

**Survey of Verreaux's Eagle and other cliff-nesting birds
in the vicinity of the proposed Inyanda-Roodeplaat wind farm
site near Uitenhage, Eastern Cape**



Andrew R. Jenkins & Johan du Plessis
AVISENSE Consulting
August 2014



Introduction

Inyanda Energy Projects (Pty) Limited is planning to build a wind farm ('Inyanda-Roodeplaat') on a ridgeline in the Groot Winterhoek mountains about 30 km north-west of Uitenhage, in the Eastern Cape Province, South Africa. The wind farm will comprise up to 48 wind turbines, with associated road, maintenance and power evacuation infrastructure. The possible impacts of this project on the region's birds have so far been assessed in terms of ongoing baseline monitoring by WildSkies Ecological Consultants (e.g. Smallie 2014), and in terms of specialist inputs on the distribution of Verreaux's Eagle *Aquila verreauxii* nest sites within the anticipated impact zone of the wind farm (Barkhuizen 2013), on the understanding that this species may be particularly affected by the proposed development.

The present report is intended to supplement and ground-truth these existing studies, and to and focuses particularly on the status of Verreaux's Eagle *Aquila verreauxii* and other large raptor species in the immediate area of the project. More specifically, the terms of reference for our survey included the following:

1. An 8-day site visit to directly assess and survey the five Verreaux's Eagle nest site locations provided, with a view to (a) determining whether or not these sites are occupied by pairs of eagles, (b) determining whether or not the pairs present are actively breeding, and (c) precisely locating and photographing all nest structures.
2. Opportunistic searches for any other key, cliff-nesting species that might be resident and possibly breeding at each of the five focal sites (possibly including red-listed species such as Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra*) as well as at any other good quality (high) cliffs in the area that can realistically be assessed within the time available.
3. The results to be presented as (i) an annotated inventory of the cliffs surveyed (Excel spreadsheet with details of location, approximate proportions and quality, species likely or known to be in occupation with supporting evidence in each case), (ii) a Google Earth file mapping all the cliffs surveyed and all the known or suspected nest sites of Verreaux's Eagle and other key species, and (iii) a brief, illustrated report, detailing the status of Verreaux's Eagle and other key cliff-nesting species within the inclusive impact zone of the development, including a summary table of the numbers of known or suspected pairs of Verreaux's Eagle and other key species present within the development area, with details on known or estimated numbers of actively breeding pairs, and with an assessment of the relative value of the surveyed cliff-nesting bird community in a regional and national context, its susceptibility to the impacts of wind energy development, and recommendations on impact mitigation.
4. The outcomes of this first survey should inform the need for further survey work to be done, as well as the timing and aims of any such work.

Methods

The study area was visited over the period 27 July to 01 August 2014. Survey work was done by two fieldworkers operating together, using a single 4x4 vehicle to access as many parts of the survey area as possible using the existing road infrastructure, and walking to more remote sites where necessary. Generally, the area comprises a central high ridgeline, descending in spurs to the north and south, with deep ravines separating each of the spurs, most of which include lengths of sheer rock walls on one or both sides overlooking each respective watercourse. To the north this habitat descends and opens out

into undulating bushveld, while the southern ravines include patches of mature forest, and open onto the steep-sided, winding course of the KwaZunga River.

Each targeted cliff-line was surveyed actively by searching sheer faces for birds, nest structures and other signs of occupation, and passively by periods of passive observation of the presence and behaviour of Verreaux's Eagles and other key species in the general area (e.g. Malan 2009). Observations were conducted from suitable observation points, with a clear view of the cliff in question, using 10 x 42 binoculars and a 20-60x spotting scope. Wherever possible, spatial information was captured on a hand-held Garmin Oregon 450 GPS, or drawn onto hard copy 1:50 000 topographic maps of the relevant area.

Early on in the survey it became obvious that we had under-estimated the logistical challenges of covering ground in the study area, and the size and complexity of the sheer-sided ravines that we were required to search. We opted to make our survey as extensive as possible, with an emphasis on covering as much cliff habitat as we could, compromising on the time spent at each feature.

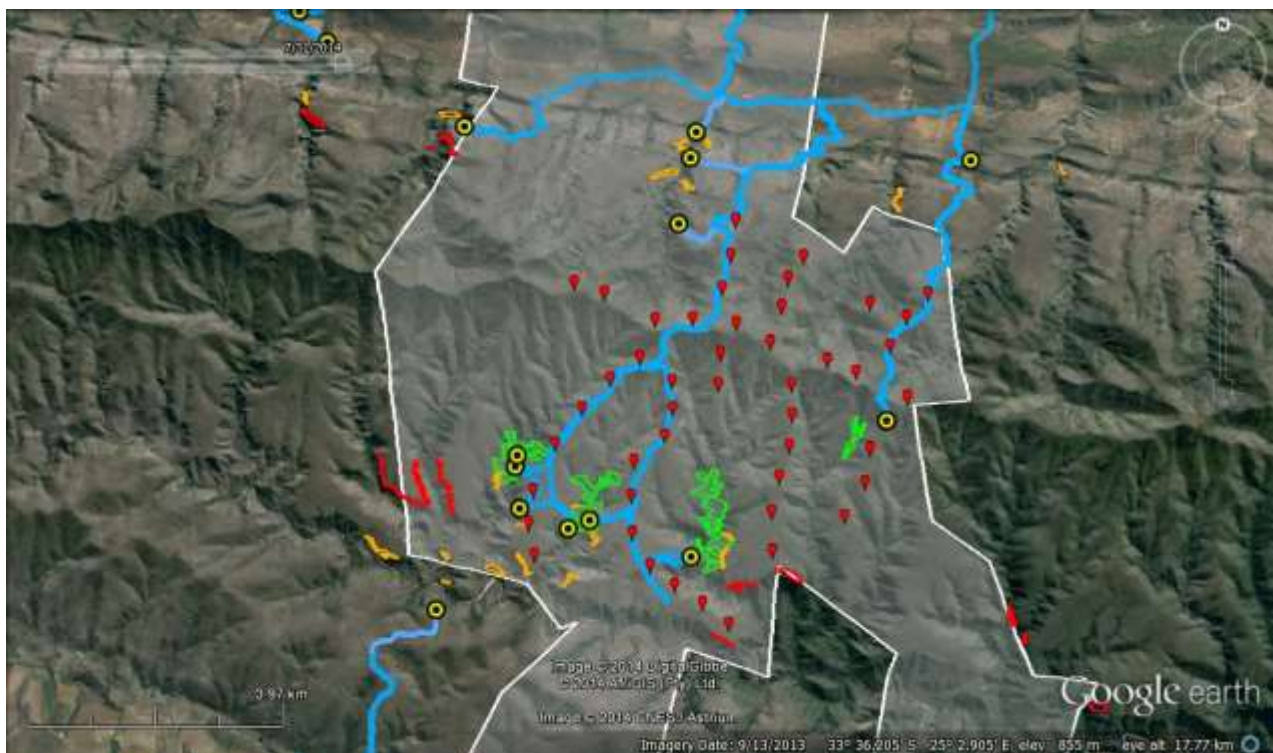


Figure 1. Areas in and around the proposed wind farm covered during the survey (blue lines), observation points from which cliffs and other habitats were assessed and observed (yellow circles), cliff-lines surveyed (orange shapes), cliff-lines surveyed (red shapes), and forests surveyed (green shapes), in relation to the proposed turbine layout (red balloons) and the entire development envelop (white polygon).

Results

Overall, coverage of the proposed development area was adequate (but far from complete - Fig. 1), and included at least four of the northern ravines and three of the corresponding spurs, two-three of the southern spurs and four-five of the corresponding ravines, and limited time spent on the top of the central ridge. We had good views of about 25 reasonable to high quality cliff-faces (assessed in terms of their vertical height, horizontal extent and verticality) within the broader impact area of the wind farm (Appendix 1), totalling

about 6 km of available habitat for cliff-nesting birds, and spent just over 20 h (Table 1) gathering information on the nature of these cliffs and the presence and behaviour of eagles and other raptors in the vicinity, working from 14 different, strategically located observation points (Fig. 1). We estimate that there is at least another 7 km of cliffs potentially affected, including some of the biggest faces in the area, located in the south-western corner of the development envelope (Fig. 1). We were also able to assess the size and quality (in terms of the availability of large, emergent trees) of four of the forest patches in the southern ravines, particularly with relevance to possible occupation of these forest by large raptors.

Table 1. Date, time and duration of periods of observation conducted at cliff-lines in and around the Inyanda-Roodeplaat wind farm site.

Date	Observation point	Start time	Duration (hh:mm)
27 July 2014	Southern cliffs and KwaZunga River	13:00	01:00
28 July 2014	Perdehoek 1, 2 & 3	09:45	02:35
29 July 2014	Tygerberg 1 & 2	08:30	03:50
29 July 2014	Februarie 1	15:15	00:45
30 July 2014	Zwartbosch cliff and forest 1.1	09:05	02:25
30 July 2014	Deysels Plaat cliffs and forest 3	13:15	02:50
31 July 2014	Cliff and forest 2.2	09:00	01:20
31 July 2014	Cliff and forest 2.1	11:00	01:10
31 July 2014	Zwartbosch cliff and forest 1.2	13:00	02:05
01 August 2014	Adolphskraal cliff	07:00	00:50
01 August 2014	Eastern section and forest 4	14:00	02:00

Four of the five Verreaux's Eagle nest sites were visited and checked (Figs 1 & 2), after which a decision was made to use the time remaining in the field to explore and survey the spurs extending to the south of the main project ridgeline, which were recently added as an extension of the development area and therefore not yet surveyed at all. Verreaux's Eagle pairs were present at all four of the checked locations, definitely breeding at one (the nest at Februarie contained two recent hatchlings – Fig. 3, Appendix 1), probably breeding at a second (the nest at Holbak was seen from a distance and looked fresh and quite possibly contained a chick), possibly breeding at a third (the pair at Tygerberg was closely attendant at the cliff and may have had a chick on a new nest that wasn't obviously visible; at least three old nest structures were checked and were not in use), and probably not breeding at the fourth (the pair at Perdehoek was very mobile around the area, spent little time in the nest ravine, there didn't seem to be a good nest structure present, and one bird had an injured left leg – Fig. 4). We also located a new Verreaux's Eagle nest site in the south-west of the proposed development area, which contained and incubating/brooding adult (Figs 2 & 3, Appendix 1), as well as a Martial Eagle nest site to the south of the central ridge-line, in a forested ravine just to the west of the westernmost turbines in the proposed layout (Figs 2 & 4). We did not have sight of the contents of this nest, but the behaviour of the attendant adults suggested that it contained a developing chick.

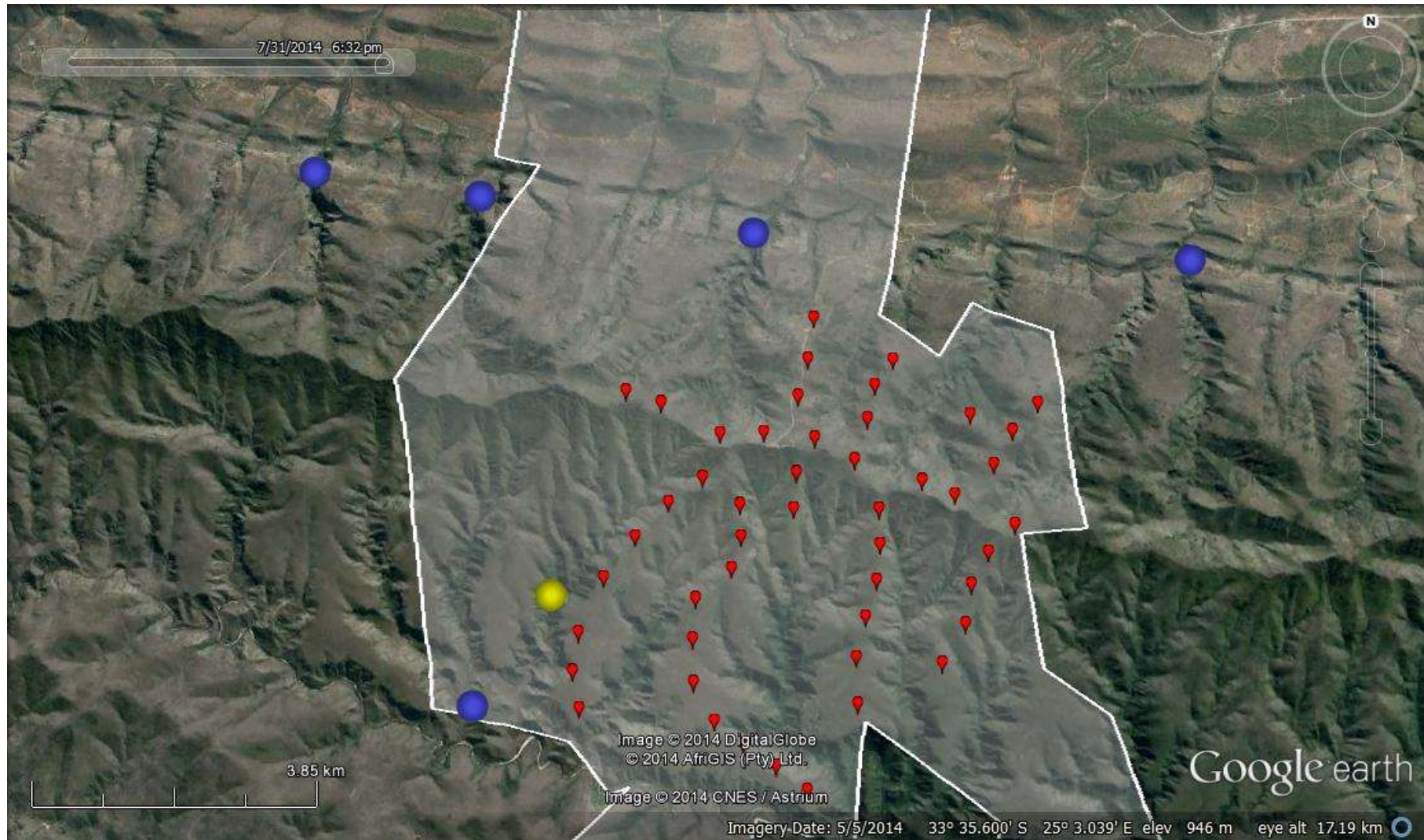


Figure 2. Five Verreaux's Eagle nest sites (blue circles) and a Martial Eagle nest site (yellow circle) confirmed as occupied (and in some cases active) during the survey, in relation to the proposed turbine layout and the development envelope.



Figure 3. (Top left) The main cliff at Februarie, and (Top right) the active Verreaux’s Eagle nest located in the lower third of that cliff, with newly hatched chicks on it. (Bottom left) Smallish cliff at the southern end of the westernmost southern spur, and (Bottom right) the active Verreaux’s Eagle nest located in the middle of that cliff, with an incubating or brooding adult on it.

Other cliff-nesting species were present in the area, and it seems likely that each of both the northern and southern ravines support multiple pairs of Rock Kestrel *Falco rupicolus*, Jackal Buzzard *Buteo rufofuscus* and White-necked Raven *Corvus albicollis* (Appendix 1). Unfortunately, our site visit was much too early in the year for these species to even be showing signs of preparing to breed, and we were not able to develop meaningful estimates of the populations and distributions of these birds in the study area. Also, we did not see either of Cape Eagle-Owl *Bubo capensis*, Lanner Falcon, Peregrine Falcon *Falco peregrinus* or Black Stork in the area at all, although we did record possible signs of Lanner Falcon and Black Stork in residence at two different cliffs (Appendix 1).

During the time spent on site, we were able to plot multiple flights of Verreaux’s Eagle (as pairs and singletons) and Martial Eagle (single birds only), and single flights of lone Crowned Eagle *Stephanoaetus coronatus* and African Fish-Eagle *Haliaeetus vocifer*, flying in and around the proposed development area (Fig. 5). We also recorded 76 bird species in the area over the full study period, including four red-listed species (Taylor In press) and 25 regional endemics (Hockey *et al.* 2005).



Figure 4. (Top left) One of the Verreux's Eagle pair at Perdehoek, recognisable by its injured left foot; (Top right) Good cliffs in one of the southern ravines, overlooking dense forest; (Bottom left) Looking south from the top of the main ridgeline, down the spur with the new road; (Bottom right) Forest patch at the top of one of the southern ravines which contained an active Martial Eagle nest.

Discussion

We found that the existing information on the status of Verreux's Eagle (and other large raptors) within the broader impact zone of the proposed wind farm (Barkhuizen 2013, and referred to in Smallie 2014) is completely accurate and reliable. All four of the five Verreux's Eagle sites that we checked (and importantly all three of the sites closest to the proposed wind farm) were occupied by pairs of eagles, and at least some of these pairs were actively breeding at the time of our visit. We also found a sixth territory containing an active nest within the development envelope to the south, and this region could easily hold a seventh pair somewhere to the east along the river, on one of the many cliffs that we weren't able to assess.

The location of a Martial Eagle nest site, situated quite centrally to the southern half of the proposed turbine layout, was a significant addition to the risk profile of the development, further compounded by a sighting of Crowned Eagle over one of the main southern spurs. While we were quite confident that this species was not resident in any of the forest patches we checked, there is more highly suitable habitat immediately to the east and west of the site that could easily hold a breeding pair of Crowned Eagles.

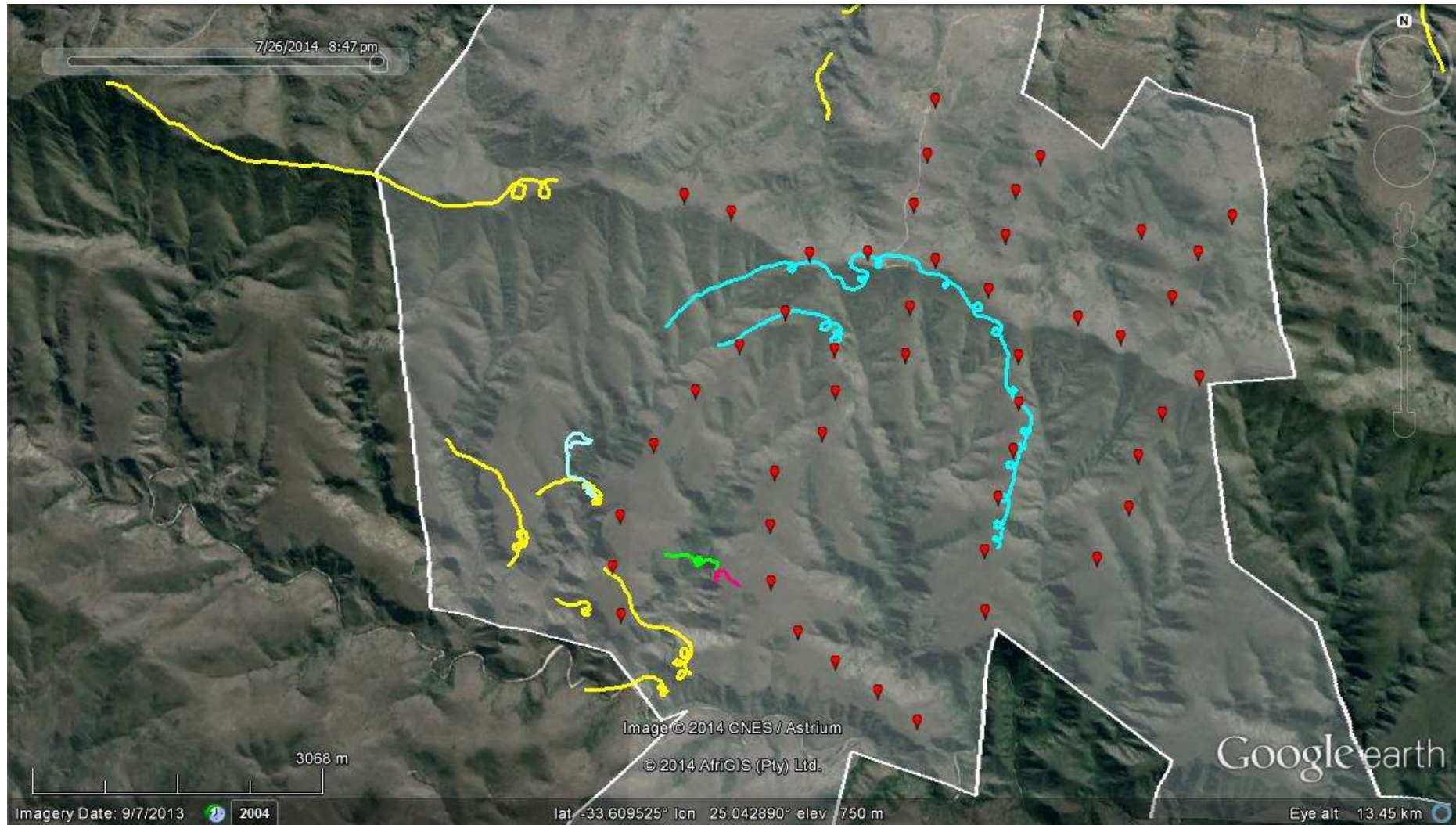


Figure 5. Flight lines of large eagles (Verreaux's Eagle = yellow tracks, Martial Eagle = blue tracks, Crowned Eagle = green track, African Fish-Eagle = pink track) in and around the development area, observed and plotted by eye during the survey period.

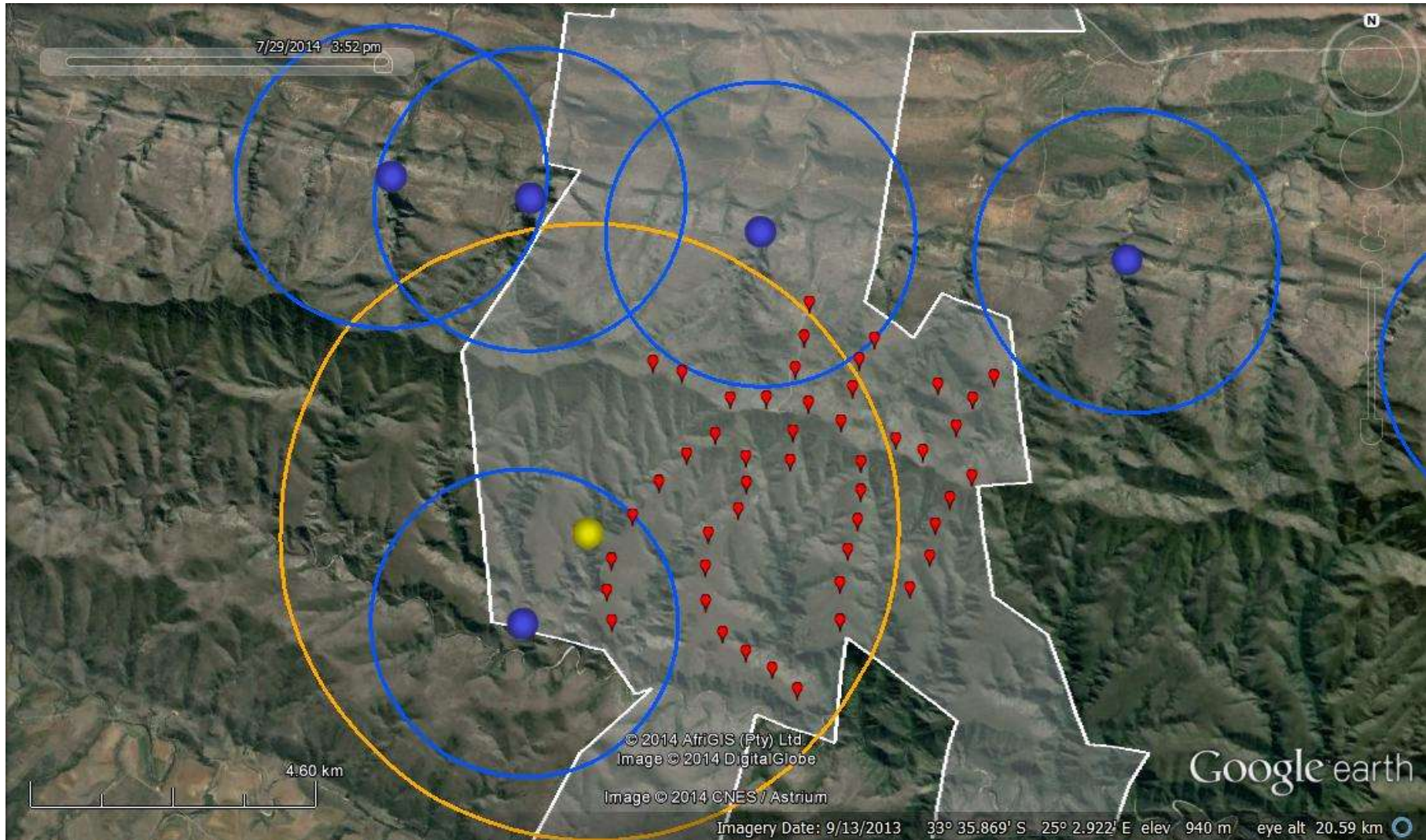


Figure 6. Protective buffers imposed around occupied eagle nest sites (Verreaux's Eagle = blue circles; 2.5 km, Martial Eagle = orange circles; 5 km) in relation to the project layout.

Our ability to survey the populations of other cliff-nesting birds present in the area was compromised by the timing of the site visit, which preceded the breeding seasons of most of the species of interest. While we suspect that each of the ravines extending to the north and south of the central ridge supports 2-3 pairs of Rock Kestrels, at least one pair of Jackal Buzzards, a pair of White-necked Ravens, and possibly a pair of Booted Eagles *Hieraetus pennatus*, we would need to visit the area again later in the year (between late September and November/December) to verify this, as well as to determine whether or not other red-listed species such as Lanner Falcon and Black Stork are resident in the area, and to properly quantify the size, composition and relative importance of the local cliff-nesting raptor community.

The dense community of breeding eagles in the vicinity of the proposed Inyanda-Roodeplaat wind farm is a significant biodiversity asset of the site, and very likely a pivotal component of the local ecology. As such, it should be given high priority in the ongoing evaluation of the sustainability of the proposed wind farm. All three of these eagle species have recently been uplisted in the national Red-Data book (Taylor In press), with Verreaux's and Crowned Eagle now considered to be nationally "Vulnerable", and Martial Eagle as nationally "Endangered" (and globally "Vulnerable" - <http://www.iucnredlist.org/search>). Also, as large, heavy, soaring birds, which occur at low densities, and are long-lived and slow to reproduce, they are likely to be highly susceptible to the impacts of wind farms (Drewitt & Langston 2008, Herera-Alsina *et al.* 2013), with collision risk markedly raised by the ridge-top design of the Roodeplaat project (which brings slope-soaring birds into very direct conflict with turbines positioned to exploit the same updrafts of wind - Barrios & Rodriguez 2004), and the demographic implications of any such impacts being greatly exacerbated by the fact that all three species are already threatened by a wide range of other anthropogenic factors (Taylor In press). (Note that Verreaux's Eagle, Martial Eagle and Crowned Eagle are ranked as the second, sixth and 30th most sensitive bird species in South Africa to the potential impacts of wind energy facilities - Retief *et al.* 2012, S. Ralston in litt.).

Even in the short time that we were present in the area, we observed several flights by Verreaux's and Martial Eagles that brought them fairly directly into the area of the proposed turbine layout (Fig. 5), suggesting that the risk of these birds colliding with the built wind farm is very real. Typically, large threatened raptors are protected against the potential impacts of wind energy projects by the imposition of circular buffer areas centred on known nest sites. The radius of these buffers is mainly a function of the measured or estimated core foraging ranges of the affected birds (Martínez *et al.* 2010). In the absence of more detailed, site-specific information, the currently accepted default approach is to buffer nest sites by half the mean inter-nest distance of the local population (e.g. U.S. Fish & Wildlife Service 2013). In this instance, the average distance between Verreaux's Eagle nests in the vicinity of the proposed wind farm is 5.1 km ($n = 6$), indicating that a buffer radius of about 2.5 km is justified and appropriate. While we don't have any local data to inform buffer size for the Martial Eagle site, this species is notoriously wide-ranging, with inter-nest distances in the central Karoo averaging about 15 km (Boshoff 1993, Machange *et al.* 2005). In this context, a buffer radius of about 5 km is surely defensible. Should such development-free buffers be applied to the known eagle sites within and near to the Inyanda-Roodeplaat wind farm layout (Fig. 6), this would effectively remove >70% of the currently proposed turbine placements from the project, and additional surveys of the south-east corner of the proposed wind farm area could easily find more nest sites requiring further buffers and more constraints on development.

The value of this study would be greatly enhanced by the opportunity to spend more time at the site, particularly to visit and survey sections of the development area that have not yet been assessed, and also to verify and expand on the data collected to date, adding detail on the size and distributions of the populations of smaller cliff-nesting species that may be affected by the wind farm. Ideally, such a site visit should be conducted in October, over a period of 6-8 days.

This said, in our opinion, the data collected to date are already sufficient to suggest that the construction and operation of the proposed Inyanda-Roodeplaat wind farm is likely to have highly significant disturbance, displacement and mortality impacts on a valuable and otherwise relatively undisturbed avifauna. In particular, the area supports regionally significant populations of nationally or globally threatened eagles, and we strongly recommend that this factor be given due consideration by both the developer, and by the presiding environmental authority, in their deliberations over the suitability and sustainability of this development proposal.

References

- Barkhuizen, A. 2013. Black Eagle nest survey for the proposed development of the Roodeplaat WEF on farm Perdehoek (NW of Uitenhage). Unpublished report to WildSkies Ecological Consulting.
- Barrios, L. & Rodríguez, A. 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. *Journal of Applied Ecology* 41: 72-81.
- Boshoff, A.F. 1993., Density, active performance and stability of Martial Eagles *Polemaetus bellicosus* active on electricity pylons in the Nama-Karoo, South Africa. In: Wilson, R.T. (Ed.). Proceedings of the Eighth Pan-African Ornithological Congress. Musee Royal de l'Afrique Centrale, Tervuren. pp 95-104.
- Drewitt, A.L. & Langston, R.H.W. 2008. Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Science* 1134: 233-266.
- Herera-Alsina, L., Villagas-Petraca, R., Eguiarte, L.E. & Arita, H.T. 2013. Bird communities and wind farms: a phylogenetic and morphological approach. *Biodiversity and Conservation* 22: 2821-2836.
- Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.
- Machange, R.W., Jenkins, A.R. & Navarro, R.A. 2005. Eagles as indicators of ecosystem health: Is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and rangeland quality? *Journal of Arid Environments* 63: 223-243.
- Malan, G. 2009. Raptor survey and monitoring – a field guide for African birds of prey. Briza, Pretoria.
- Martínez, J.E., Calco, J.F., Martínéz, J.A., Zuberogoitia, I., Cerezo, E., Manrique, J., Gómez, G.J., Nevado, J.C., Sánchez, M., Sánchez, R., Bayo, J. Pallarés, A., González, C., Gómez, J.M., Pérez, P. & Motos, J. 2010. Potential impact of wind farms on territories of large eagles in southeastern Spain. *Biodiversity and Conservation* 19: 3757-3767.
- Retief, E.F., Diamond, M., Anderson, M.D., Smit, H.A., Jenkins, A.R. & Brooks, M. 2012. Avian wind farm sensitivity map: criteria and procedures used. BirdLife South Africa, Johannesburg.
- Smallie, J. 2014. Inyanda-Roodeplaat Wind Energy Facility: Pre-construction bird monitoring, Progress report 3. Unpublished report to Inyanda Energy Projects (Pty) Ltd.
- Taylor, M.R. (Ed.) In press. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.
- US Fish & Wildlife Service. 2013. Eagle conservation plan guidance; Module 1 - land-based wind energy. Version 2. Division of Migratory Bird Management. Unpublished guidance document.

Appendix 1. Parameters describing the cliff faces surveyed during the July/August site visit, with information on the cliff-nesting birds seen in association with each cliff.

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
Februarie 1	270 x 60	south	lower / ravine	1000	Verreaux's Eagle	1	1	1	Two smallish downy chicks at new cup of lowest of 3-4 nests obvious structures; pair of adults in close attendance.
					Jackal Buzzard	1	?	0	Single bird seen in area; probably at least one breeding pair in this ravine.
					Rock Kestrel	1	?	0	Single bird seen in area; possibly 2-3 breeding pairs in this ravine.
					White-necked Raven	1	?	0	Pair seen in ravine; very likely one pair in residence.
Tygerberg 1	200 x 100	north-west	lower / ravine	5000	Verreaux's Eagle	1	1	?	At least 4 nest structures on E side of ravine, neither active. Pair present and spent some time out of sight on W side; mostly flying together, but some time apart.
					Jackal Buzzard	1	?	0	Pair of birds mobbing eagle pair to north of main ravine - possibly resident on nearby outlier or else on cliffs immediately to west.

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
					White-necked Raven	1	?	0	Pair of birds present in vicinity of main ravine cliffs; very likely one pair in residence.
Perdehoek 1	250 x 80	east	lower / ravine	1500	Verreaux's Eagle	1	1	0	Smallish, scrappy nest structure present but definitely not in use; signs of burn around probable previous nest ledges but no definite nest structures present. Good, fresh whitewash at roost site. Pair seen soaring over opposite ridge, displaying over cliff, perched on both E and W sides of ravine and copulating. One of pair with injured left leg.
					Jackal Buzzard	1	?	0	Regular sightings of single birds; possible nest structure further south up ravine. Probably at least one breeding pair in this ravine.
					Rock Kestrel	1	?	0	Regular sightings of single birds; good whitewash on cliff immediately to south up ravine, space in this system for at least 2-3 pairs.

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
					White-necked Raven	1	?	0	Pair of birds present in area; possible old nest structure on eagle cliff. Very likely a breeding pair in this ravine.
Perdehoek 2	160 x 25	west	lower / ravine	1400					
Perdehoek 3	200 x 50	west	lower / ravine	1300	African Harrier-Hawk	1	1	?	Bird seen flying over the forest below.
Perdehoek 4	250 x 20	south-west	lower / ravine	900					
Perdehoek 5	300 x 40	east	lower / ravine	1200					
Adolphspoort 1	100 x 10	south	on river	8200	Rock Kestrel	1	1	0	Bird near cliff well after sunset; some promising whitewash.
Perdehoek 6	60 x 30	south-west	on river	7100		0	?	?	Medium sized stick nest (old) - possibly White-necked Raven.
Adolphskraal 1	250 x 50	south	low / plain on river	4600	Rock Kestrel	1	1	0	Pair present, copulating and performing ledge displays.
					White-necked Raven	1	0	0	Flock flew over cliff from the east
					Verreaux's Eagle	1	0	0	One subadult flew low over cliff from the west to east.
Holbak 1	190 x 60	south-west	lower / ravine	3000	Verreaux's Eagle	1	1	1?	Pair present, good fresh nest. Didn't see eagles visit nest, but otherwise looked active.
					White-necked Raven	1	?	?	Pair present in the ravine, probably in residence.

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
					Jackal Buzzard	1	?	?	Single bird observed in area.
					Verreaux's Eagle	1	0	0	Subadult seen interacting with resident pair.
Mannetje 1	470 x 30	south-west	lower / ravine	1500					
KwaZunga 1	800 x 50	south-west	on river	2100					
Roodeplaat 1	120 x 50	south-west	lower / river gorge	1300	Verreaux's Eagle	1	1	1	Adult incubating on nest (Tiptree).
KwaZunga 2	130 x 30	south-west	on river	1300					
KwaZunga 3	110 x 50	south-west	on river	500	Jackal Buzzard	1	?	?	At least one bird present in the area, and a decent (but old) nest structure on the cliff.
Roodeplaat 3	250 x 30	north-east	middle / river valley	200	Lanner Falcon?	0	?	?	Promising ledge with good whitewash but no birds seen.
					Verreaux's Eagle	1	0	0	One bird observed flying above western valley system - probably from Tiptree site.
					White-necked Raven	1	1	?	Pair observed in area & returning to cliff on more than one occasion.
					Jackal Buzzard	1	?	?	One bird seen soaring near cliff.
Roodeplaat 2	200 x 60	east	upper / river valley	500	Rock Kestrel	1	?	0	One bird observed on cliff with good whitewash...?

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
Zwartbosch Plaat 1	120 x 50	south-west	lower / river gorge	600					
Zwartbosch Plaat 2	100 x 25	south	lower / river gorge	600					
Zwartbosch Plaat 3	230 x 50	west	lower / river gorge	500					
Zwartbosch Plaat 4	400 x 80	east	mid / river valley	600	Rock Kestrel	1	1	0	Pair in area, one perched on cliff, good whitewash.
					Verreaux's Eagle	1	0	0	Two birds, possibly from different, distant sites (Tiptree and ?) observed in area and drifted to east and north-east.
Zwartbosch Plaat 5	500 x 70	north-west	middle / river valley	550	Jackal Buzzard	1	?	?	One bird observed in area.
Deysels Plaat 1	180 x 30	south-west		600					
Deysels Plaat 2	350 x 60	west	mid / river valley	700	Verreaux's Eagle	0	1?	0	Two good nest structures, neither lined, and both flat-topped; copious, fresh whitewash nearby. Could also be Black Stork site.
					White-necked Raven	1	?	0	Pair of birds observed on cliff several times.
					Jackal Buzzard	1	?	0	Two birds in vicinity, at least one made repeated fly-bys; very likely a resident pair nearby.

Google Earth cliff ID	Approximate length and height of cliff (m)	Cliff aspect	Cliff elevation / placement	Distance to nearest turbine (m)	Species	Status			
						Present	Resident	Breeding	Evidence
					Rock Kestrel	1	?	?	One bird flew past.

Appendix 2. List of birds seen in the vicinity of the proposed Inyanda-Roodeplaat wind farm over the period 27 July to August 01 2014.

Species	Scientific name	Endemic	Red-listed
Red-necked Spurfowl	<i>Pternistis afer</i>	-	-
Helmeted Guineafowl	<i>Numida meleagris</i>	-	-
Common Quail	<i>Coturnix coturnix</i>	-	-
South African Shelduck	<i>Tadorna cana</i>	-	-
Red-throated Wryneck	<i>Jynx ruficollis</i>	-	-
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	-	-
Olive Woodpecker	<i>Dendropicos griseocephalus</i>	-	-
Black-collared Barbet	<i>Tricholaema leucomelas</i>	-	-
Acacia Pied Barbet	<i>Lybius torquatus</i>	Near-endemic	-
Red-fronted Tinkerbird	<i>Pogoniulus pusillus</i>	-	-
African Hoopoe	<i>Upupa africana</i>	-	-
Green Wood-Hoopoe	<i>Phoeniculus purpureus</i>	-	-
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	-	-
Speckled Mousebird	<i>Colius striatus</i>	-	-
Red-faced Mousebird	<i>Urocolius indicus</i>	-	-
Alpine Swift	<i>Apus melba</i>	-	-
Knysna Turaco	<i>Tauraco corythaix</i>	-	-
Spotted Eagle-Owl	<i>Bubo africanus</i>	-	-
Speckled Pigeon	<i>Columba guinea</i>	-	-
African Olive-Pigeon	<i>Columba arquatrix</i>	-	-
Laughing Dove	<i>Streptopelia senegalensis</i>	-	-
Cape Turtle-Dove	<i>Streptopelia capicola</i>	-	-
Emerald-spotted Wood-Dove	<i>Turtur chalcospilos</i>	-	-
African Fish-Eagle	<i>Haliaeetus vocifer</i>	-	-
Black Harrier	<i>Circus maurus</i>	Endemic	Endangered
Southern Pale Chanting Goshawk	<i>Melierax canorus</i>	Near-endemic	-
Rufous-chested Sparrowhawk	<i>Accipiter rufiventris</i>	-	-
Jackal Buzzard	<i>Buteo rufofuscus</i>	Endemic	-

Species	Scientific name	Endemic	Red-listed
African Harrier-Hawk	<i>Polyboroides typus</i>	-	-
Verreaux's Eagle	<i>Aquila verreauxii</i>	-	Vulnerable
Martial Eagle	<i>Polemaetus bellicosus</i>	-	Endangered
Crowned Eagle	<i>Stephanoaetus coronatus</i>	-	Vulnerable
Rock Kestrel	<i>Falco rupicolus</i>	-	-
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	-	-
Hadedda Ibis	<i>Bostrychia hagedash</i>	-	-
Southern Tchagra	<i>Tchagra tchagra</i>	Endemic	-
Southern Boubou	<i>Laniarius ferrugineus</i>	Endemic	-
Bokmakierie	<i>Telophorus zeylonus</i>	Near-endemic	-
Cape Batis	<i>Batis capensis</i>	Endemic	-
Cape Crow	<i>Corvus capensis</i>	-	-
Pied Crow	<i>Corvus albus</i>	-	-
White-necked Raven	<i>Corvus albicollis</i>	-	-
Common Fiscal	<i>Lanius collaris</i>	-	-
Cape Rockjumper	<i>Chaetops frenatus</i>	Endemic	-
Cape Peduline-Tit	<i>Anthoscopus minutus</i>	Near-endemic	-
Rock Martin	<i>Hirundo fuligala</i>	-	-
Cape Bulbul	<i>Pycnonotus capensis</i>	Endemic	-
Sombre Greenbul	<i>Andropadus importunus</i>	-	-
Cape Grassbird	<i>Sphenoeacus afer</i>	Endemic	-
Victorin's Warbler	<i>Cryptillas victorini</i>	Endemic	-
Chestnut-vented Tit-Babbler	<i>Parisoma subcaeruleum</i>	Near-endemic	-
Lazy Cisticola	<i>Cisticola aberrans</i>	-	-
Grey-backed Cisticola	<i>Cisticola subruficapilla</i>	-	-
Neddicky	<i>Cisticola fulvicapilla</i>	-	-
Karoo Prinia	<i>Prinia maculosa</i>	Endemic	-
Bar-throated Apalis	<i>Apalis thoracica</i>	-	-
Cape Rock-Thrush	<i>Monticola rupestris</i>	Endemic	-
Olive Thrush	<i>Turdus olivaceus</i>	-	-
Fiscal Flycatcher	<i>Sigelus silens</i>	Endemic	-
Cape Robin-Chat	<i>Cossypha caffra</i>	-	-
Karoo Scrub-Robin	<i>Cercotrichas coryphoeus</i>	Endemic	-

Species	Scientific name	Endemic	Red-listed
African Stonechat	<i>Saxicola torquatus</i>	-	-
Familiar Chat	<i>Cercomela familiaris</i>	-	-
Red-winged Starling	<i>Onychognathus morio</i>	-	-
Cape Glossy Starling	<i>Lamprotornis nitens</i>	-	-
Pied Starling	<i>Spreo bicolor</i>	Endemic	-
Orange-breasted Sunbird	<i>Anthobaphes violacea</i>	Endemic	-
Malachite Sunbird	<i>Nectarinia famosa</i>	-	-
Southern Double-collared Sunbird	<i>Cinnyris chalybeus</i>	Endemic	-
Greater Double-collared Sunbird	<i>Cinnyris afer</i>	Endemic	-
Cape Sparrow	<i>Passer melanurus</i>	Near-endemic	-
Cape Wagtail	<i>Motacilla capensis</i>	-	-
Cape Longclaw	<i>Macronyx capensis</i>	Endemic	-
Long-billed Pipit	<i>Anthus similis</i>	-	-
Cape Canary	<i>Serinus canicollis</i>	Endemic	-
Cape Bunting	<i>Emberiza capensis</i>	-	-