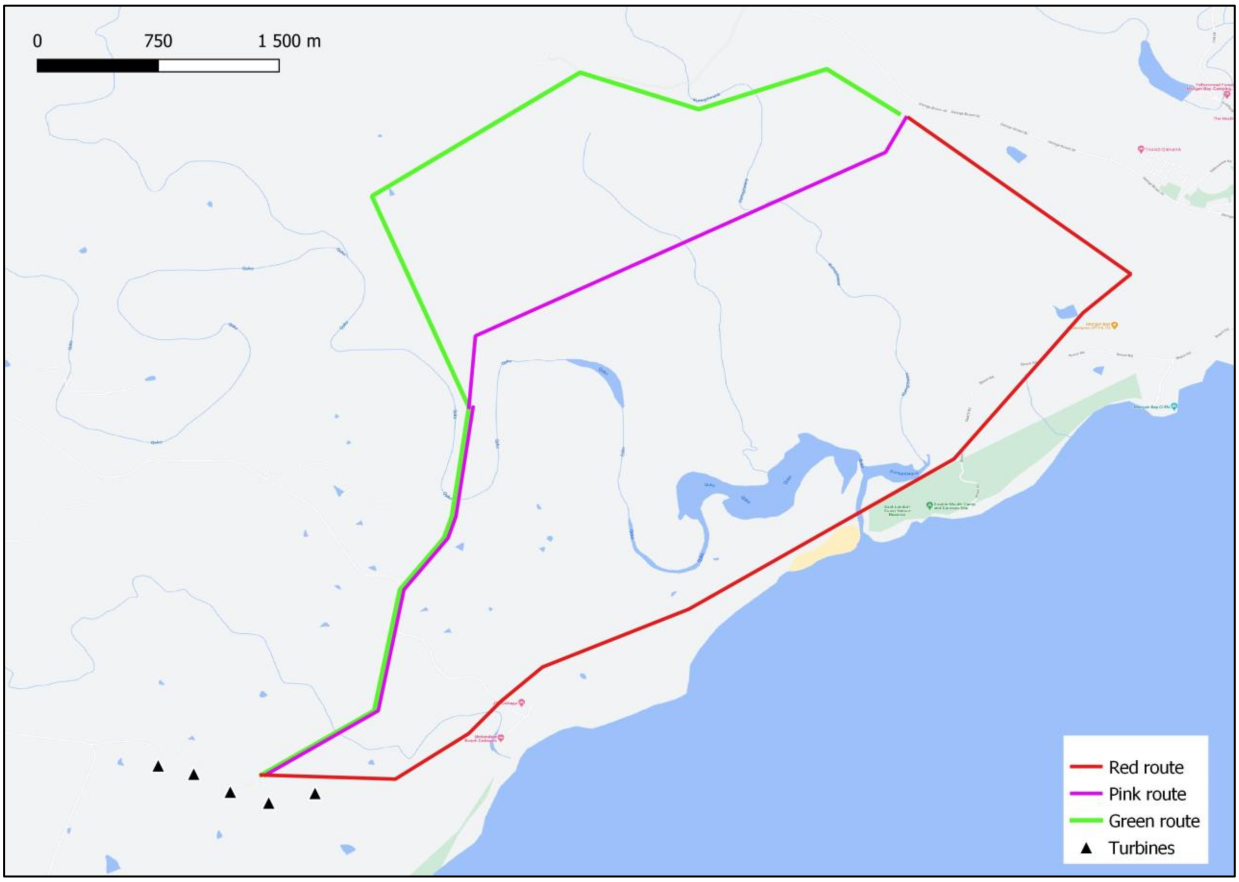

Figure 8. The three alternative routes for the <33kv grid connection power line.

5. Conclusions & Recommendations

We make the following conclusions regarding the avifaunal community and potential impacts of the Latrodex Wind Farm:

- At a national level the proposed site is Low sensitivity in our judgement. On site itself, no sensitive areas exist on the proposed footprint, the only sensitivities being off site to the north and site.
- We classified two bird species as being at high risk for this assessment. These are: Jackal Buzzard, and Yellow-billed Kite.
- We calculated crude predicted bird species fatality rates through turbine collision. These are very low in our view (0.4156 fatalities per annum of all priority species collectively, including most importantly 0.2124 Jackal Buzzard fatalities per annum).

We make the following findings with respect to impact significance for avifauna, according to the formal impact assessment methods provided by CES.

Impact	Pre-mitigation	Post-mitigation
Construction Phase		
Habitat destruction	Low Negative	Low Negative
Disturbance	Low Negative	Low Negative
Operational Phase		
Disturbance	Low Negative	Low Negative
Displacement	Low Negative	Low Negative
Turbine collisions	Low Negative	Low Negative
Power line Collision & Electrocution	Moderate Negative	Low Negative
Decommissioning Phase		
Disturbance	Low Negative	Low Negative

We recommend the following mitigation measures be applied to manage and reduce the significance of impacts on birds:

- No changes to the current turbine positions should be made without consulting the specialist.
- A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- A post construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled.
- Given that the impact of bird collision with turbines could occur once the wind farm is operational and require mitigation, we recommend strongly that an appropriate mitigation budget be provided for by the Applicant. At this stage it is not possible to determine what mitigation may be appropriate, and in the time between writing this report and the mitigation need arising (likely several years) new mitigation methods may be developed. However if such a need arises and suitable mitigation is identified it cannot be argued by the wind farm operator that mitigation was not budgeted for. Mitigation could cost the operator either in the form of additional costs or lost productivity as a result of changes to turbine operations. We have suggested a budget for this aspect in this report. It is also important that the developer be aware that mitigation measures may require the installation of equipment on turbines, or possibly the painting of blades. Potential technical and warrantee challenges should be noted where possible throughout the planning process so that they do not prevent the implementation of reasonable mitigation if required.
- Internal power line must be placed underground.
- Overhead conductors or earth wires on the grid connection power line should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.

- The pole/pylon design on the grid connection power line must be a bird friendly design.
- A post construction monitoring programme in accordance with the latest available version of the best practice guidelines at the time must be implemented for a minimum of two years, but longer if impacts on Red Listed species occur. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels.

It is our professional opinion that if the recommendations contained in this report are adhered to, this project should be allowed to proceed.

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Appendix 1. Walked transect data.

		Full year			Winter			Spring			Summer			Autumn		
	Transect length	**12.304**			**3.076**			**3.076**			**3.076**			**3.076**		
	# species	**52**			**25**			**23**			**30**			**28**		
Common name	**Taxonomic name**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**
Dark-capped Bulbul	*Pycnonotus tricolor*	50	28	4.06	12	9	3.90	7	4	2.28	22	9	7.15	9	6	2.93
Sombre Greenbul	*Andropadus importunus*	41	28	3.33	7	5	2.28	7	6	2.28	17	9	5.53	10	8	3.25
Black-bellied Starling	*Notopholia corrusca*	30	12	2.44	5	3	1.63	19	8	6.18	6	1	1.95			
Red-winged Starling	*Onychognathus morio*	29	6	2.36	6	2	1.95				11	2	3.58	12	2	3.90
Spur-winged Goose	*Plectropterus gambensis*	21	2	1.71				2	1	0.65				19	1	6.18
Hadeda Ibis	*Bostrychia hagedash*	18	4	1.46				4	1	1.30	2	1	0.65	12	2	3.90
Southern Boubou	*Laniarius ferrugineus*	18	15	1.46	5	5	1.63	2	2	0.65	7	5	2.28	4	3	1.30
Barn Swallow	*Hirundo rustica*	17	6	1.38				5	3	1.63	12	3	3.90			
Black-crowned Tchagra	*Tchagra senegalus*	15	11	1.22	2	2	0.65	1	1	0.33	7	5	2.28	5	3	1.63
Red-fronted Tinkerbird	*Pogoniulus pusillus*	14	12	1.14	2	2	0.65	5	4	1.63	7	6	2.28			
Wailing Cisticola	*Cisticola lais*	12	9	0.98	1	1	0.33				8	6	2.60	3	2	0.98
Lazy Cisticola	*Cisticola aberrans*	11	9	0.89	1	1	0.33	4	4	1.30	5	3	1.63	1	1	0.33
African Olive Pigeon	*Columba arquatrix*	9	2	0.73										9	2	2.93
Bar-throated Apalis	*Apalis thoracica*	9	8	0.73	2	2	0.65	4	4	1.30	1	1	0.33	2	1	0.65
Black-headed Oriole	*Oriolus larvatus*	9	9	0.73	3	3	0.98	1	1	0.33	2	2	0.65	3	3	0.98
Green-backed Camaroptera	*Camaroptera brachyura*	9	9	0.73				4	4	1.30	5	5	1.63			
Black-collared Barbet	*Lybius torquatus*	8	5	0.65	5	3	1.63				2	1	0.65	1	1	0.33
Chinspot Batis	*Batis molitor*	8	8	0.65	2	2	0.65	3	3	0.98	1	1	0.33	2	2	0.65
Spotted Thick-knee	*Burhinus capensis*	8	1	0.65										8	1	2.60
Fork-tailed Drongo	*Dicrurus adsimilis*	7	4	0.57	1	1	0.33				4	2	1.30	2	1	0.65
Lesser-striped Swallow	*Cecropis abyssinica*	7	2	0.57				7	2	2.28						
Brimstone Canary	*Crithagra sulphurata*	6	2	0.49							6	2	1.95			

Green Wood Hoopoe	*Phoeniculus purpureus*	6	2	0.49							5	1	1.63	1	1	0.33
Amethyst Sunbird	*Chalcomitra amethystina*	5	3	0.41				2	1	0.65				3	2	0.98
Ring-necked Dove	*Streptopelia capicola*	5	4	0.41	3	2	0.98				2	2	0.65			
Crowned Hornbill	*Lophoceros alboterminatus*	5	3	0.41	4	2	1.30							1	1	0.33
Southern Black Tit	*Melaniparus niger*	5	2	0.41										5	2	1.63
Brown-hooded Kingfisher	*Halcyon albiventris*	4	4	0.33				1	1	0.33	3	3	0.98			
Common Starling	*Sturnus vulgaris*	4	1	0.33										4	1	1.30
Greater Double-collared Sun-bird	*Cinnyris afer*	4	3	0.33	1	1	0.33							3	2	0.98
Rufous-naped Lark	*Mirafra africana*	4	4	0.33				4	4	1.30						
Trumpeter Hornbill	*Bycanistes bucinator*	4	3	0.33										4	3	1.30
White-browed Scrub Robin	*Cercotrichas leucophrys*	4	3	0.33	4	3	1.30									
Yellow-fronted Canary	*Crithagra mozambica*	4	5	0.33	1	4	0.33	3	1	0.98						
Grey-backed Cisticola	*Cisticola subruficapilla*	3	3	0.24				1	1	0.33	2	2	0.65			
Yellow Weaver	*Ploceus subaureus*	3	2	0.24										3	2	0.98
Red-necked Spurfowl	*Pternistis afer*	3	2	0.24				3	2	0.98						
African Hoopoe	*Upupa africana*	2	2	0.16	1	1	0.33							1	1	0.33
Egyptian Goose	*Alopochen aegyptiaca*	2	1	0.16										2	1	0.65
Knysna Turaco	*Tauraco corythaix*	2	2	0.16	1	1	0.33				1	1	0.33			
Red-eyed Dove	*Streptopelia semitorquata*	2	2	0.16	1	1	0.33				1	1	0.33			
Southern Fiscal	*Lanius collaris*	2	2	0.16	1	1	0.33				1	1	0.33			
Speckled Mousebird	*Colius striatus*	2	2	0.16	1	1	0.33				1	1	0.33			
Southern Grey-headed Spar-row	*Passer diffusus*	2	1	0.16							2	1	0.65			
Burchell's Coucal	*Centropus burchellii*	1	1	0.08				1	1	0.33						
Cape Longclaw	*Macronyx capensis*	1	1	0.08	1	1	0.33									
Cape Weaver	*Ploceus capensis*	1	1	0.08										1	1	0.33
Cardinal Woodpecker	*Dendropicos fuscescens*	1	1	0.08										1	1	0.33
Diderick Cuckoo	*Chrysococcyx caprius*	1	1	0.08							1	1	0.33			
Pearl-breasted Swallow	*Hirundo dimidiata*	1	1	0.08							1	1	0.33			
Red-collared Widowbird	*Euplectes ardens*	1	1	0.08							1	1	0.33			

Tawny-flanked Prinia	*Prinia subflava*	1	1	0.08				1	1	0.33

Appendix 2. Vehicle transect data.

		Full year			Winter			Spring			Summer			Autumn		
	Transect length	**44**			**11**			**11**			**11**			**11**		
	# species	**3**			**2**			**2**			**2**			**1**		
Common name	**Taxonomic name**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**	**Birds**	**Rec**	**Birds /km**
Jackal Buzzard	*Buteo rufofuscus*	4	4	0.09	1	1	0.09	1	1	0.09	1	1	0.09	1	1	0.09
African Fish-Eagle	*Haliaeetus vocifer*	3	2	0.07	2	1	0.18				1	1	0.09			
Yellow-billed Kite	*Milvus migrans*	1	1	0.02				1	1	0.09						

Appendix 3. Priority bird flight activity data.

			Full year			Winter			Spring			Summer			Autumn		
	# species		**11**			**6**			**4**			**3**			**4**		
Common name	**Taxonomic name**	**Conservation status**	**Birds**	**Rec**	**Birds /hr**	**Birds**	**Rec**	**Birds /hr**	**Birds**	**Rec**	**Birds /hr**	**Birds**	**Rec**	**Birds /hr**	**Birds**	**Rec**	**Birds /hr**
		All species	95	69	1.98	17	12	1.42	27	27	2.25	23	21	1.92	28	9	2.33
Jackal Buzzard	*Buteo rufofuscus*		46	44	0.96	5	5	0.42	21	21	1.75	17	15	1.42	3	3	0.25
Spur-winged Goose	*Plectropterus gambensis*		19	1	0.40										19	1	1.58
Yellow-billed Kite	*Milvus parasitus*		9	9	0.19				4	4	0.33	5	5	0.42			
Lanner Falcon	*Falco biarmicus*	VU	4	4	0.08										4	4	0.33
Egyptian Goose	*Alopochen aegyptiaca*		4	2	0.08	2	1	0.17							2	1	0.17
African Spoonbill	*Platalea alba*		4	1	0.08	4	1	0.33									
Black-headed Heron	*Ardea melanocephala*		3	2	0.06	3	2	0.25									
African Fish-Eagle	*Haliaaetus vocifer*		3	3	0.06	2	2	0.17	1	1	0.08						
Hamerkop	*Scopus umbretta*		1	1	0.02	1	1	0.08									
Denham's Bustard	*Neotis denhamii*	VU	1	1	0.02				1	1	0.08						
Common Buzzard	*Buteo buteo*		1	1	0.02							1	1	0.08			

Appendix 4. Summary bird species data.

Note "1" denotes presence not abundance

Full Name	***Scientific Name***	**RD (Re-gional, Global)**	**End Em ism**	**Retief**	**SAB AP1**	**SAB AP2**	**Wi**	**Sp**	**Su**	**Au**
Black Harrier	*Circus maurus*	EN, EN	NE	6	1					
Cape Vulture	*Gyps coprotheres*	EN, EN		1	1					
Grey Crowned Crane	*Balearica regulorum*	EN, EN		15	1	1	1	1	1	
Yellow-billed Stork	*Mycteria ibis*	EN, LC		9	1					
African Marsh Harrier	*Circus ranivorus*	EN, LC		24	1	1				
Mangrove Kingfisher	*Halcyon senegaloides*	EN, LC				1				
Cape Parrot	*Poicephalus robustus*	EN, VU	E	71	1					
Martial Eagle	*Polemaetus bellicosus*	EN, VU		4	1					
Southern Ground-Hornbill	*Bucorvus leadbeateri*	EN, VU		17	1	1				
Gurney's Sugarbird	*Promerops gurneyi*	LC, NT	NE	174		1				
Forest Buzzard	*Buteo trizonatus*	LC, NT	SLS	100	1	1				
Red Knot	*Calidris canutus*	LC, NT			1					
Curlew Sandpiper	*Calidris ferruginea*	LC, NT			1					
Half-collared Kingfisher	*Alcedo semitorquata*	NT, LC		107	1	1				
European Roller	*Coracias garrulus*	NT, LC		132	1					
Knysna Woodpecker	*Campethera notata*	NT, NT	E	110	1	1				
Chestnut-banded Plover	*Charadrius pallidus*	NT, NT		57	1					
Eurasian Curlew	*Numenius arquata*	NT, NT			1	1				
Blue Crane	*Grus paradisea*	NT, VU		11	1					
Verreaux's Eagle	*Aquila verreauxii*	VU, LC		3	1					
Great White Pelican	*Pelecanus onocrotalus*	VU, LC		7	1					
Black Stork	*Ciconia nigra*	VU, LC		8	1					
Lanner Falcon	*Falco biarmicus*	VU, LC		23	1	1				1
African Grass Owl	*Tyto capensis*	VU, LC		32	1					
Caspian Tern	*Hydropogne caspia*	VU, LC		50	1	1				
Striped Flufftail	*Sarothrura affinis*	VU, LC		85	1					
White-backed Night Heron	*Gorsachius leuconotus*	VU, LC		138	1					
African Finfoot	*Podica senegalensis*	VU, LC			1					
Denham's Bustard	*Neotis denhami*	VU, NT		21	1	1		1		
Crowned Eagle	*Stephanoaetus coronatus*	VU, NT		26	1	1				
Secretarybird	*Sagittarius serpentarius*	VU, VU		12	1					
African Fish Eagle	*Haliaeetus vocifer*			29	1	1	1	1		
Knysna Warbler	*Bradypterus sylvaticus*	VU, VU		78						
Jackal Buzzard	*Buteo rufofuscus*		NE	44	1	1	1	1	1	1
Booted Eagle	*Hieraaetus pennatus*			55	1	1				
Western Osprey	*Pandion haliaetus*			58	1	1				

White Stork	*Ciconia ciconia*		61	1					
Yellow-billed Kite	*Milvus aegyptius*		62*	1	1		1		
Amur Falcon	*Falco amurensis*		68	1	1				
Common (Steppe) Buzzard	*Buteo buteo*		69	1	1			1	
Marsh Owl	*Asio capensis*		80	1					
African Harrier-Hawk	*Polyboroides typus*		83	1	1				
Long-crested Eagle	*Lophaetus occipitalis*		84	1	1				
Brown Snake Eagle	*Circaetus cinereus*		91	1					
Black-winged Kite	*Elanus caeruleus*		94	1	1				
Black-winged Lapwing	*Vanellus melanopterus*		97	1	1				
Spotted Eagle-Owl	*Bubo africanus*		98	1	1				
Southern Tchagra	*Tchagra tchagra*	NE	129	1	1				
Cape Grassbird	*Sphenoeacus afer*	NE	156	1	1				
Karoo Prinia	*Prinia maculosa*	NE	157	1	1				
Cape Weaver	*Ploceus capensis*	NE	182	1	1				1
Cape White-eye	*Zosterops virens*	NE	183	1	1			1	
Southern Double-collared Sun-bird	*Cinnyris chalybeus*	NE	184	1	1	1			1
Fiscal Flycatcher	*Melaenornis silens*	NE	187	1	1				
Cloud Cisticola	*Cisticola textrix*	NE		1	1				
Brown Scrub Robin	*Cercotrichas signata*	NE		1	1				
Karoo Thrush	*Turdus smithi*	NE		1					
Barratt's Warbler	*Bradypterus barratti*	NE		1	1				
Swee Waxbill	*Coccopygia melanotis*	NE		1					
Pied Starling	*Lamprotornis bicolor*	SLS	116	1					
Cape Rock Thrush	*Monticola rupestris*	SLS	119	1	1				
Drakensberg Prinia	*Prinia hypoxantha*	SLS	169	1					
Greater Double-collared Sun-bird	*Cinnyris afer*	SLS	171	1	1	1			
Forest Canary	*Crithagra scotops*	SLS		1	1				
Chorister Robin-chat	*Cossypha dichroa*	SLS		1	1				
Knysna Turaco	*Tauraco corythaix*	SLS		1	1	1		1	
Black Sparrowhawk	*Accipiter melanoleucus*		101	1	1				
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*		102	1					
Rock Kestrel	*Falco rupicolus*		111	1	1				
Hamerkop	*Scopus umbretta*		118	1	1	1			
Barn Swallow	*Hirundo rustica*		127	1	1		1	1	
Three-banded Plover	*Charadrius tricollaris*		140	1	1				
Black-headed Heron	*Ardea melanocephala*		141	1	1	1	1		1
Pearl-breasted Swallow	*Hirundo dimidiata*		150	1	1			1	
Lesser Striped Swallow	*Cecropis abyssinica*		151	1	1			1	
Blacksmith Lapwing	*Vanellus armatus*		159				1	1	1
Egyptian Goose	*Alopochen aegyptiaca*		162	1	1	1	1		1
Purple Heron	*Ardea purpurea*		163	1	1				
European Bee-eater	*Merops apiaster*		172	1					

Wattled Starling	*Creatophora cinerea*	173	1	1				
Cape Longclaw	*Macronyx capensis*	178	1	1				
Horus Swift	*Apus horus*	180	1	1				
Western Cattle Egret	*Bubulcus ibis*	189	1	1				
African Goshawk	*Accipiter tachiro*	190	1	1				
Fiery-necked Nightjar	*Caprimulgus pectoralis*	193	1	1				1
Dusky Indigobird	*Vidua funerea*	199	1	1				
Red-backed Shrike	*Lanius collurio*	201	1	1				
White-crowned Lapwing	*Vanellus albiceps*	209	1	1				
Bar-throated Apalis	*Apalis thoracica*		1	1	1		1	
Yellow-breasted Apalis	*Apalis flavida*		1	1				
Pied Avocet	*Recurvirostra avosetta*		1					
Black-collared Barbet	*Lybius torquatus*		1	1	1		1	
Cape Batis	*Batis capensis*		1	1				
Chinspot Batis	*Batis molitor*		1	1	1	1	1	1
Southern Red Bishop	*Euplectes orix*		1	1				
Little Bittern	*Ixobrychus minutus*		1					
Bokmakierie	*Telophorus zeylonus*		1	1				
Southern Boubou	*Laniarius ferrugineus*		1	1	1		1	1
Terrestrial Brownbul	*Phyllastrephus terrestris*		1	1				
Dark-capped Bulbul	*Pycnonotus tricolor*		1	1		1	1	1
Cape Bunting	*Emberiza capensis*		1					
Cinnamon-breasted Bunting	*Emberiza tahapisi*			1				
Golden-breasted Bunting	*Emberiza flaviventris*		1	1				
Grey-headed Bush-Shrike	*Malaconotus blanchoti*		1	1				
Olive Bush-Shrike	*Chlorophoneus olivaceus*		1	1				
Orange-breasted Bush-Shrike	*Chlorophoneus sulfureo-pectus*		1	1				1
Green-backed Camaroptera	*Camaroptera brachyura*		1	1	1	1	1	
Brimstone Canary	*Crithagra sulphurata*		1	1			1	
Cape Canary	*Serinus canicollis*		1	1				
Yellow Canary	*Crithagra flaviventris*		1	1				
Yellow-fronted Canary	*Crithagra mozambica*		1	1	1	1		
Ant-eating Chat	*Myrmecocichla for-micivora*		1					
Familiar Chat	*Oenathe familiaris*		1	1				
Mocking Cliff Chat	*Thamnolaea cinnamo-meiventris*		1					
Croaking Cisticola	*Cisticola natalensis*		1	1				
Grey-backed Cisticola	*Cisticola subruficapilla*				1	1		
Lazy Cisticola	*Cisticola aberrans*		1	1	1	1	1	1
Levaillant's Cisticola	*Cisticola tinniens*		1	1				
Wailing Cisticola	*Cisticola lais*		1	1		1	1	1
Wing-snapping Cisticola	*Cisticola ayresii*		1	1				
Zitting Cisticola	*Cisticola juncidis*		1	1			1	
Red-knobbed coot	*Fulica cristata*		1	1				

Reed Cormorant	*Microcarbo africanus*	1	1	1			
Burchell’s Coucal	*Centropus burchellii*	1	1	1	1	1	
Baillon's Crake	*Porzana pusilla*	1					
Black Crake	*Amaurornis flavirostra*	1					
Cape Crow	*Corvus capensis*	1	1	1			
Pied Crow	*Corvus albus*	1	1		1		
African Emerald Cuckoo	*Chrysococcyx cupreus*	1					
Black Cuckoo	*Cuculus clamosus*	1	1				
Common Cuckoo	*Cuculus canorus*	1	1				
Diederik Cuckoo	*Chrysococcyx caprius*	1	1		1	1	
Jacobin Cuckoo	*Clamator jacobinus*	1	1				
Klaas's Cuckoo	*Chrysococcyx klaas*	1	1				
Red-chested Cuckoo	*Cuculus solitarius*	1			1		
Black Cuckooshrike	*Campephaga flava*	1	1				
Grey Cuckooshrike	*Ceblepyris caesius*	1	1				
African Darter	*Anhinga rufa*	1	1				
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*	1	1	1		1	
Emerald-spotted Wood Dove	*Turtur chalcospilos*	1	1				
Laughing Dove	*Spilopelia senegalensis*	1	1			1	1
Lemon Dove	*Columba larvata*	1	1				
Namaqua Dove	*Oena capensis*	1					
Red-eyed Dove	*Streptopelia semitorquata*	1	1	1	1	1	1
Rock Dove	*Columba livia*	1	1				
Tambourine Dove	*Turtur tympanistria*	1	1				
Fork-tailed Drongo	*Dicrurus adsimilis*	1	1	1	1	1	1
Common Square-tailed Drongo	*Dicrurus ludwigii*	1	1				
African Black Duck	*Anas sparsa*	1	1				
White-backed Duck	*Thalassornis leuconotus*	1					
White-faced Whistling Duck	*Dendrocygna viduata*	1	1				
Yellow-billed Duck	*Anas undulata*	1	1				
Great Egret	*Ardea alba*	1	1				
Little Egret	*Egretta garzetta*	1	1				
Yellow-billed (Intermediate) Egret	*Ardea intermedia*	1					
African Firefinch	*Lagonosticta rubricata*	1	1				
Southern (Common) Fiscal	*Lanius collaris*	1	1	1	1	1	1
Buff-spotted Flufftail	*Sarothrura elegans*	1	1				
Red-chested Flufftail	*Sarothrura rufa*	1					
African Dusky Flycatcher	*Muscicapa adusta*	1	1				
African Paradise Flycatcher	*Terpsiphone viridis*	1	1				1
Ashy Flycatcher	*Muscicapa caerulescens*	1	1				
Blue-mantled Crested Fly-catcher	*Trochocercus cyanomelas*	1	1				
Southern Black flycatcher	*Melaenornis pammelaina*	1	1				
Spotted flycatcher	*Muscicapa striata*	1	1				

Red-winged Francolin	*Scleroptila levaillantii*	1	1				
Spur-winged Goose	*Plectropterus gambensis*	1	1		1		1
Little Grebe	*Tachybaptus ruficollis*	1	1				
Sombre Greenbul	*Andropadus importunus*	1	1	1	1	1	1
Common Greenshank	*Tringa nebularia*	1	1				
Helmeted Guineafowl	*Numida meleagris*	1	1				1
Grey-headed Gull	*Chroicocephalus cirro-cephalus*	1	1				
African Cuckoo Hawk	*Aviceda cuculoides*	1					
Black-crowned Night Heron	*Nycticorax nycticorax*	1	1				
Goliath Heron	*Ardea goliath*	1	1				
Green-backed (Striated) Heron	*Butorides striata*		1				
Grey Heron	*Ardea cinerea*	1	1				
Squacco Heron	*Ardeola ralloides*	1					
Brown-backed Honeybird	*Prodotiscus regulus*	1	1				
Greater Honeyguide	*Indicator indicator*	1	1				
Lesser Honeyguide	*Indicator minor*	1	1				
Scaly-throated Honeyguide	*Indicator variegatus*	1					
African Hoopoe	*Upupa africana*	1	1	1			1
Crowned Hornbill	*Lophocerus alboterminatus*	1	1	1	1	1	1
Trumpeter Hornbill	*Bycanistes bucinator*	1	1		1		1
African Sacred Ibis	*Threskiornis aethiopicus*	1	1	1			
Hadeda (Hadada) Ibis	*Bostrychia hagedash*	1	1	1	1	1	1
African Jacana	*Actophilornis africanus*	1					
African Pygmy Kingfisher	*Ispidina picta*	1	1				
Brown-hooded Kingfisher	*Halcyon albiventris*	1	1		1	1	1
Giant Kingfisher	*Megaceryle maxima*	1	1				
Malachite Kingfisher	*Corythornis cristatus*	1	1				
Pied Kingfisher	*Ceryle rudis*	1	1				
Crowned Lapwing	*Vanellus coronatus*	1	1				
Red-capped Lark	*Calandrella cinerea*	1					
Rufous-naped Lark	*Mirafra africana*	1	1		1		
Yellow-throated Longclaw	*Macronyx croceus*	1	1				
Bronze Mannikin	*Lonchura cucullata*	1	1				
Banded Martin	*Riparia cincta*	1					
Brown-throated Martin	*Riparia paludicola*	1	1	1			
Common House Martin	*Delichon urbicum*	1	1				
Rock Martin	*Ptyonoprogne fuligula*	1	1				
Common Moorhen	*Gallinula chloropus*	1	1				
Red-faced Mousebird	*Urocolius indicus*	1	1				1
Speckled Mousebird	*Colius striatus*	1	1	1	1	1	
Neddicky	*Cisticola fulvicapilla*	1	1	1	1	1	1
European Nightjar	*Caprimulgus europaeus*	1					
Black-headed Oriole	*Oriolus larvatus*	1	1	1	1	1	1

Eurasian Golden Oriole	*Oriolus oriolus*	1					
Common Ostrich	*Struthio camelus*		1				
African Scops Owl	*Otus senegalensis*	1					
African Wood Owl	*Strix woodfordii*	1	1				
Western Barn Owl	*Tyto alba*	1					
Yellow-throated Petronia	*Gymnoris superciliaris*	1	1				
African Green Pigeon	*Treron calvus*	1	1		1		1
African Olive Pigeon	*Columba arquatrix*	1	1				
Speckled Pigeon	*Columba guinea*	1	1				
African Pipit	*Anthus cinnamomeus*	1	1				
Buffy Pipit	*Anthus vaalensis*		1				
Nicholson's Pipit	*Anthus similis*		1				
Plain-backed Pipit	*Anthus leucophrys*	1	1				1
Striped Pipit	*Anthus lineiventris*	1	1				
Grey Plover	*Pluvialis squatarola*	1					
Kittlitz’s Plover	*Charadrius pecuarius*	1	1				
Southern Pochard	*Netta erythrophthalma*	1					
Tawny-flanked Prinia	*Prinia subflava*	1	1		1		
Black-backed Puffback	*Dryoscopus cubla*	1	1				
African Quail-finch	*Ortygospiza atricollis*	1	1				
Common Quail	*Coturnix coturnix*	1	1				
Red-billed Quelea	*Quelea quelea*		1				
African Rail	*Rallus caerulescens*	1	1				
White-necked Raven	*Corvus albicollis*	1	1				
Cape Robin-chat	*Cossypha caffra*	1	1				1
Red-capped Robin-chat	*Cossypha natalensis*	1	1				
White-browed Scrub Robin	*Cercotrichas leucophrys*	1	1	1			
White-starred Robin	*Pogonocichla stellata*	1	1				
Ruff	*Calidris pugnax*	1					
Sanderling	*Calidris alba*	1	1				
Common Sandpiper	*Actitis hypoleucos*	1	1				
Marsh Sandpiper	*Tringa stagnatilis*	1	1				
Terek Sandpiper	*Xenus cinereus*	1					
Wood Sandpiper	*Tringa glareola*	1	1				
Black Saw-wing	*Psalidoprocne pristoptera*	1	1				
Streaky-headed Seedeater	*Crithagra gularis*	1	1				
South African Shelduck	*Tadorna cana*	1	1				
Cape Shoveler	*Spatula smithii*	1					
African Snipe	*Gallinago nigripennis*	1					
Cape Sparrow	*Passer melanurus*	1	1				
House Sparrow	*Passer domesticus*	1	1		1		
Southern Grey-headed Sparrow	*Passer diffusus*	1	1			1	1
Little Sparrowhawk	*Accipiter minullus*	1	1				
African Spoonbill	*Platalea alba*	1	1	1			

Red-necked Spurfowl	*Pternistis afer*	1	1		1	1	
Black-bellied Starling	*Notopholia corusca*	1	1	1	1	1	1
Cape Glossy (Cape) Starling	*Lamprotornis nitens*	1	1				1
Common Starling	*Sturnus vulgaris*	1	1		1		1
Red-winged Starling	*Onychognathus morio*	1	1	1	1	1	
Little Stint	*Calidris minuta*	1	1				
African Stonechat	*Saxicola torquatus*	1	1	1	1	1	1
Amethyst Sunbird	*Chalcomitra amethystina*	1	1		1	1	1
Collared Sunbird	*Hedydipna collaris*	1	1				1
Grey Sunbird	*Cyanomitra veroxii*	1	1				
Malachite Sunbird	*Nectarinia famosa*	1					
Olive Sunbird	*Cyanomitra olivacea*	1	1				1
Greater Striped Swallow	*Cecropis cucullata*	1	1		1		
White-throated Swallow	*Hirundo albigularis*	1	1				
African (Purple) Swamphen	*Porphyrio madagascari-ensis*	1					
African Black Swift	*Apus barbatus*	1	1				
African Palm Swift	*Cypsiurus parvus*		1				
Alpine Swift	*Tachymarptis melba*	1	1				
Common Swift	*Apus apus*			1			
Little Swift	*Apus affinis*	1	1			1	
White-rumped Swift	*Apus caffer*	1	1		1	1	
Black-crowned Tchagra	*Tchagra senegalus*	1	1	1	1	1	1
Cape Teal	*Anas capensis*	1					
Red-billed Teal	*Anas erythrorhyncha*	1	1				
Whiskered Tern	*Chlidonias hybrida*	1					
White-winged Tern	*Chlidonias leucopterus*	1					
Spotted Thick-knee	*Burhinus capensis*	1	1				1
Water Thick-knee	*Burhinus vermiculatus*	1	1				
Olive Thrush	*Turdus olivaceus*	1	1				
Red-fronted Tinkerbird	*Pogoniulus pusillus*	1	1	1		1	1
Southern Black Tit	*Melaniparus niger*	1	1				1
Narina Trogon	*Apaloderma narina*	1	1				
Livingstone's Turaco	*Tauraco livingstonii*	1					
Ruddy Turnstone	*Arenaria interpres*	1	1				
African Pied Wagtail	*Motacilla aguimp*	1	1				
Cape Wagtail	*Motacilla capensis*	1	1	1	1	1	1
Mountain Wagtail	*Motacilla clara*	1	1				
African Reed Warbler	*Acrocephalus baeticatus*	1					
Dark-capped (African) Yellow Warbler	*Iduna natalensis*	1	1				
Garden Warbler	*Sylvia borin*	1					
Great Reed Warbler	*Acrocephalus arundina-ceus*	1					
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	1	1				
Little Rush Warbler	*Bradypterus baboecala*	1	1				

Marsh Warbler	*Acrocephalus palustris*	1	1			
Willow Warbler	*Phylloscopus trochilus*	1	1			
Yellow-throated Woodland Warbler	*Phylloscopus ruficapilla*	1	1			
Black-throated Wattle-eye	*Platysteira peltata*	1				
Common Waxbill	*Estrilda astrild*	1	1			
Dark-backed Weaver	*Ploceus bicolor*	1	1			
Southern Masked Weaver	*Ploceus velatus*	1	1			
Spectacled Weaver	*Ploceus ocularis*	1	1	1		
Thick-billed Weaver	*Amblyospiza albifrons*	1	1			
Village Weaver	*Ploceus cucullatus*	1	1	1		
Yellow (Eastern Golden) Weaver	*Ploceus subaureus*	1	1			1
(Common) Whimbrel	*Numenius phaeopus*	1	1			
Pin-tailed Whydah	*Vidua macroura*	1	1	1		
Fan-tailed Widowbird	*Euplectes axillaris*	1	1	1		1
Long-tailed Widowbird	*Euplectes progne*	1	1			
Red-collared Widowbird	*Euplectes ardens*	1	1	1		
Green Wood-hoopoe	*Phoeniculus purpureus*	1	1	1	1	1
Cardinal Woodpecker	*Dendropicos fuscescens*	1	1			1
Olive Woodpecker	*Dendropicos griseocepha-lus*	1	1			
Red-throated Wryneck	*Jynx ruficollis*	1	1			

Appendix 5. Criteria used for the formal assessment of impacts.

The following standard rating scales have been defined for assessing and quantifying the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. The identified impacts have been assessed against the following criteria:

Six factors are considered when assessing the significance of the identified issues, namely:

1. **Significance** - Each of the below criterion (points 2-6 below) are ranked with scores assigned, as presented in Table 1 to determine the overall significance of an activity. The total scores recorded for the effect (which includes scores for duration; extent; consequence and probability) and reversibility / mitigation are then read off the matrix presented in Table 9-1, to determine the overall significance of the issue. The overall significance is either negative or positive.
2. **Consequence/severity** - the consequence scale is used in order to objectively evaluate how severe a number of negative impacts might be on the issue under consideration, or how beneficial a number of positive impacts might be on the issue under consideration.
3. **Extent** - the spatial scale defines the physical extent of the impact.
4. **Duration** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
5. The **probability** of the impact occurring - the likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident) and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
6. **Reversibility / Mitigation** – The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 9-1 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

The relationship of the issue to the temporal scale, spatial scale and the severity are combined to describe the overall importance rating, namely the significance of the assessed impact.

The impact is first classified as a positive (+) or negative (-) impact. The impact then undergoes an evaluation according to a set of criteria.

Ranking of Evaluation Criteria.

Effect	**Duration**	
	Short term	Less than 5 years
	Medium term	Between 5-20 years
	Long term	More than 20 years
	Permanent	Over 40 years or resulting in a permanent and lasting loss
	Extent	
	Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
	Study area	The proposed site and its immediate surroundings.
	Municipal	Impacts affect the Nelson Mandela Bay Metropolitan Municipality, or any towns within the municipality.
	Regional	Impacts affect the wider area or the Eastern Cape Province as a whole.
	National	Impacts affect the entire country.
	International/Global	Impacts affect other countries or have a global influence.
	Consequence/severity	
	Slight	Slight impacts or benefits on the affected system(s) or party(ies)
	Moderate	Moderate impacts or benefits on the affected system(s) or party(ies)
	Severe/ Beneficial	Severe impacts or benefits on the affected system(s) or party(ies)
	Probability	
	Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
	Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
	Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
	Unsure/Unlikely	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.
Reversibility/ Mitigation	**Impact Reversibility / Mitigation**	
	Easy	The impact can be easily, effectively and cost effectively mitigated/reversed
	Moderate	The impact can be effectively mitigated/reversed without much difficulty or cost
	Difficult	The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs
	Very Difficult	The impact could be mitigated/reversed but it would be very difficult to ensure

		effectiveness, technically very challenging and financially very costly

Impacts Severity Rating

Impact severity *(The severity of negative impacts, or how beneficial positive impacts would be on a affected system or affected party)*	
Very severe	**Very beneficial**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	**Beneficial**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	**Moderately beneficial**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing a sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	**Slightly beneficial**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	**Don't know/Can't know**
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Overall Significance Rating

OVERALL SIGNIFICANCE *(THE COMBINATION OF ALL THE ABOVE CRITERIA AS AN OVERALL SIGNIFICANCE)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL (VERY HIGH +)**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance. Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	

HIGH NEGATIVE	BENEFICIAL (HIGH +)
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	**SOME BENEFITS (MODERATE +)**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	**FEW BENEFITS (LOW +)**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. Example: The effect of a development on people's psychological perspective of the environment.	

All feasible alternatives and the "no-go option" will be equally assessed in order to evaluate the significance of the "as predicted" impacts (prior to mitigation) and the "residual" impacts (that remain after mitigation measures are taken into account). The reason(s) for the judgement will be provided when necessary.

All impacts must have a "cause and comment", a significance rating before mitigation, after mitigation and for the no-go option. Impacts should also indicate applicable mitigation measure/ recommendations to reduce the impact significance.

Appendix 6. Specialist Curriculum Vitae

JONATHAN JAMES SMALLIE
WildSkies Ecological Services (2011/131435/07)
Curriculum Vitae

BACKGROUND

Date of birth:	20 October 1975
Qualifications:	BSC – Agriculture (Hons) (completed 1998)
	University of Natal – Pietermaritzburg
	MSC – Environmental Science (completed 2011)
	University of Witwaterstrand
Occupation:	Specialist avifaunal consultant
Profession registration:	South African Council for Natural Scientific Professions

CONTACT DETAILS

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Postal: 36 Utrecht Avenue, Bonnie Doon, East London, 5210
ID #: 7510205119085

PROFESSIONAL EXPERIENCE

Strategic Assessments:

East Cape Biodiversity Strategy & Action Plan – avifauna.

Renewable energy:

Post construction bird monitoring for wind energy facilities:

Dassieklip (Caledon) –initiated in April 2014 (2yrs); Dorper Wind Farm (Molteno) – initiated in July 2014 (2yrs); Jeffreys Bay Wind Farm – initiated in August 2014 (4yrs); Kouga Wind Farm – started Feb 2015 (2yrs); Cookhouse West Wind Farm – started March 2015 (1yr); Grassridge Wind Farm – initiated in April 2015 (2yrs); Chaba Wind Farm – initiated December 2015 (1yr); Amakhala Emoyeni 01 Wind Farm initiated August 2016 (2yrs); Gibson Bay Wind Farm – initiated March 2017 (2yrs); Nojoli Wind Farm initiated March 2017 (2yrs); Sere Wind Farm (2yrs).

Pre-construction bird monitoring & EIA for wind energy facilities:

Golden Valley 1; Middleton; Dorper; Qumbu; Ncora; Nqamakhwe; Ndakana; Thomas River; Peddie; Mossel Bay; Hluhluwe; Richards Bay; Garob; Outeniqua; Castle; Wolf; Inyanda-Roodeplaat; Dassiesridge; Great Kei; Bayview; Grahamstown; Bakenskop; Umsobomvu; Stormberg; Zingesele; Oasis; Gunstfontein; Naumanii; Golden Valley Phase 2; Ngxwabangu; Hlobo; Woodstock; Scarlet Ibis; Albany; Golden Valley 1 2nd monitoring; Umtathi Emoyeni; Pensulo Zambia; Unika 1 Zambia; Impofu; Nuweveld; Kleinsee wind energy facilities.

Screening studies for wind energy facilities:

Tarkastad Wind Farm; Quanti Wind Farm; Ruitjies Wind Farm; Stutterheim Wind Farm; Molteno Wind Farm; Noupoort Wind Farm.

Avifaunal walk through for wind energy facilities:
Garob Wind Farm; Golden Valley 1 wind farm; Nxuba Wind Farm.

Pre-construction bird monitoring and EIA for Solar energy facilities:
Bonnievale Solar Energy Facility; Dealesville Solar Energy Facility; Rooipunt Solar Energy Facility; De Aar Solar Energy Facility; Noupoort Solar Energy Facility, Aggeneys Solar Energy Facility; Eskom Concentrated Solar Power Plant; Bronkhorstspruit Solar Photovoltaic Plant; De Aar Solar Energy Facility; Paulputs Solar Energy Facility; Kenhardt Solar Energy Facility; Wheatlands Solar Energy Facility; Nampower CSP project;

Other Electricity Generation:
Port of Nqura Power Barge EIA; Tugela Hydro-Electric Scheme; Mmamabula West Coal Power Station (Botswana).

Electricity transmission & distribution:
Overhead transmission power lines (>132 000 kilovolts):
Oranjemund Gromis 220kv; Perseus Gamma 765kv; Aries Kronos 765kv; Aries Helios 765kv; Perseus Kronos 765kv; Helios Juno 765kv; Borutho Nzelele 400kv; Foskor Merensky 275kv; Kimberley Strengthening; Mercury Perseus 400kV; Eros Neptune Grassridge 400kV; Kudu Juno 400kV; Garona Aries 400kV; Perseus Hydra 765kV; Tabor Witkop 275kV; Tabor Spencer 400kV; Moropule Orapa 220kV (Botswana); Coega Electrification; Majuba Venus 765kV; Gamma Grassridge 765kV; Gourikwa Proteus 400KV; Koeberg Strengthening 400kV; Ariadne Eros 400kV; Hydra Gamma 765kV; Zizabona transmission – Botswana; Maphutha Witkop 400kv; Makala B 400kv; Aggeneis Paulputs 400kv; Northern Alignment 765kv; Kappa Omega 765kv; Isundu 400kv and Substation; Senakangwedi B Integration; Oranjemund Gromis;

Overhead distribution power lines (<132 000 kilovolts):
Kanoneiland 22KV; Hydra Gamma 765kV; Komani Manzana 132kV; Rockdale Middelburg 132kV; Irenedale 132 kV; Zandfontein 132kV; Venulu Makonde 132 kV; Spencer Makonde 132 kV; Dalkeith Jackal Creek 132kV; Glen Austin 88kV; Bulgerivier 132kV; Ottawa Tongaat 132kV; Disselfontein 132kV; Voorspoed Mine 132kV; Wonderfontein 132kV; Kabokweni Hlau Hlau 132kV; Hazyview Kiepersol 132kV; Mayfern Delta 132kV; VAAL Vresap 88kV; Arthursview Modderkuil 88kV; Orapa, AK6, Lethakane substations and 66kV lines (Botswana); Dagbreek Hermon 66kV; Uitkoms Majuba 88kV; Pilanesberg Spitskop 132kV; Qumbu PG Bison 132kV; Louis Trichardt Venetia 132kV; Rockdale Middelburg Ferrochrome 132kV; New Continental Cement 132KV; Hillside 88kV; Marathon Delta 132kV; Malelane Boulder 132kV; Nondela Strengthening 132kV; Spitskop Northern Plats 132kV; West Acres Mataffin 132kV; Westgate Tarlton Kromdraai 132kV; Sappi Elliot Ugie 132kV; Melkhout Thyspunt 132kV; St Francis Bay 66kv; Etna Ennerdale 88kv; Kroonstad 66kv; Firham Platrand; Paradise Fondwe 132kv; Kraal Mafube 132kv; Loeriesfontein 132kv; Albany Mimosa 66kv; Zimanga 132kv; Grootpan Brakfontein; Mandini Mangethe; Valkfontein Substation; Sishen Saldanha; Corinth Mzongwana 132kv; Franklin Vlei 22kv; Simmerpan Strengthening; Ilanga Lethemba 132kv; Cuprum Burchell Mooidraai 132; Oliphantskop Grassridge 132;

Risk Assessments on existing power lines:
Hydra-Droerivier 1,2 & 3 400kV; Hydra-Poseidon 1,2 400kV; Butterworth Ncora 66kV; Nieu-Bethesda 22kV; Maclear 22kV (Joelshoek Valley Project); Wodehouse 22kV (Dordrecht district); Burgersdorp Aliwal North Jamestown 22kV; Cradock 22kV; Colesberg area 22kV; Loxton self build 11kV; Kanoneiland 22kV; Stutterheim Municipality 22kV; Majuba-Venus 400kV; Chivelston-Mersey 400kV; Marathon-Prairie 275kV; Delphi-Neptune 400kV; Ingagane – Bloukrans 275kV; Ingagane – Danskraal 275kV; Danskraal – Bloukrans 275kV

Avifaunal "walk through" (EMP's):
Kappa Omega 765kv; Rockdale Marble Hall 400kv; Beta Delphi 400kV; Mercury Perseus 765kV; Perseus 765kV Substation; Beta Turn 765kV in lines; Spencer Tabor 400kV line; Kabokweni Hlau Hlau 132kV;

Mayfern Delta 132kV; Eros Mtata 400kV; Cennergi Grid connect 132kV; Melkhout Thyspunt 132kv; Imvubu Theta 400kv; Outeniqua Oudshoorn 132kv; Clocolan Ficksburg 88kv.

Strategic Environmental Assessments for Master Electrification Plans:
Northern Johannesburg area; Southern KZN and Northern Eastern Cape; Northern Pretoria; Western Cape Peninsula

Other electrical infrastructure work
Investigation into rotating Bird Flapper saga – Aberdeen 22kV; Special investigation into faulting on Ariadne-Eros 132kV; Special investigation into Bald Ibis faulting on Tutuka Pegasus 275kV; Special investigation into bird related faulting on 22kV Geluk Hendrina line; Special investigation into bird related faulting on Camden Chivelston 400kV line

Water sector:
Umkhomazi Dam and associated tunnel and pipelines; Rosedale Waste Water Treatment Works; Lanseria Outfall Sewer; Lanseria Wastewater Treatment Works;

Wildlife airport hazards:
Kigali International Airport – Rwanda; Port Elizabeth Airport – specialist study as part of the EIA for the proposed Madiba Bay Leisure Park; Manzini International Airport (Swaziland); Polokwane International Airport; Mafekeng International Airport; Lanseria Airport

Other sectors:
Lizzard Point Golf Estate – Vaaldam; Lever Creek Estates housing development; East Cape Biodiversity Strategy and Action Plan 2017; Cathedral Peak Road diversion; Dube Tradeport; East London Transnet Ports Authority Biodiversity Management Plan; Leazonia Feedlot; Carisbrooke Quarry; Senekal Sugar Development; Frankfort Paper Mill;

Employment positions held to date:
- August 1999 to May 2004: Eastern Cape field officer for the South African Crane Working Group of the Endangered Wildlife Trust
- May 2004 to November 2007: National Field officer for Eskom-EWT Strategic Partnership and Airports Company SA – EWT Strategic Partnership (both programmes of Endangered Wildlife Trust)
- November 2007 to August 2011: Programme Manager – Wildlife & Energy Programme – Endangered Wildlife Trust
- **August 2011 to present: Independent avifaunal specialist – Director at WildSkies Ecological Sevices (Pty) Ltd**

Relevant achievements:
- Recipient of BirdLife South Africa’s Giant Eagle Owl in 2011 for outstanding contribution to bird conservation in SA
- Founded and chaired for first two years – the Birds and Wind Energy Specialist Group (BAWESG) of the Endangered Wildlife Trust & BirdLife South Africa.

Conferences attended & presented at:
- August 2019. Conference of Wind Energy and Wildlife, Stirlign, Scotland.
- November 2018. Raptor Research Foundation. Skukuza, Soith Africa.
- October 2017. Conference of Wind Energy and Wildlife, Estoril Portugal
- May 2011. Conference of Wind Energy and Wildlife, Trondheim, Norway.
- March 2011. Chair and facilitator at Endangered Wildlife Trust – Wildlife & Energy Programme – “2011 Wildlife & Energy Symposium”, Howick, SA

- September 2010 – Raptor Research Foundation conference, Fort Collins, Colorado. Presented on the use of camera traps to investigate Cape Vulture roosting behaviour on transmission lines
- May 2010 - Wind Power Africa 2010. Presented on wind energy and birds
- October 2008. Session chair at Pan-African Ornithological Conference, Cape Town, South Africa
- March 27 – 30 2006: International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. Presented a paper entitled "Assessing the power line network in the Kwa-Zulu Natal Province of South Africa from a vulture interaction perspective".
- June 2005: IASTED Conference at Benalmadena, Spain – presented a paper entitled "Impact of bird streamers on quality of supply on transmission lines: a case study"
- May 2005: International Bird Strike Committee 27th meeting – Athens, Greece. Presented a paper entitled Bird Strike Data analysis at SA airports 1999 to 2004.
- 2003: Presented a talk on "Birds & Power lines" at the 2003 AGM of the Amalgamated Municipal Electrical Unions – in Stutterheim - Eastern Cape
- September 2000: 5th World Conference on Birds of Prey in Seville, Spain.

Papers & publications:

- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Guidelines on how to avoid or mitigate impacts of electricity power grids on migratory birds in the African-Eurasian Region. CMS Technical Series Number XX. Bonn, Germany.
- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series Number XX, Bonn, Germany.
- Jenkins, A.R., van Rooyen, C.S, Smallie, J.J, Harrison, J.A., Diamond, M.D., Smit-Robinson, H.A & Ralston, S. 2014. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa
- Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International.
- Jordan, M., & Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust , Unpublished report
- Smallie, J., & Virani, M.Z. 2010. A preliminary assessment of the potential risks from electrical infrastructure to large birds in Kenya. Scopus 30: p32-39
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 2010. 81 (2) p109-113
- Jenkins, A.R., Smallie, J.J., & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 2010. 20: 263-278.
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. Modelling power line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 2010 (152) p590-599.
- Jenkins, A.R., Allan, D.G., & Smallie, J.J. 2009. Does electrification of the Lesotho Highlands pose a threat to that countries unique montane raptor fauna? Dubious evidence from surveys of three existing power lines. Gabar 20 (2).
- Smallie, J.J., Diamond, M., & Jenkins, A.R. 2008. Lighting up the African continent – what does this mean for our birds? Pp 38-43. In Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H., & Muchai. (eds). Proceedings of the 12th Pan-african Ornithological Congress. 2008. Cape Town. Animal Demography Unit. ISBN (978-0-7992-2361-3)
- Van Rooyen, C., & Smallie, J.J. 2006. The Eskom –EWT Strategic Partnership in South Africa: a brief summary. Nature & Faunae Vol 21: Issue 2, p25
- Smallie, J. & Froneman, A. 2005. Bird Strike data analysis at South African Airports 1999 to 2004. Proceedings of the 27th Conference of the International Bird Strike Committee, Athens Greece.

- Smallie, J. & Van Rooyen, C. 2005. Impact of bird streamers on quality of supply on transmission lines: a case study. Proceedings of the Fifth IASTED International Conference on Power and Energy Systems, Benalmadena, Spain.
- Smallie, J. & Van Rooyen, C. 2003. Risk assessment of bird interaction on the Hydra-Droërivier 1 and 2 400kV. Unpublished report to Eskom Transmission Group. Endangered Wildlife Trust. Johannesburg. South Africa
- Van Rooyen, C. Jenkins, A. De Goede, J. & Smallie J. 2003. Environmentally acceptable ways to minimise the incidence of power outages associated with large raptor nests on Eskom pylons in the Karoo: Lessons learnt to date. Project number 9RE-00005 / R1127 Technology Services International. Johannesburg. South Africa
- Smallie, J. J. & O'connor, T. G. (2000) Elephant utilization of *Colophospermum mopane*: possible benefits of hedging. African Journal of Ecology 38 (4), 352-359.

Courses & training:

- Successfully completed a 5 day course in High Voltage Regulations (modules 1 to 10) conducted by Eskom – Southern Region
- Successfully completed training on, and obtained authorization for, live line installation of Bird Flappers

Appendix 7. During & post construction bird monitoring framework

The work done to date on the Latrodex Wind Farm site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However this is purely the ‘before’ baseline and aside from providing input into turbine micro-siting, it is not very informative until compared to post construction data. The following programme has therefore been developed to meet these needs. It is recommended that this programme be implemented by the wind farm if constructed. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any imnpacts on avifauna to acceptable levels.

During construction monitoring

It will not be necessary to monitor any particular avifaunal features on site during construction.

Operational phase monitoring

The intention with operational phase bird monitoring is to repeat as closely as possible the methods and activities used to collect data pre-construction. This work will allow the assessment of the impacts of the proposed facility and the development of active and passive mitigation measures that can be implemented in the future where necessary. One very important additional component needs to be added, namely mortality estimates through carcass searches under turbines. The following programme has therefore been developed to meet these needs, and should start as soon as possible after the operation of the first phase of turbines (not later than 3 months):

Note that this framework is an interim draft. The most up to date version of the best practice guidelines (Jenkins *et al* 2015) should inform the programme design at the time.

Live bird monitoring

Note that due to the construction of the wind farm and particularly new roads it may be necessary to update the location of the below monitoring activities from those used pre-construction. However essentially the pre-construction methods described in this report should be repeated post construction.

Bird Fatality estimates

This is now an accepted component of the post construction monitoring program and the newest guidelines (Jenkins *et* al, 2015) will be used to design the monitoring program. It is important that in addition to searching for carcasses under turbines, an estimate of the detection (the success rate that monitors achieve in finding carcasses) and scavenging rates (the rate at which carcasses are removed and hence not available for detection) is also obtained (Jenkins *et al*, 2015). Both of these aspects can be measured using a sample of carcasses of birds placed out in the field randomly. The rate at which these carcasses are detected and the rate at which they decay or are removed by scavengers should also be measured.

Fatality searches should be conducted as follows:

- The area surrounding the base of turbines should be searched (up to a radius equal to 75% of the maximum height of turbine) for collision victims.
- All turbines should be searched at least once a week (Monday to Friday).
- Any suspected collision casualty should be comprehensively documented (for more detail see Jenkins *et al*, 2015).
- It is also important that associated infrastructure such as power lines and wind masts be searched for collision victims according to similar methods.

The most up to date version of the best practice guidelines (Jenkins *et al*, 2015) should inform the programme design at the time.