AN AVIFAUNA SPECIALIST REPORT FOR THE PROPOSED COMBINED CYCLE GAS TURBINE (CCGT) POWER PLANT AND ASSOCIATED INFRASTRUCTURE, SALDANHA BAY LOCAL MUNICIPALITY, WEST COAST DISTRICT MUNICIPALITY, WESTERN CAPE PROVINCE

An EOH Company

Prepared for: **VORTUM ENERGY (PTY) LTD**

Prepared by: **Exigo Sustainability**

Email info@exigo3.com
Tel +27 012 751 2160
Fax +27 086 607 2406

The Village Office Park (Block E),
309 Glenwood Road, Faerie Glen,
Pretoria, 0043

Postnet Suite 74,
Private Bag X07,
Arcadia, 0007

An EOH Company

Innovation in Sustainability

www.exigo3.com

AN AVIFAUNA SPECIALIST REPORT FOR THE PROPOSED COMBINED CYCLE GAS TURBINE (CCGT) POWER PLANT AND ASSOCIATED INFRASTRUCTURE, SALDANHA BAY LOCAL MUNICIPALITY, WEST COAST DISTRICT MUNICIPALITY, WESTERN CAPE PROVINCE

AVIFAUNA SPECIALIST STUDY

April 2016

Conducted on behalf of:
VORTUM ENERGY (PTY) LTD

Compiled by:

Dr. BJ Henning (PhD plant Ecology; M.Sc Botany - Soil Science related Pr.Sci.Nat)

Reviewed by:

Ms. E. Grobler (EAP.)

REPORT DISTRIBUTION LIST

Name	Institution
Mr. D. Ventura	VORTUM ENERGY (PTY) LTD
Ms. E. Grobler	AGES Limpopo

DOCUMENT HISTORY

Date	Version	Status
November 2015	1.0	Draft 1
April 2016	2.0	Final

Declaration

I, Barend Johannes Henning, declare that -

- I act as the independent specialist;
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the project proponent and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent;
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

_____

Signature of specialist

Company: Exigo Sustainability (Pty) Ltd.

Date: April 2016

Table of contents

List of Figures

List of Tables

Vortum Thermal Power Plant Avifauna Study

1 ASSIGNMENT

Exigo Sustainability was appointed by AGES Limpopo on behalf of VORTUM ENERGY (PTY) LTD to conduct an avifauna specialist study for the proposed establishment of an energy generation facility (thermal power plant) with associated infrastructure and structures on a portion (±130 ha) of the Remainder of the Farm LANGEBERG 188, Malmesbury RD (861.6007 ha in extent), located within the Saldanha Bay Local Municipality, West Coast District Municipality, Western Cape Province. The development also includes the development of a new powerline corridor between the site and the Aurora Substation, as well as a natural gas or liquid fuel supply pipeline.

The assignment is interpreted as follows: Compile a study on the avifauna potentially occurring in the project area and determine the potential impacts of the proposed Thermal Power Plant, access road and associated infrastructure on the birds as well as proposed mitigation measures. The study will be done according to guidelines and criteria set by Eskom, Birdlife South Africa (BLSA) and the by Cape Nature for avifauna studies. The study will include an impact assessment. In order to compile this, the following had to be done:

1.1 Information Sources

The following information sources were obtained:

- Using the Guide to Access Avian Data for Environmental Impact Assessment Reports (Birdlife SA, 2015);
- Information on the biology (Hockey et al 2005), distribution (Harrison et al. 1997) and conservation status (Barnes 2000) of southern African birds was consulted. Up to date data were extracted from the Southern African Bird Atlas Projects (SABAP), which were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the relevant “pentads” of 5’ x 5’ from (SABAP 2). These data were combined, with a 2 day site visit in November 2015.
- Other avifauna studies relevant for powerline studies and other renewable energy development was used as background and monitoring data for this study;
- All relevant maps through GIS mapping, and information (previous studies and environmental databases) on the avifauna of the area concerned.
- Requirements regarding the avifauna study as requested by Eskom, Birdlife SA and Cape Nature;
- Conservation status and collision-prone ranking of all species considered likely to occur in the area was determined from the South African Red-list for birds and its updates (Barnes 2000, M Taylor in litt), and the ranking of collision-prone birds drawn from the BAWESG tabulation.

- A classification of the vegetation types in the Savanna Biome as classified by Mucina & Rutherford (2006) as well as the CAPE fine scale project.
- Information on the micro-habitat level was obtained through visiting the area and obtaining a first-hand perspective.

1.2 Regulations governing this report

This report has been prepared in terms of Regulation 32 of the National Environmental Management Act (No. 107 of 1998) Regulations GN 33306 GNR 543 for environmental impact assessment. Regulation 33 states that a specialist report must contain:

1. An application or the EAP managing an application may appoint a person to carry out a specialist study or specialized process.
2. The person referred to in sub-regulation 1 must comply with the requirements of regulation 17 (General requirements for EAPs or a person compiling a specialist report or undertaking a specialized process).
3. A specialist report or a report on a specialized process prepared in terms of these regulations must contain:
    a. Details of
        i. The person who prepared the report; and Letter of Appointment
        ii. The expertise of that person to carry out the specialist study or specialized process.
    b. A declaration that the person is independent in a form as may be specified by the competent authority;
    c. An indication of the scope of, and purpose for which, the report was prepared;
    d. A description of the methodology adopted in preparing the report or carrying out the specialized process;
    e. A description of any assumptions made and any uncertainties or gaps in knowledge;
    f. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
    g. Recommendations in respect of any mitigation measures that should be considered by the applicant and competent authority;
    h. A description of any consultation process that was undertaken during the course of

carrying out the study;

i. A summary and copies of any comments that were received during any consultation process;

j. Any other information requested by the competent authority.

1.3 Terms of reference

1.3.1 Rationale of thermal power plant development

In the last few years, the demand for electricity in South Africa has been growing at a rate of approximately 3% per annum. The urgent need to procure power in the short-to-medium term has been qualified as a priority by the Government of South Africa in the Integrated Resource Plan 1 (IRP1).

Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (IRP 2010). The IRP1 (2009) and the IRP 2010 (2011, updated in March 2014) outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa.

In particular, the IRP 2010 highlights the necessity of commissioning 2370 MW with Gas-CCGT technology and 3910 MW with Peak-OCGT technology by the end of 2030. On 19 December 2012 the Minister of Energy issued three Determinations in terms of section 34 of the Electricity Regulation Act, 2006:

- "IPP Procurement Programme 2012" published in Government Notice 1074 in Government Gazette No. 36005 on 19 December 2012;
- "Baseload IPP Procurement Programme 2012" published in Government Notice 1075 in Government Gazette No. 36005 on 19 December 2012;
- "Medium Term Risk Mitigation Project IPP Procurement Programme 2012" published in Government Notice 1076 in Government Gazette No. 36005 on 19 December 2012.

Pursuant to the "Baseload IPP Procurement Programme 2012" and to the "Medium Term Risk Mitigation Project IPP Procurement Programme 2012", the Minister of Energy has determined in particular:

- That baseload and/or mid-merit energy generation capacity is needed to contribute towards energy security, including 2652 MW to be generated from Natural Gas (which includes Liquefied Natural Gas or Natural Gas delivered by pipeline from a Natural Gas Field), which represents the capacity allocated to "Gas CCGT (natural gas)" and "OCGT (diesel)", under the

heading "New build", for the years 2021 to 2025, in Table 3 of the IRP 2010-2030;

- That baseload energy generation capacity is needed to contribute towards energy security, including 474 MW to be generated from Natural Gas, which represents the capacity allocated to "Gas CCGT (natural gas)", under the heading "New build", for the years 2019 to 2020, in Table 3 of the IRP 2010-2030;
- The electricity must be purchased from Independent Power Producers.

As indicated in the “Request for Registration and Information Issued to Potential developers of New Generation Capacity: Medium Term Risk Mitigation (including Cogeneration and Natural Gas); and Baseload (including Coal, Natural Gas and Hydro)”, issued by the Department of Energy in June 2013:

- Pursuant to the Medium Term Risk Mitigation and Baseload energy Determinations, the Department of Energy is in the process of designing a range of appropriate procurement processes for the procurement of this energy. The Department of Energy is committed to one or more procurement process/es which comply with the requirements of, amongst other things, section 217 of the Constitution of the Republic of South Africa, 1996 and the Public Finance Management Act, 1999.
- In designing the procurement processes, the Department of Energy will have regard to the Determinations, which state that the energy should be procured through one or more IPP procurement programmes as contemplated in the Electricity Regulations on New Generation Capacity (“New Generation Capacity Regulations”) which may include tendering processes, direct negotiation with one or more project developers, or other procurement procedures.

On 16 April 2015, the Department of Energy confirmed (media statement) that they have been engaged in a process to design a Gas to Power Procurement Programme for a combined 3126 MW allocation. The Gas to Power Request for Information (RFI) has been released in May 2015 (https://www.ipp-gas.co.za/). Responses to this RFI will be used in designing the Gas to Power Procurement Programme. This programme is expected to stimulate the gas sector which could contribute towards the growth of the local economy. As indicated in the RFI for the Gas to Power Procurement Programme (May 2015):

- The two determinations will be amended and then consolidated into a new determination for the procurement of 3126 MW of generation capacity from any gas type or source generated using any appropriate technology.
- As the basis of supporting the objectives of the Integrated Energy Plan, the Department is, at present, finalising a Gas Utilisation Master Plan (“GUMP”) for South Africa. The GUMP is a roadmap for the development of a gas economy. It analyses the potential and opportunity for the development of South Africa’s gas economy and sets out a plan of how this could be

achieved. One of the key objectives of the GUMP is to enable the development of indigenous gas resources and to create the opportunity to stimulate the introduction of a portfolio of gas supply options.

- The demand from the Gas to Power Programme will provide a market for a potential supply of gas. It will also provide long term gas demand sinks for future indigenous gas supplies.

Therefore, the development of Gas CCGT (natural gas) power plants and OCGT (diesel) power plants will represent a key feature in the fulfilment of the proposed goals of new generation capacities for energy security.

The purpose of the proposed Vortum Thermal Power Plant is to add new capacity for the generation of electrical energy to the national electricity supply, in compliance with the Minister of Energy's Determinations and in order to meet the “electricity consumptions’ growth” of the Western Cape Province.

1.3.2 Objectives

1. Determine the number of bird habitats present in the direct area of the proposed development from relevant databases and field surveys (micro-habitats);
2. Determine the potential ecological impacts and actions the development (especially the powerlines) will have on the avifauna populations and provide mitigation measures to limit impacts to a minimum.

1.3.3 Scope

1. Bird habitat survey – in each vegetation type/plant community on site:
    a. After studying the aerial photograph to identify specific bird habitats where micro-habitats might occur to be surveyed and confirm location by making use of a Geographical Positioning System (GPS).
    b. List the potential bird species present and link them to the specific potential habitats that occur as identified in the habitat survey.
    c. List the bird species observed during the field survey as well as specific relevant habitat characteristics.
2. Identify the impact of the proposed development on the avifauna of the area, with specific relevance to the red data birds potentially occurring in the area.
3. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the avifauna of the area.

4. Identify potential problem areas in need of special treatment or management related to the avifauna in the area, e.g. bush encroachment, erosion, degraded areas, reclamation areas.
5. Make recommendations and impact rating assessments for each specific impact on the avifauna.

1.3.4 Limitations and assumptions

In order to obtain a comprehensive understanding of the dynamics of avifauna communities and the status of endemic, rare or threatened species in an area, avifauna studies should ideally be replicated over several seasons and over a number of years. A 2-day site visit is insufficient to cover all areas, so the lines were sub-sampled. These sampling bouts may miss certain areas of importance that a longer visit with longer sampling would cover better. However, due to project time constraints such long-term studies are not feasible.

The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative sections, as well as general observations and a desktop analysis.

2 INTRODUCTION

South Africa has one of the world's greatest diversity of plant and animal species contained within one country, and is home to many species found nowhere else in the world. From an avifauna perspective, South Africa has 101 Global Important Bird Areas (IBAs) and an additional 21 Regional IBAs. South Africa is a large country, supporting eight biomes and 841 bird species, of which more than 700 are resident or annual visitors, 74 of which are endemic or near-endemic and 125 of which are listed in The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

Terrestrial resources are rapidly disappearing due to conversion of natural habitat to farmland, forestry, human settlement, and industrial development. Thermal Power Plant is smaller than solar farms, although the associated powerlines typically cover large areas and if incorrectly located, could displace or exclude threatened, rare, endemic, or range-restricted bird species from important habitats. Associated infrastructure can also cause disturbance and sometimes mortality. Overhead power lines and associated infrastructure such as substations are known to impact significantly on various bird species, both directly through causing mortality of birds, and indirectly through disturbance of birds and destruction of habitats. This study will identify these impacts, their location and significance, and recommend suitable mitigation measures that can be implemented to minimize these impacts. The study will also identify the preferred corridor from a bird impact perspective. An important principle of the guidelines is to encourage the thorough assessment and mitigation of the potential impacts of renewable energy developments on birds.

This study will identify the potential impacts of the development on the avifauna of the study and recommend suitable mitigation measures that can be implemented to minimize these impacts. The study will also identify the preferred corridor from a bird impact perspective.

3 STUDY AREA

3.1 Location and description of activity

The project site consists of a portion (±130 ha) of the Remainder of the Farm LANGEBERG 188, Malmesbury RD (861.6007 ha in extent), located within the Saldanha Bay Local Municipality, West Coast District Municipality, Western Cape Province. The project site is located 9 km North-East of the Port of Saldanha Bay, West of the regional road R27, in an area excluded from the provisions of the Subdivision of Agricultural Land Act (Act 70 of 1970) and already earmarked for Industrial Uses.

The Eskom Blouwater Distribution Substation is located 3.2 km South-West of the project site; the Saldanha Steel Works is 5km West-South-West from the project site; the Langebaanweg Military Airport is 7.5 km East of the project site.

Access to the project site would be either:

- From the regional road R27, which runs adjacent to the eastern boundary of the project site; or
- From a secondary road (R79) linking the regional road R27 with the regional road R399, which runs adjacent to the southern boundary of the project site.

The developed area (footprint) will be up to 80 hectares. The energy generation facility will be a thermal power plant with a maximum generation capacity up to 1200 MWel (electrical rated power). The aerial image of the site is indicated in figure 2.

The name of the facility will be VORTUM THERMAL POWER PLANT. The characteristics, the technology and the extent of the initiative are defined more in detail below.

The proposed thermal power plant will be a Combined Cycle Gas Turbine (CCGT) power plant, to be fuelled with natural gas imported by means of one or more gas import facilities (e.g. LNG Import Terminal(s) and/or new gas pipeline(s)). Indeed the Department of Energy is investigating the feasibility of new gas pipelines and LNG Import Terminals, in order to import natural gas from new offshore gas fields and/or from other countries (e.g. Mozambique). The securing of new energy sources, like natural gas, has become high priority for the Government, considering that the current energy production is not able to meet the increased energy demand of the Country. This leads to frequent electricity shortage and fluctuations in supply (“load shedding”), detrimental to the economic development of South Africa.

Should natural gas not be available at the time of the commissioning of the Vortum Thermal Power Plant, the proposed facility may be fuelled with liquid fuel (diesel or other types of liquid fuels) until natural gas is available. Gas turbines can be fuelled either with natural gas or liquid fuel.

Due to the current electricity shortage and the urgent need for new power generation units in the

Country, the Vortum Thermal Power Plant may operate as an Open Cycle Gas Turbine (OCGT) power plant as a first phase and in the second phase, with the “closure” of the open cycle (by means of steam turbine units added to the gas turbine unites), as a Combined Cycle Gas Turbine (CCGT) power plant. The construction timeframe of an OCGT plant is notably shorter than that of a CCGT plant.

In a CCGT power plant a Rankine cycle (steam cycle) is added to a Brayton cycle (gas cycle). The combination of the two thermodynamic cycles results in improved overall efficiency as less heat is wasted because heat is recovered - the "waste" heat from the gas cycle is utilised to produce steam to generate additional electricity via steam turbine units, enhancing the efficiency of overall electricity generation. The thermal efficiency of a CCGT power plant is up to 62%.

A Combined Cycle Gas Turbine (CCGT) power plant consists of gas turbine units coupled with steam turbine units: the "waste" heat from each gas turbine is sent to heat recovery steam generators (HRSG) to generate high pressure steam; the steam from the HRSG drives steam turbines coupled with generators, in order to generate electricity increasing the efficiency of the power plant.

Each gas turbine and steam turbine are coupled to the single generator in a tandem arrangement, on a single shaft (single-shaft configuration). The CCGT power plant will consist of the following components:

- Two or more gas turbine units with a capacity up to 400 MWel (electrical rated power) each;
- Fuel storage facility (in case of liquid fuel);
- Heat recovery steam generators (HRSG) to generate steam;
- Two or more steam turbine units with a capacity up to 220 MWel (electrical rated power) each;
- Electrical generators, which convert the mechanical energy of the gas and steam turbine units to electricity;
- Gas compressors and combustors, for the gas cycle;
- Water pumps and pressurisers, for the steam cycle;
- Cooling system, with condensers & cooling towers, in order to condensate the steam to water;
- A dam, to collect the water necessary for the generation of steam;
- A control room with offices;
- Warehouses;
- A natural gas or liquid fuel supply pipeline;

- A water supply pipeline;
- On-site high voltage substation;
- High-voltage power lines, for the connection to the Eskom grid.

The number and size (capacity) of the gas and steam turbine units has not been finalised yet and will depend on the load (demand) curve required by the grid. This will be assessed during the scoping phase in consultation with Eskom.

The CCGT power plant may consist of - e.g.:

- 2 gas turbines units of 375 MWel each + 2 steam turbines units of 200 MWel each (overall installed capacity: 1150 MWel); or (e.g.)
- Gas turbines units of 150 MWel each + 5 steam turbines units of 80 MWel each (overall installed capacity: 1150 MWel); or (e.g.);
- A combination of different sizes of gas and steam turbine units.

The overall installed capacity will nevertheless be up to 1200 MWel. The Vortum Thermal Power Plant will deliver the energy to the Eskom AURORA main transmission substation via one or more 400 kV power lines approximately 27 km long. The number of new 400 kV power lines will be assessed during the scoping phase in consultation with Eskom. The proposed power line corridor runs parallel to existing Eskom high-voltage power lines and may cross through the following properties (please refer to Locality Map Figure 1)

- Portions 1 and 9 (Remaining Extent) of the Farm LANGEBERG 187;
- Portions 1 and Remainder of the Farm UYEKRAAL 189;
- Farm EVERTS HOPE 190;
- Farm WASCHKLIP 183;
- Farm ZOUTEKUYLEN 179;
- FARM 1162;
- Portions 3 and 8 of the Farm LANGVERWACHT 178;
- Farm ADJOINING SPRINGFONTEIN 174;
- Portions 3 and 4 of the Farm DRIEHOEKS FONTEIN 176

A natural gas / fuel supply pipeline is also planned from the

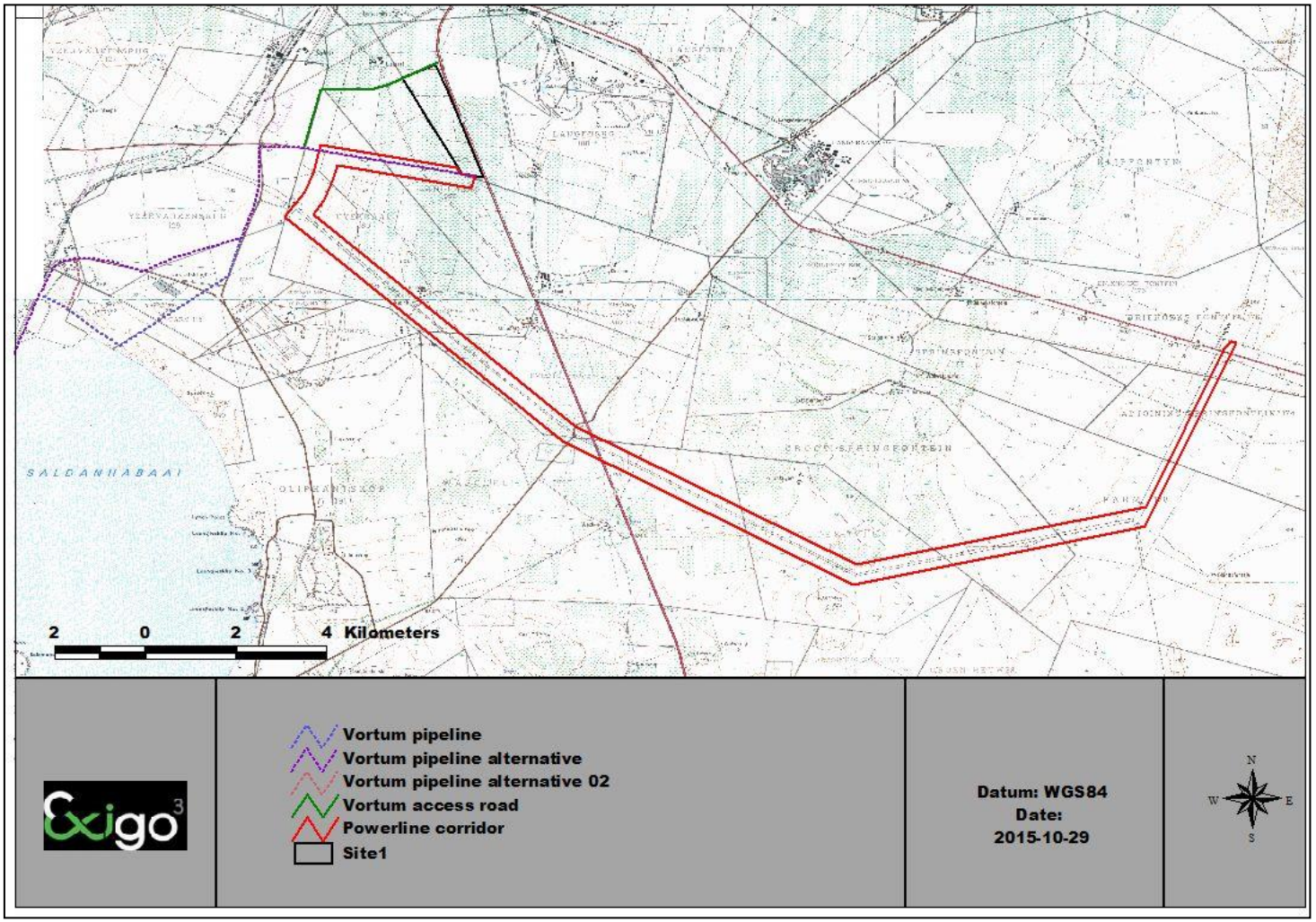


Figure 1. Regional Location Map

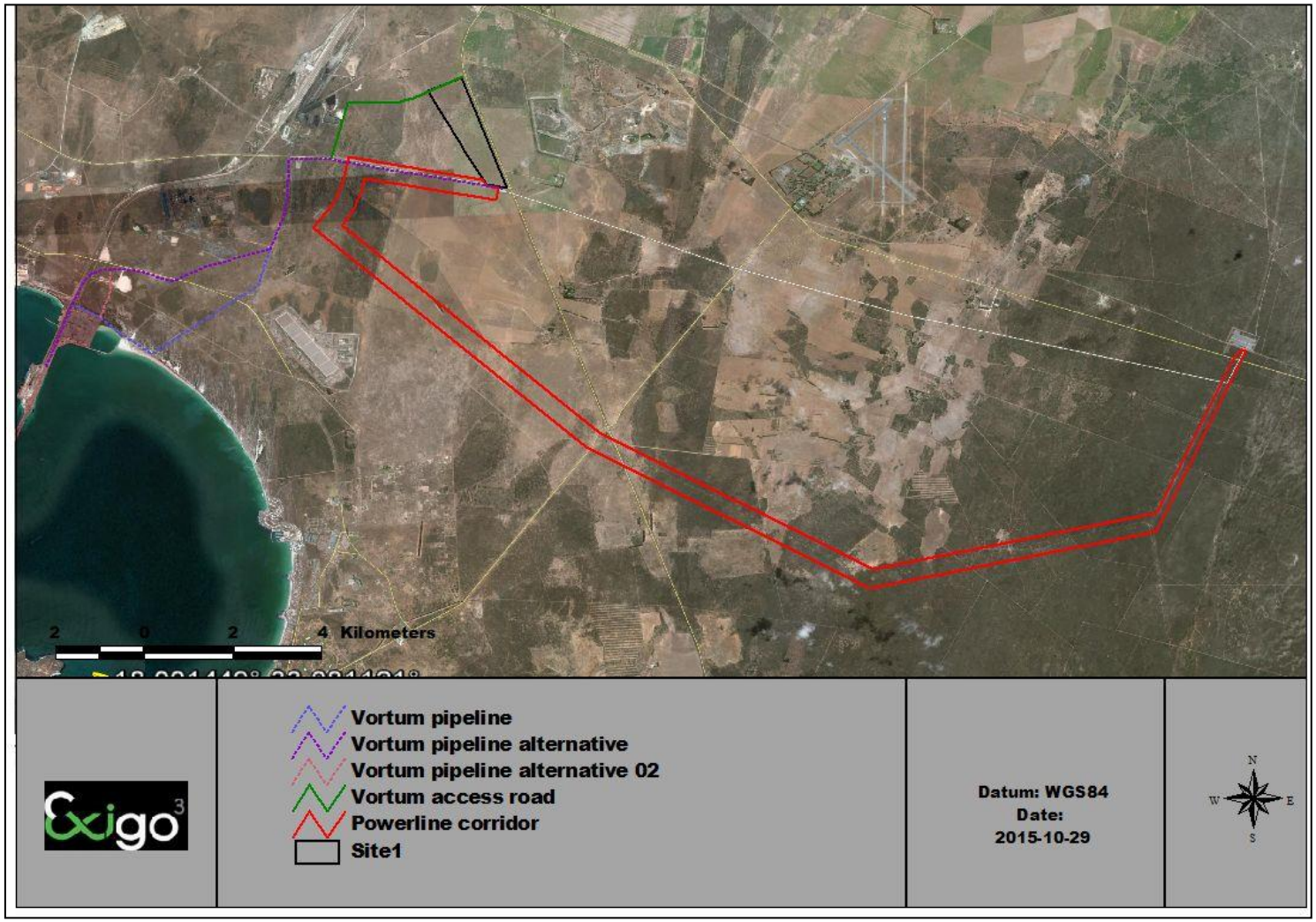


Figure 2. Satelite image showing the project area (Google Pro, 2010)

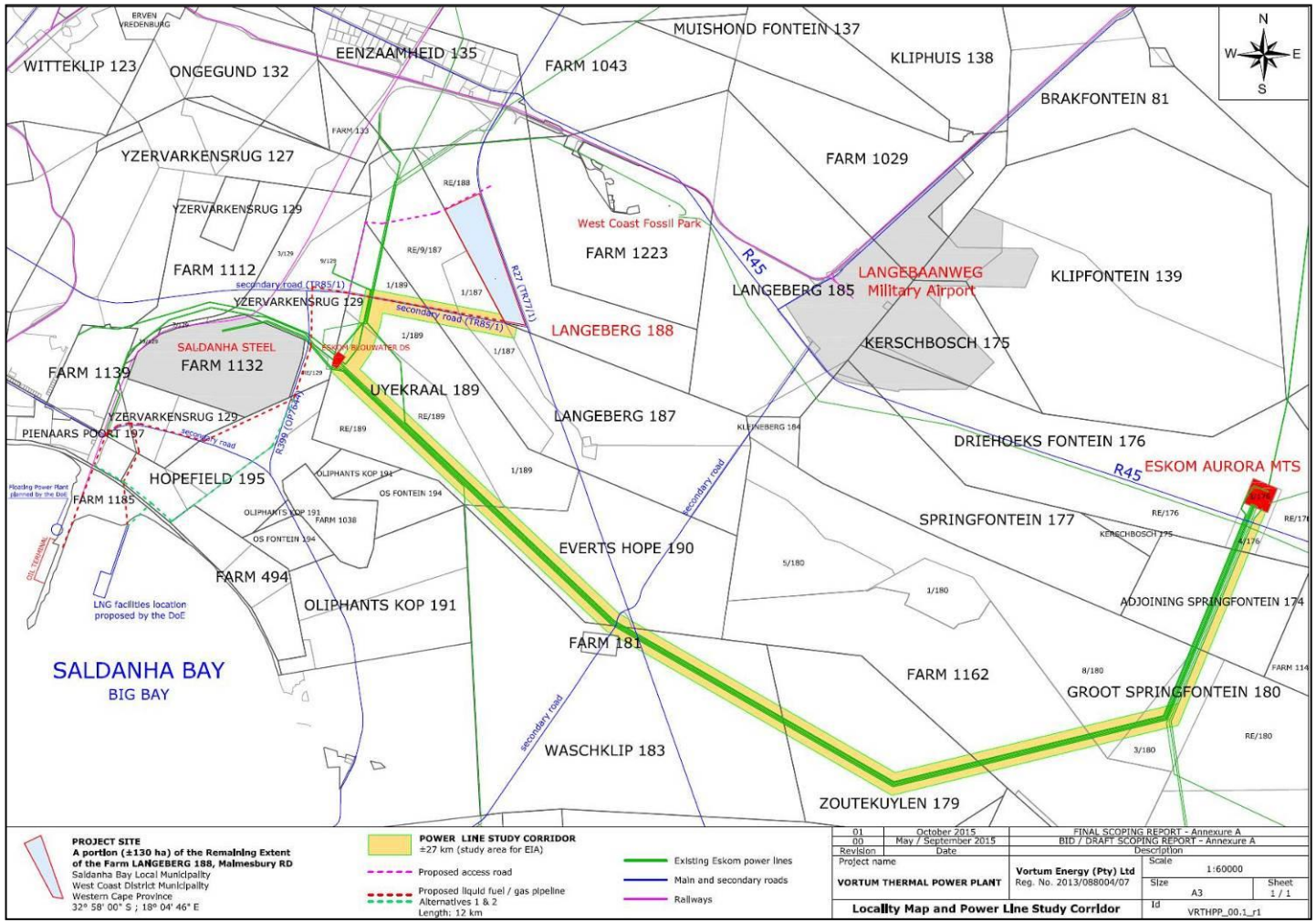


Figure 3. Layout Map of the proposed Vortum Thermal Power Plant and associated powerline and gas / fuel pipelines

4 METHODS

4.1 AVIFAUNA SURVEY

The avifauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the broad vegetation types and micro-habitats. Avifauna observed on site or any specific indication of species was noted as confirmed in the species lists obtained from the SABAP2 databases for the development footprints;
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area.
- The data obtained from the surveys was then used to identify the most suitable footprint area after an impact assessment was conducted.

4.1.1 Data recorded included:

A list of all species of avifauna and their status as observed on the site or that could potentially occur on the site. Notes were made of any specific sensitive or specialized habitats that occur on the site. The data were obtained from the following sources

4.1.2 Species of Conservation Concern

A species list of the species of conservation concern (SCC) was obtained from the Atlas of the Southern African Birds – SABAP 2 project for degree grid data (Avian Demography Unit, University of Cape Town). Up to date data were extracted from the Southern African Bird Atlas Projects (SABAP), which were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the relevant “pentads” of 5’ x 5’ from (SABAP 2).

4.2 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the avifauna species. In addition to species observed on the site, lists of the potential bird species were compiled, an impact assessment was conducted for the specific power line corridors and mitigating measures recommended to minimize the potential negative impacts of the proposed development on the avifauna.

4.3 IMPACT RATING ASSESSMENT MATRIX

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability: This describes the likelihood of the impact actually occurring:

- Improbable: The possibility of the impact occurring is very low, due to the circumstances, design or experience.
- Probable: There is a probability that the impact will occur to the extent that provision must be made therefore.
- Highly Probable: It is most likely that the impact will occur at some stage of the development.
- Definite: The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.

Duration: The lifetime of the impact

- Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- Medium term: The impact will last up to the end of the phases, where after it will be negated.
- Long term: The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale: The physical and spatial size of the impact

- Local: The impacted area extends only as far as the activity, e.g. footprint.
- Site: The impact could affect the whole, or a measurable portion of the above mentioned properties.
- Regional: The impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity: Does the impact destroy the environment, or alter its function.

- Low: The impact alters the affected environment in such a way that natural processes are not affected.
- Medium: The affected environment is altered, but functions and processes continue

in a modified way.

- High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

- Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute (Table 1):

Table 1. Impact ratings and weights attributed for each rating

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1

Aspect	Description	Weight
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8
Significance	**Sum(Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for the development.

5 RESULTS

5.1 Biome

The development site lies within the Fynbos biome which is dominated by low shrubs and comprises two major vegetation types: true fynbos, characterized by restioid, ericoid and proteoid components, and renosterveld, dominated by Asteraceae, specifically renosterbos *Elytropappus rhinocerotis*, with some grasses and geophytes. Agricultural crop-fields and planted pastures have now largely replaced renosterveld throughout this biome. Fynbos is characterized by a high level of diversity and endemism in its botanical composition.

The Fynbos Biome is considered by many to be synonymous with the Cape Floristic Region or Cape Floral Kingdom. However, the "biome" refers only to the two key vegetation groups (Fynbos and Renosterveld) within the region, whereas both the "region" and the "kingdom" refer to the general geographical area and include other vegetation types in the Forest, Nama Karoo, Succulent Karoo and Thicket Biomes. The contribution of Fynbos vegetation to the species richness, endemicity and fame of the region is so overwhelming, that the Cape Floristic Region and Cape Floral Kingdom can be considered to be "essentially Fynbos."

The Fynbos variation is characterized by the presence of the following three elements:

- A restioid component, belonging to the Restionaceae or the Cape Reed Family. Some definitions require a mere 5% cover of restiods in an area to classify it as a Fynbos vegetation type. The Restionaceae have been described as shrubby grasses, and replace grasses on nutrient-poor soils where there is a strong winter component to the annual rainfall. Sedges and many grasses within Fynbos also share the "restioid" characters of reduced or absent leaves and tough, wiry stems.
- An ericoid or heath component. By far the majority of plant species - and the greatest cover after restioids comprise plants with small, narrow, rolled leaves with thick-walled cells on the upper leaf surface and a channel containing hairs on the lower surface. Although the Heaths (Ericaceae) feature prominently, the Daisy (Asteraceae), Blacktip (Bruniaceae), Pea (Fabaceae), Jujube (Rhamnaceae) and Thyme (Thymelaeaceae) Families also have structurally similar leaves. Many of these plants are wispy and insubstantial, although some form quite dense bushes.
- A proteoid component. These plants, almost exclusively of the Proteaceae, have broad, isobilateral (both surfaces similar) leaves. They are the dominant overstorey in Fynbos. Although some members occur in ecotones and some occur in Renosterveld, by far the majority are confined to Fynbos.

Fynbos is characterized by the presence of seven endemic or near-endemic plant families: Blacktips (Bruniaceae), Guyalone (Geissolomaceae), Sillyberry (Grubbiaceae), Brickleaf (Penaeaceae), Buttbush (Retziaceae), Dewstick (Roridulaceae) and Candlestick (Stilbaceae). Only the Bruniaceae (75 spp.), Penaeaceae (21 spp.) and Stilbaceae (13 spp.) comprise more than five species. The fifteen largest families comprise 70% of the species in the Fynbos Biome

Fynbos vegetation types occur predominantly on well-leached, infertile soils. The Cape Supergroup sandstones typically produce such soils, but under high rainfall conditions, granites and even shales become sufficiently leached to support Asteraceous Fynbos, replacing Renosterveld. This usually occurs at about 600 to 800 mm annual rainfall, but may be much less on granites, especially at higher altitudes. Below 200 mm Fynbos is replaced by Succulent Karoo, presumably because at such low rainfall, the vegetation does not burn frequently enough.

Because of the low productivity of Fynbos vegetation types, due to the infertile soils, they are little utilized for agriculture. The major use of Fynbos is for recreation, water catchment and exotic plantations. In some areas vegetation harvesting for the cut-flower trade occurs, and wild flower orchards are being established in Fynbos areas

5.1.1 Value of the Fynbos Biome

The intrinsic value of conserving this unique Biome is undoubtedly its high levels of biodiversity and endemism. However, the Biome is also an important agricultural hub for the nation, sustaining wheat, fruit and thriving wine industries, which are possible through the soil and climatic conditions which exist. The mountains of the Biome provide an essential water catchment area for the City of Cape Town, sustaining the ever growing population. Other ecosystem services such as carbon sequestration, water filtration and buffering against floods also exist. The total value of the Fynbos Biome's and associated marine environment's ecosystem services has been estimated at R9.6 billion annually.

5.1.2 Major Fynbos Threats

The chain of large mountain ranges which comprise the CFR are viewed as essential water catchment areas, and as such have historically received the focus of conservation action in the region. This has unfortunately neglected the low lying Fynbos areas which hold high levels of biodiversity. Much of the vegetation types of the lowlands have been converted into agricultural fields or rangelands, or succumbed to the expansion of infrastructure development. The disruption of the natural fire regimes has impacted negatively on many of the Fynbos plant species as these species utilise specific fire frequencies to set seed and germinate. Infestation by alien invasive plant species, such as certain Australian Acacia and Eucalyptus species, has also converted much of the natural habitat areas into

alien "forests", devoid of the natural biodiversity of the region. The Fynbos Biome is predicted to be severely impacted upon by climate change, with estimates of as high as a 50% loss of the Fynbos Biome. The drastic climatic changes predicted could alter the conditions required for the persistence of the biome, such as changes in rainfall patterns and temperature, which in turn lead to changes in the plant communities which are able to persist in the area. Ultimately replacing the Fynbos with a different suite of species and thereby reducing the extent of the Biome.

5.1.3 Current Conservation Initiatives

Due to the high levels of diversity and the threats affecting this region, some authors have termed this the "hottest of Hotspots". This Biome has therefore received much attention through both conservation planning and action. In particular the Cape Action Plan for People and the Environment (CAPE), driven by the South African Biodiversity Institute, has mobilised much conservation action across the region. Conservation successes have been achieved by the Biodiversity Stewardship Programme in the Province, which engages and involves local landowners in the conservation of their properties through various incentives and improved land management. This region has also seen the work of the Business and Biodiversity Initiatives which aim to entrench sustainable farming practices in a variety of agricultural production, whilst also conserving critical vegetation types. The high level of collaboration between different conservation agencies including public, private and governmental institutions is well regarded, and widely acknowledged as one of the keys to the conservation success in this Biome. BirdLife South Africa will hope to add to the diversity of existing collaborations and use this approach to assist in conserving the diversity of birds and the Important Birds Areas present in this Biome.

5.2 Vegetation Types of the study area

The footprint site for the plant and a large stretch of the powerline corridor is located in Saldanha Flats Strandveld (calcrete flats thicket), while the powerline corridor also stretches through a small section of Saldanha Limestone Strandveld along the western section of the powerline corridor while the eastern section close to the Aurora Substation is located in Hopefield Sand Fynbos (Mucina & Rutherford, 2006) (Figure 3).

The Saldanha Flats Strandveld and Hopefield Sand Fynbos vegetation types were classified initially as ‘endangered’ by the National Spatial Biodiversity Assessment. This means that the functioning of the ecosystems has been compromised because they have lost significant amounts of their original natural habitat. This was changed to ‘vulnerable’ in the Draft National List of Threatened Ecosystems, that is, there is irreversible loss of natural habitat for both, while at least 40 or more Red Data List plant species are associated with Hopefield Sand Fynbos.

Saldanha Flats Strandveld is found between Saldanha and Hopefield, and consists of sclerophyllous

shrublands built of a sparse emergent and moderately tall shrub layer, with an open succulent shrub layer forming the undergrowth. It may be characterised as a transitional vegetation type, since it is usually found in a band between the Sand Fynbos and the Langebaan Dune Strandveld and shares elements of both, with more Thicket species than Sand Fynbos. The vegetation on site is in pristine to disturbed condition.

Hopefield Sand Fynbos is a moderately tall, ericoid-leaved shrubland with dense herbaceous stratum of aphyllous hemicryptophytes. About 49% of its original area remains, and it is classified as 'hardly protected' since < 1 % of the original area is protected for conservation purposes, against a target of 30 %. The ecosystem is most diverse in the Hopefield area, where extensive stands of Leucadendron foedum, Leucospermum rodolentum and Serruria fucifolia are dominant. At least five endemic plant species and 45 Red Data List plant species occur in the ecosystem. The Hopefield Sand Fynbos on site is in good to pristine condition, with minimal alien invasive vegetation (<1%).

Saldanha Limestone Strandveld is regarded as 'endangered' and not protected', with 59% of its original extent still remaining, a conservation target of 24% and 0% protected. It has a very high number of threatened and endemic species, although none of these are present on site. The vegetation on site is heavily disturbed, probably by heavy grazing and trampling, with indications of ploughing.

5.3 Cape Nature Fine Scale Project

The Fine-scale Biodiversity Planning Project (FSP) is a four year project, (May 2005 – July 2009), funded by the Global Environment Facility. The FSP is undertaking fine-scale biodiversity planning within the Cape Floristic Region and will be producing municipal biodiversity plans and land-use guidelines. These plans are to serve as the primary spatial biodiversity informant guiding proactive conservation action and directing land-use planning and reactive decision-making in local, provincial and national spheres of government. The more recent fine-scale vegetation maps compiled as part of the CAPE fine-scale project, which are more accurate for this area. According to a more recent analysis (than that used for the NSBA 2011 listings) conducted by CapeNature Saldanha Flats Strandveld should be considered as Endangered under criterion A1 (loss of habitat). The powerline will pass through a substantial area containing Hopefield Sand Fynbos in good condition. This area has been determined as a Critical Biodiversity Area and is required to meet conservation targets for the region and is of high conservation value. Hopefield Sand Fynbos has also undergone an analysis by our conservation planner which showed that the vegetation should be listed as Vulnerable although it is very close to qualifying as Endangered under criterion A1 (remaining extent) and could possibly qualify as Endangered under criterion D1 (number of threatened species associated with this habitat). The map for the proposed thermal power plant and associated powerlines is presented in Figure 5.

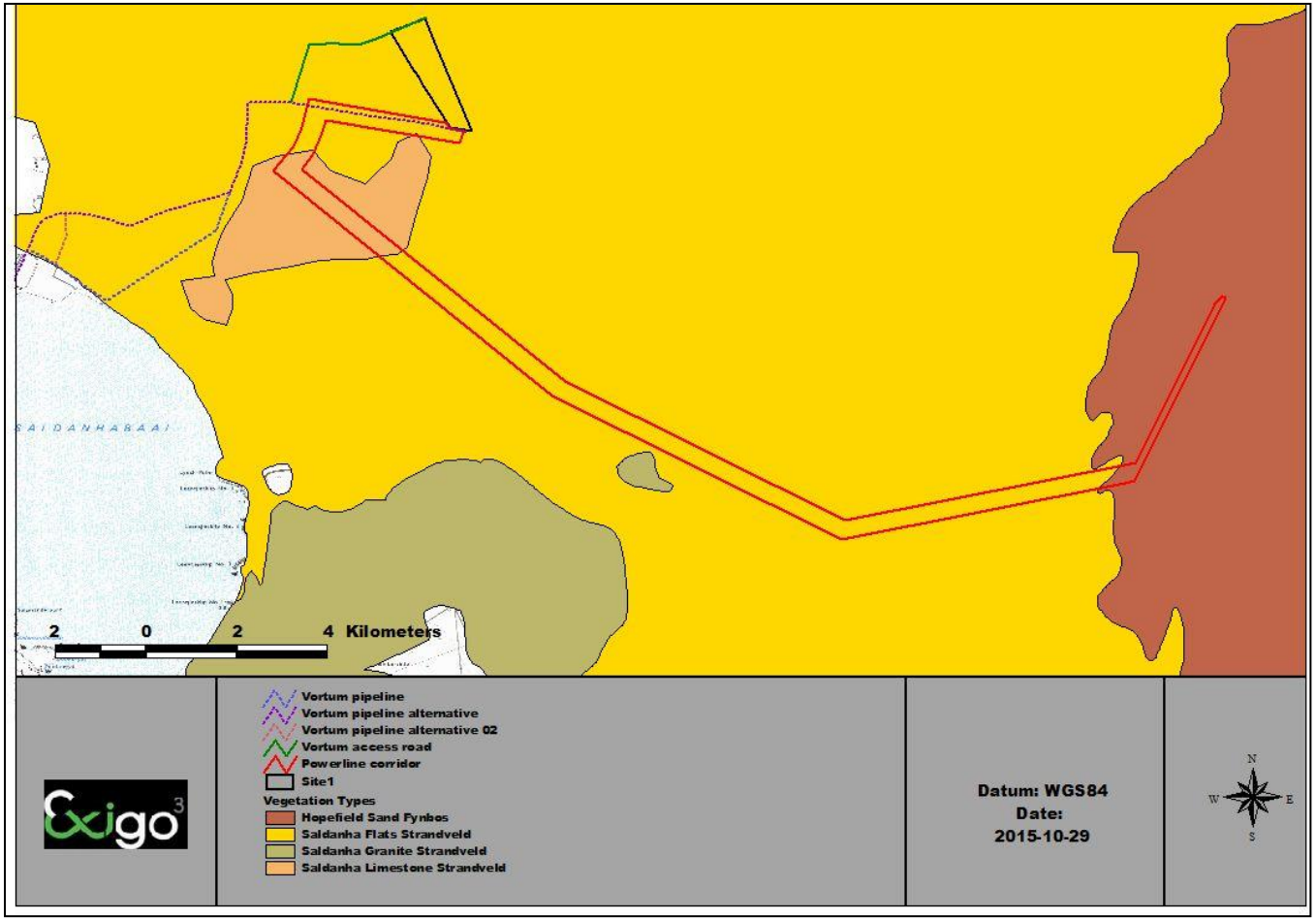


Figure 4. Vegetation Types of the study area (Mucina & Rutherford, 2006)

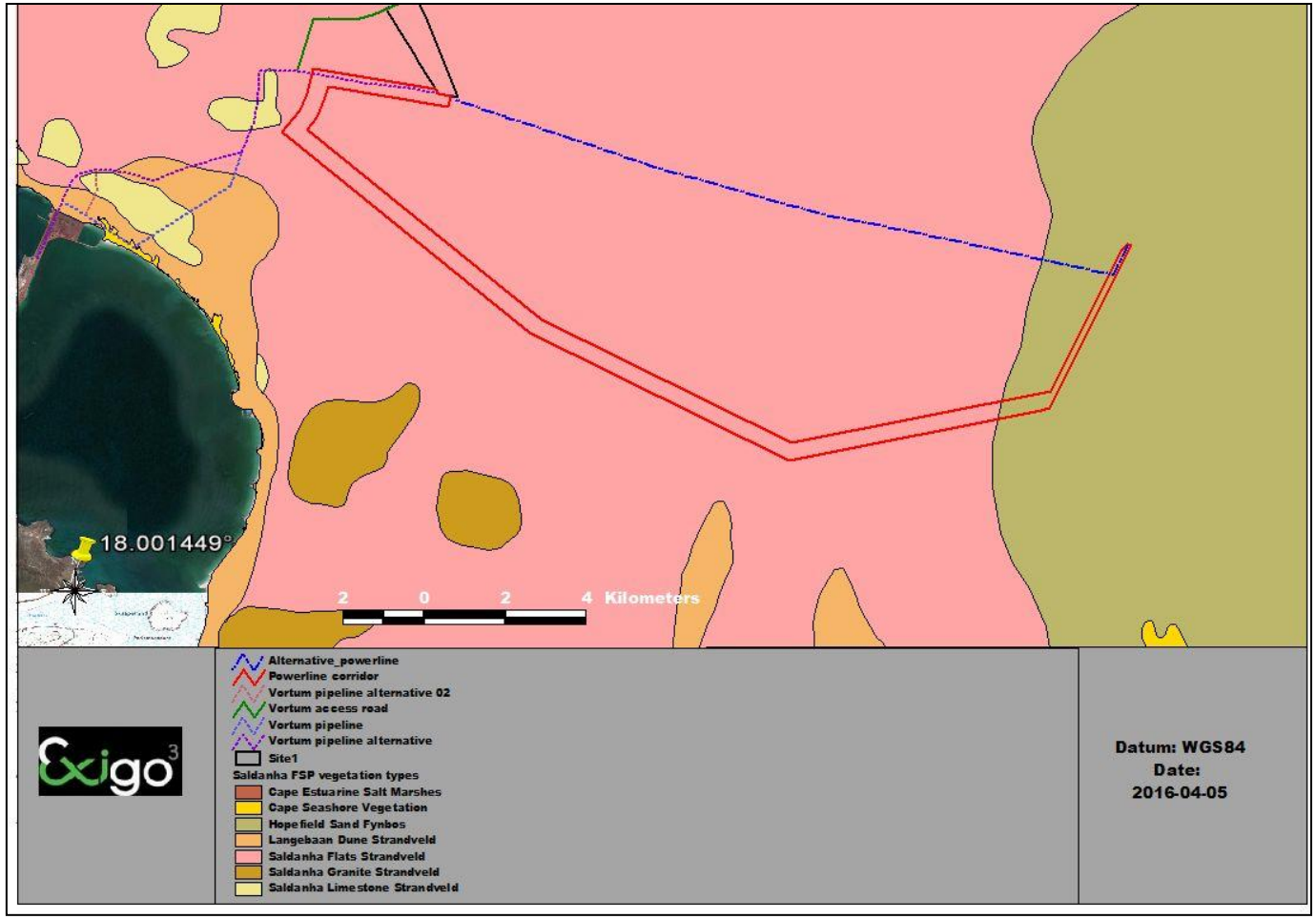


Figure 5. Cape Nature FSP Vegetation Map for the project area

5.4 Important Bird Areas of the Saldanha Area

The avifauna plays an important role in the West Coast ecosystem. The West Coast National Park is an Important Bird Area (SA 105) (Figure 6), which includes Langebaan Lagoon, a wetland of international importance. Well-developed Strandveld comprising low bushes and succulents dominate the terrestrial vegetation that surround the lagoon. Over 250 bird species have been recorded in the park. The lagoon is the most important wetland for waders in South Africa. It regularly accounts for 10% of South Africa's coastal wader numbers, one of the highest densities of waders worldwide, and more than 34 500 waders, of which 93% are Palearctic migrants. In some years, the wader numbers can increase from 4 000 in winter to 50 000 in summer. In winter, the lagoon regularly supports more than 10 500 birds of which 4 500 are Greater Flamingos.

In addition, the five islands (Jutten, Malgas, Marcus, Schaapen and Meeuw) are important breeding platforms for a number of marine bird species of which Malgas Island supports 25 % of the global population of Cape Gannets (*Morus capensis*).

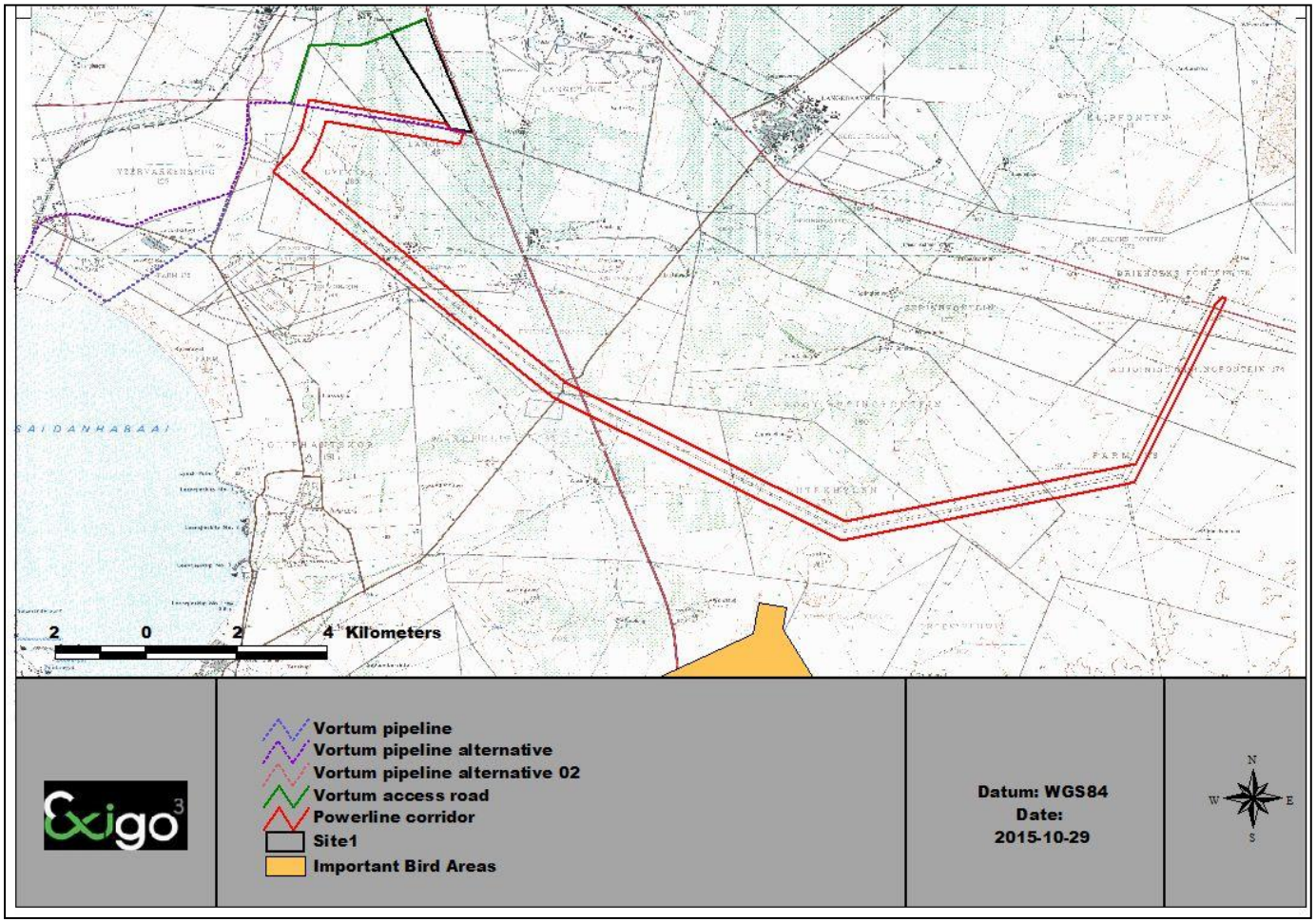


Figure 6. Location of the project area in relation to IBAs

5.5 Critical Biodiversity & Ecological Support Areas of the project area

The Fine-Scale Biodiversity Planning (FSP) project led by Cape Nature in partnership with the South African National Biodiversity Institute (SANBI) is part of the C.A.P.E. (Cape Action for People and the Environment) programme and is funded through the Global Environmental Facility. Specific Critical Biodiversity Areas (CBAs) for terrestrial and aquatic areas was identified through the FSP for the project area. CBA's are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools. The FSP clearly states that maps of CBAs will be useful in determining which areas of the province most urgently require fine-scale biodiversity planning.

The CBA map aims to guide sustainable development by providing a synthesis of biodiversity information to decision makers. It serves as the common reference for all multi-sectoral planning procedures, advising which areas can be developed, and which areas of critical biodiversity value and their support zones should be protected against impacts. The broad objective is to ensure appropriate land use and planning for the best possible long-term benefits and to promote integrated management of natural resources. The main CBA Map categories are Critical Biodiversity Areas (Terrestrial and Aquatic), Ecological Support Areas (Critical and Other), Other Natural Remaining Areas and No Natural Remaining Areas. The first two mentioned categories represent the biodiversity priority areas which should be maintained in a natural to near natural state. The last two mentioned categories are not considered as priority areas and a loss of biodiversity within these areas may be acceptable. The CBA map indicates the most efficient (least land-hungry) selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives (termed biodiversity thresholds). Furthermore, wherever possible, the selection has attempted to avoid conflict with other land uses. The criteria used for the CBA map categories as part of the project area is indicated in Table 2, while the CBA map for the project area is presented in Figure 7.

Table 2. Criteria used to define the CBA categories

Biodiversity Land Management Classification Key

Recommended Activity 1 | Restricted Activity 2 | Unsuitable Activity 3

Land Use Category	Biodiversity Criteria	Land Management Objectives	Conservation Management	Extensive Game Farming	Priority areas for stewardship and veld restoration programmes	Extensive Livestock Production	Rural Recreational Development	Rural (Communal) Settlement	Dryland Crop Cultivation	Intensive Animal Farming (eg. dairy, piggeries)	Irrigated Crop Cultivation	Urban & Business Development	Major/Extensive Development Projects	Linear Engineering Structures	Water Projects & Transfers	Underground Mining	Surface Mining, Dumping & Dredging
Protected Areas	Statutory protected and conservation areas	Maintain in a natural state with limited or no biodiversity loss	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3
CBA 1: Irreplacable Sites	The most important areas for biodiversity conservation	Maintain in a natural state with no further biodiversity loss	1	1	1	1	3	3	3	3	3	3	3	2	3	3	3
CBA 2: Important Areas	Other areas known to be of high biodiversity value	Maintain near-natural landscapes with no or limited loss of biodiversity pattern and limited loss of ecosystem processes	1	1	1	1	2	2	3	3	3	3	3	2	2	1	3
Ecological Support Areas	Areas that support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors) in the landscape	Maintain near-natural landscapes with some loss of biodiversity pattern and limited loss of ecosystem processes	1	1	1	1	2	2	2	2	2	3	2	2	2	1	2
Other Natural Areas	Areas of natural vegetation where the land has not been ploughed, mined or built on	Functional landscapes: manage land to maintain basic ecosystem processes	1	1	2	1	1	2	1	1	1	2	2	2	2	1	2
Agricultural transformation	Croplands with limited or no natural remaining	Sustainable management	1	1	2	1	1	1	1	1	1	1	1	2	2	2	2
Infrastructural transformation	Urban areas and roads with no natural remaining	Sustainable management	1	1	3	1	1	1	1	1	1	1	1	2	2	2	2
Mining and Quarrying	Limited or no natural remaining	Sustainable management	1	1	3	1	1	1	1	1	1	1	1	2	2	2	2

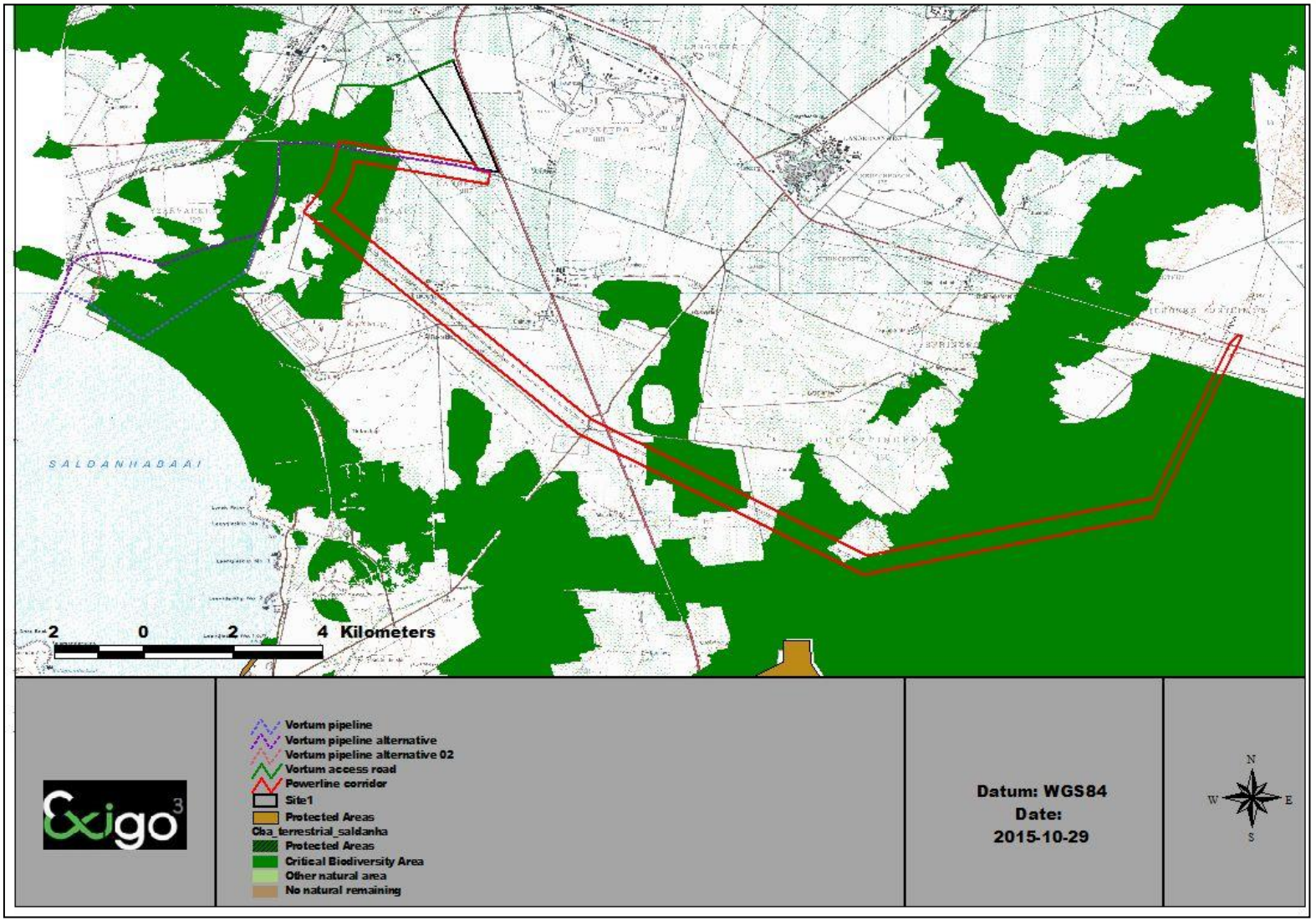


Figure 7. Terrestrial CBA areas of the study area

5.6 Bird microhabitats of the study area

5.6.1 Agricultural land / old fields / exotic bushclumps

The agricultural habitats of Southern Africa range from pastures for grazing of livestock, through ploughed lands for the growing of crops such as maize, wheat and sugarcane, to the planting of commercial timber. These agricultural habitats sometimes cover extensive areas, and have become an artificial habitat that attracts a wide range of generalist species. Herons, storks, ibises, francolins, cranes, korhaans, plovers, pigeons and doves, larks, chats, pipits and starlings are attracted to the more open cultivated areas, while smaller species such as cuckoos, robins, sparrows, widows, finches, canaries and buntings are attracted to secondary growth around cultivation. Young crops attract gamebirds, especially guineafowl and quail, and grazing waterfowl like Spurwinged Goose and Egyptian Goose. Ploughed fields with recently sown grain crops also attract storks and cranes, which feed on the grain and thereby come into conflict with farmers. On the other hand, timber plantations support an impoverished avifauna, limited mainly to buzzards, doves, cuckoos, bulbuls and smaller seed eaters. However, crop farming in Southern Africa has had a profound influence in radically transforming vast areas of land originally under natural vegetation. The changes to the bird communities in these areas have also been profound, with some species benefitting and advancing, and others decreasing and retreating, in the face of these transformations.

The introduction of alien trees and the establishment of extensive crop fields and planted pastures in the fynbos biome have resulted in numerous species of woodland and grassland birds colonizing these areas. Examples are the Pied Barbet and Blue Crane. The open agricultural plains of the fynbos biome show an interesting difference in the abundance of several species characteristic of these modified regions. For example, the Blackheaded Heron, White Stork, Blue Crane and Black Crow are all substantially more common on the west coast.

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable landsoften represent the only green or attractive food sources in an otherwise dry landscape. Very often the most attractive phase of crop production for birds is when the land is first ploughed – before planting even takes place. In this study area some arable lands exist which are irrigated.

The old fields occur on a large section of the proposed development site and represent short, degraded grassland as well as open secondary woodland. When cultivated fields are left fallow, it results in a landscape mosaic of patches of secondary vegetation varying in age and dominated

by various grass species (Moll, 1965). Different stages of succession occur in the old fields, and Wildi (2002) described how dynamic these systems are over time and space. Bird species such as crowned plovers, crested guineafowls, francolin species as well as the birds of prey the smaller bird species attract utilize these areas. Although this microhabitat is in a degraded state, the area is a popular habitat for bird species, especially as foraging area, while species such as crowned plover and other smaller non-passerine birds also breed on the ground in this area. At present many high voltage power lines bisect this area.

Stretching from the northern outskirts of Cape Town lie the extensive cereal croplands and planted pastures of the Swartland agricultural region. The area is bordered on its western side by the atlantic Ocean and on its eastern side by a number of mountain ranges. The Swartland is home to a variety of grassland species and species characteristic of agricultural areas. Interesting birds include the recently described Cape Longbilled Lark and Cape Clapper Lark.

The grasslands and agricultural fields hold species such as Orangethroated Longclaw, Capped Wheatear, Fantailed Cisticola, Grassveld Pipit and Pied Starling. Listen out for Blue Cranes, Black Korhaan and Common Quail, which can all be found in the vicinity of agricultural fields. Other ground birds occurring in the area include Greywing Francolin, Cape Francolin and Namaqua Sandgrouse. Together with the occasional loose flocks of Greybacked Finchlark, a number of lark species occur within the area including the Thickbilled Lark, Redcapped Lark and the recently described Cape Longbilled Lark and Cape Clapper Lark.

5.6.2 Fynbos habitat

The high botanical diversity of fynbos is not reflected in its terrestrial avifauna, which is poor in species relative to other Southern African biomes. There are, however, several important species endemic to the fynbos biome: Cape Rockjumper, Victorin's Warbler, Cape Sugarbird, Orangebreasted Sunbird, Protea Canary and Cape Siskin. The Cape Bulbul and Cape Francolin are also largely endemic to the fynbos biome, occurring only marginally in the adjacent Karoo. The Black Harrier, endemic to Southern Africa, is likely to have its main breeding grounds in the fynbos biome. The Knysna Warbler is largely confined to the fynbos region but is associated with forest edge habitats and extends up the east coast well beyond the limits of the fynbos biome.

Two of these species (the Cape Rockjumper and Cape Siskin) have their sole congeners (Orangebreasted Rockjumper and Drakensberg Siskin) restricted to the highlands of Lesotho, in the grassland biome, suggesting a biogeographical connection between these two now widely separated regions. The Cape Sugarbird also has its sole congener, Gurney's Sugarbird in the high lying grasslands further north in Southern Africa. The fynbos, however, also shares many species with the Karoo (e.g. Greybacked Cisticola) and the close affinities of the avifaunas of these three biomes suggest an ancient continuous link between them, and quite distinct from the woodland and closed forest habitats further north in the region. The relatively tall and woody habitats

found in the coastal strandveld areas in the fynbos support several species more typically associated with Karoo and even woodland to forest habitats, such as the Karoo Robin, Titbabbler, Barthroated Apalis and Longbilled Crombec.Microphyllous Woodland and dune habitat

5.6.3 Strandveld habitat

The coastal strandveld hosts a plethora of bush birds. Typical species Longbilled Crombec, Barthroated Apalis, Greybacked Cisticola, Titbabbler, Layard's Titbabbler, Karoo Lark, the diminutive Cape Penduline Tit, Namaqua Dove, Karoo Robin, Yellow Canary and Greywing Francolin (especially in the early morning). Raptors overhead might include Blackshouldered Kite and Yellowbilled Kite (summer), Steppe Buzzard (summer), Rock Kestrel, Booted Eagle and Black Harrier. Falcons such as Northern Hobby Falcon, lanner and Peregrine Falcon (including the northern race "calidus" during summer) also occur in the area. In summer, hordes of Eurasian Bee-eater can be seen hawking insects over the bush together with many hirundines including Eurasian Swallow, Greater Striped Swallow, Pearlbreasted Swallow, Brownthroated Martin, Rock Martin and Banded Martin.

The bird habitats represented in the area are presented in Figure 8 below:

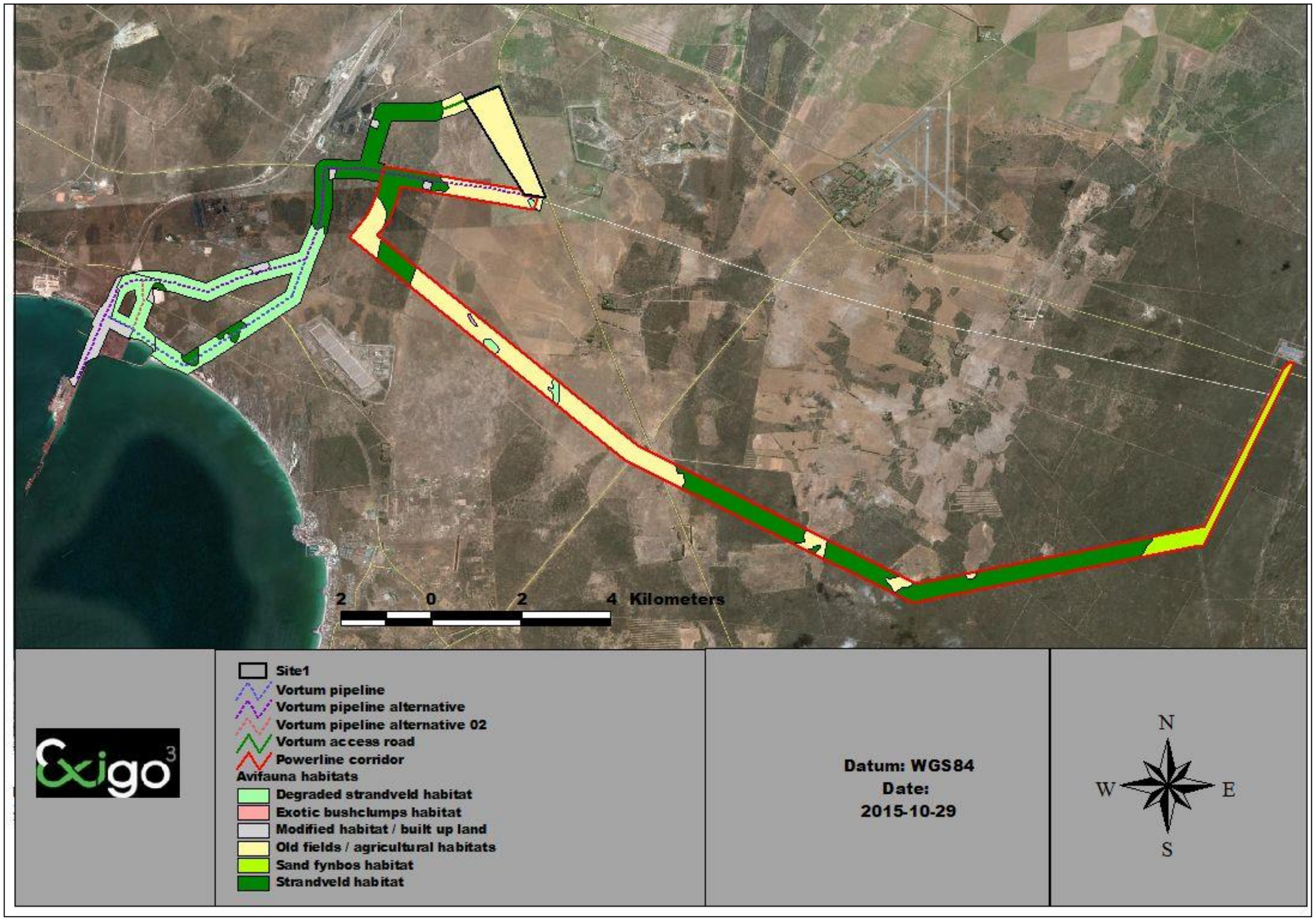


Figure 8. **Avifauna habitat map for the proposed thermal power plant, powerline and gas / fuel pipeline corridors**

5.7 Avifauna documented in the project area

The avifauna is currently fairly typical of the agricultural landscape in this region, and two Species of Conservation Concern (SCC) have previously been recorded foraging in the vicinity of the study area, with another three passing overhead. The avian SCC recorded (pers. obs.) foraging in the area are Black Harrier (*Circus maurus*; Near Threatened; Barnes 2000) and Blue Crane (Anthropoides paradiseus; Vulnerable), whilst Great White Pelican (Pelecanus onocratalus; Near Threatened), Lesser Flamingo (*Phoeniconaias minor*; Near Threatened) and Greater Flamingo (Phoenicopterus roseus; Near Threatened) have been observed flying nearby, presumably to and from the Langebaan Lagoon (to the south) and the Berg River estuary (to the north), both critically important wetlands on a national scale (Helme, 2014).

The Hopefield Sand Fynbos and Saldanha Flats Strandveld vegetation support smaller, generalised species and typical species observed in these areas include cape bunting, pied crow, plain-backed pipit, cape sparrow, jackal buzzard, yellowbilled kite, pied starling, common starling, greywinged francolin, and karoo scrub robin No SCC was observed in the natural vegetation units.

5.8 Monitoring data from previous studies in the area

Various avifauna studies have been conducted in the area, with specific reference to powerlines that leads to the Aurora Substation. The data from these studies was taken into consideration assessing impacts for the proposed development as well as residual impacts.

5.8.1 Vredendal – Aurora Powerlines (RSMM Consulting, 2014)

This study addressed power line impacts on avifauna, and identifies potential impacts associated with three alternative 132 kV power lines proposed from Vredendal to the Aurora substation near Hopefield Darling, Western Cape. The impact zone of the three alternative power line routes lies **within the Hopefield Sand Fynbos and Swartland Renosterveld** vegetation zones. Up to date bird atlas data from the region indicates that habitat around 194 km option 1 supports up to 179 bird species, including 12 threatened (red-listed) species, and 22 collision-prone species ranked in the top 105 species (RSMM Consulting, 2014).

The 176 km option 2 supports at least 181 species, including 14 red-listed species and 26 collision-prone species. The 163 km option 3 supports 182 species of which 12 were red-listed species and a total 24 collision-prone species. **The avian groups of greatest conservation significance likely to be impacted by the power lines include the flocking waterbirds near the two main wetland hotspots of Verloren Vlei River and the Berg River. Species include pelicans, cormorants and ibises and elsewhere collision-prone Blue Cranes which were recorded on some farmland. Resident raptors such as Black Harriers, Verreaux's Eagles and Martial Eagles were rare but present and may be at some risk (RSMM Consulting, 2014)..**

Bird atlas data suggest more red-listed wetland birds (flamingos and cranes) are at risk in the option 2 due to the higher number of red-listed species, while direct observations suggest option 1 is the highest risk where it crosses the Verloren Vlei and the Berg River because up to 166 collision-prone birds an hour were recorded in the site visit. Option 3 is the least risky but requires some re-routing to avoid impact hotspots over wetlands (RSMM Consulting, 2014).

5.8.2 Bulk Power Infrastructure at the Port of Saldanha (Chris van Rooyen Consulting, 2015)

This study found that the risk of avifauna mortality of Red Data species through collisions with the earth wire is limited by the location of the proposed line in fairly degraded habitat and close to areas of high industrial activity, which makes the regular occurrence of collision-prone Red Data species in the study area unlikely. Furthermore, the proposed line is only around 500m long, the proposed 66kV monopole structures are generally lower than the plethora of existing high voltage lines already present in the area and it will be located outside the most likely flight path between IBAs in the region. This impact is therefore assessed to be of very low significance and no mitigation is required.

The risk of displacement of Red Data species due to habitat destruction and disturbance is likely to be fairly limited, given the low likelihood of Red Data species occurring regularly in the study area, and the small footprint of the proposed project. **Black Harrier and Southern Black Korhaan are the Red Data species most closely associated with fynbos, and the most likely candidates in the study area for potential displacement due to disturbance and habitat transformation.** However, it is unlikely that there are any breeding Black Harriers which will be disturbed by the proposed construction activities, as the current levels of human activity in the study area is fairly high and likely acting as a deterrent to the species. This impact is therefore assessed to be of low significance. The implementation of mitigation should reduce the impact to very low.

The following mitigation is proposed:

Essential Mitigation Measures:

- Construction activity should be restricted to the immediate footprint of the infrastructure and associated working areas should be identified in consultation with the ECO.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied during construction.

Best Practice Mitigation Measures

- Maximum use should be made of existing access roads and the construction of new roads

should be kept to a minimum.

5.8.3 Aurora – Omega Powerline (Nzumbululo, 2015)

Bird habitats along the four line options were often similar because all four crossed similar sandplain Fynbos, (northern section) and some phragmites-choked rivers and agricultural areas and pans (option 1) further south. Option 4 crossed more farmland than any other line. In the north the environment is largely dry pristine sandplain Fynbos scrub between Hopefield and the R27 – these areas support indigenous species such as prinias, sunbirds, sugarbirds and Black Harriers (which breed here: RE Simmons unpublished data). A Martial Eagle has also built its nest on one of the existing pylons close to the R27, and the pair is likely to hunt over the pristine vegetation here. In the southern sections near the Darling road (R315) one line runs through farmland dominated by a series of pans that flood in winter and are dry in summer. These pans attract flamingos and ibises when flooded and the farmland supports Blue Cranes. The Slangkop farm holds most of these birds. Further south the lines pass over “dry” rivers filled with phragmites (e.g. Modder River) and no open water. These areas are cattle grazed. Intensive cattle farming attract large flocks of Sacred ibis near the Rheboksfontein farm south of Darling.

5.9 Species of Conservation Concern (Sanbi) / Priority Bird Species (Birdlife SA)

A healthy environment is inhabited by animals that vary from micro-organisms to the birds and mammals. The species composition and diversity are often parameters taken into consideration when determining the state of the environment. A comprehensive survey of all avifauna is a time consuming task that will take a long time and several specialists to conduct. The alternative approach to such a study is to do a desktop study from existing databases and conduct a site visit to verify the habitat requirements and condition of the habitat.

As discussed in the previous section the area represents a homogenous vegetation structure and height class. A detailed species list for the avifauna is included in Appendix A for the study area, while the threatened species list for South Africa is presented in Appendix B. According to the existing databases and field survey the following number of birds species included in the Birdlife SA red data lists (Barnes 2000, M Taylor in litt) and priority species lists (Birdlife SA) can potentially be found in the proposed development sites for the proposed powerline corridor, fuel / gas pipelines and thermal power plant site (Table 3).

Table 3. Red data and priority species list of potential avifauna for the study area (Very high priority species for larger project area marked in red)

English Name	Regional Conservation status	Priority Species (Birdlife SA)	Probability of occurrence in area	Probability of impact on species
African Fish-Eagle	Least Concern	X	High	Medium to High
African Marsh-Harrier	Endangered	X		Medium
Black Harrier	Endangered	X	High	VERY HIGH
Black-shouldered Kite	Least Concern	X	High	Medium to Low
Blue Crane	Near Threatened	X	High	VERY HIGH
Booted Eagle	Least Concern	X	High	Medium
Cape Cormorant	Endangered	X	High	Medium
Great White Pelican	Vulnerable	X	High	High
Greater Flamingo	Near Threatened	X	High	VERY HIGH
Grey-winged Francolin	Least Concern	X	High	Medium to Low
Jackal Buzzard	Least Concern	X	High	Medium
Lanner Falcon	Vulnerable	X	High	VERY HIGH
Lesser Flamingo	Near Threatened	X	High	VERY HIGH
Ludwig's Bustard	Endangered	X	High	VERY HIGH
Montagu's Harrier	Least Concern	X	High	Medium to Low
Peregrine Falcon	Least Concern	X	Medium	Medium to High
Secretarybird	Vulnerable	X	High	VERY HIGH
Southern Black Korhaan	Vulnerable	X	High	VERY HIGH
Southern Pale Chanting Goshawk	Least Concern	X	Medium	Medium to Low
Spotted Eagle-Owl	Near Threatened	X	High	VERY HIGH
Steppe Buzzard	Least Concern	X	High	Medium to Low
Verreauxs' Eagle	Vulnerable	X	Medium	Medium to High

The following general observations and recommendations regarding the red data avifauna of the area can be made:

- The field study revealed the presence of some of the priority species according to the Birdlife SA sensitivity map. This emphasise the need for future monitoring as recommended by Birdlife SA. It must be noted that many “non-priority” bird species also occur in the study area and will also be impacted on by the proposed development. Although this impact assessment focuses on priority species, the impact on non-priority species is also assessed;
- Examination of the data reveals that the report rates for most Red Data species according to the Bird Atlas Project of Southern Africa are probable or possible, with the exception of the birds associated with open water habitats (e.g. harrier species, storks) being unlikely. It must be noted that many “non-Red Data” bird species also occur in the study area and will also be impacted on by the proposed development. Although this impact assessment focuses on Red Data species, the impact on non-red Data species is also assessed;
- If one considers the habitat descriptions of the red data species, some of them are limited in range or threatened as a direct result of habitat loss in the southern African sub-region, although other species with large home ranges are not directly threatened by habitat loss. The impact of development on the red data species would therefore be less than predicted;
- The removal of vegetation should only occur if necessary considering the height of the vegetation layer that will occur beneath the power line. Slashing of the herbaceous layer and shrubs is only recommended where unavoidable and no clearing of the rare vegetation types such as Hopefield Sand Fynbos should be allowed. The anticipated impact will be on linear sections vegetation that varies from natural to degraded in relation to the total available surrounding habitat for avifauna. The habitats of the avifauna will be partially fragmented since the area below the powerline corridor will still be available for avifauna to move through. Development could potentially influence the natural feeding and movement patterns of the existing avifauna in the area. Peripheral impacts on the larger area should however still be avoided;
- The actual construction of the thermal power plant will not have a direct significant impact on the above mentioned red data fauna since the site occurs on degraded grassland (old fields). The remaining natural habitat/vegetation would be available on the peripheral fynbos and strandveld habitats outside the study area, although this would

not secure permanent habitat to birds considering the development pressures in the area. The natural areas below the powerline and on the pipeline corridors should not be slashed considering that this has shown to cause a decrease in biodiversity. The probability that the plant and associated powerline will indirectly impact on certain of the larger red data bird species (e.g. storks, vultures etc.) through collisions and / or electrocutions is Medium to High though; although the development in close proximity to other powerlines could reduce this impact slightly;

- The protection of different habitat types in the area will be important to ensure the survival of the different birds due to each species' individual needs and requirements. Specific natural corridor sections should be identified and protected around the proposed development footprints to allow avifauna to move freely between the different microhabitats in the study area. The Saldanha Fine Scale Vegetation Map could be used as reference to identify specific corridors during the pre- and post-construction monitoring.
- Considering that the current power lines in the area as well as proposed future power lines planned by Eskom for the site, the impact on the avifauna population of the proposed development site and surrounding areas could be slightly reduced as a result of the following aspects:
    - It is either close to or will be adjacent to existing or planned power lines for most of its route in the future or at present. This means that habitat destruction, and disturbance of birds will be less significant as the area is already disturbed to some extent.
    - It will also mean that electrocution of birds is less likely on the connection lines as for the large transmission lines which it connects to are significantly taller and it is likely that birds such as vultures would choose to perch on the taller lines.
    - Building the Thermal Power Plant and the connection line close to existing power lines should to a certain extent eliminate the need for new access roads and gates etc. This would reduce the level of disturbance and habitat destruction. In addition, birds in the immediate vicinity of the existing power line would already be relatively tolerant of disturbance as a result of maintenance activities on the already established lines.
    - The impact of collision of birds is partially mitigated for by placing new infrastructure close to existing lines for the following reasons:
        - The more overhead power lines and other associated infrastructure

there are together, the more visible they would be to the birds in the area (Avian Power Line Interaction Committee - 1994).

- Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities. Hence adding a new small connection line and Photovoltaic Power Plant adjacent to existing lines would probably have less impact than putting it in a totally new area, where the resident birds are not yet accustomed to overhead power lines.
- Spatially, it makes more sense to have all the threats to birds (in particular through collision) in one relatively confined area, rather than spread out across the landscape. As many bird species are territorial to some extent, keeping the development impacts confined to a smaller area could potentially impact on fewer birds.

The cumulative negative impact of the development on the fauna has the potential to be moderate. However, considering the following general mitigation and management actions taken on site during construction, the impact on avifauna populations should be low.

- Where trenches pose a risk to bird safety, they should be adequately cordoned off to prevent ground-living birds falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process;
- No birds may be poached during the construction of the thermal power plant development or the associated infrastructure. Many birds are protected by law and poaching or other interference could result in a fine or jail term;
- Do not feed any birds on site;
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptor species as well as other birds of prey occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist;
- The habitat and feeding grounds of the water birds would be on the peripheral areas of the rivers and lagoons in the larger area. None of these habitats occur on site and the impact on these bird species in the study area will therefore be restricted to areas where the birds perch. Further avifauna monitoring will give a clearer indication of bird flight patterns in the larger area;

- Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the constructional and operational phases. Monitoring of specific bird species is necessary to ensure that these species would be unaffected over the longer term by the development. Information on red data species should be provided to construction workers to make them more aware of these fauna and their behaviour. **The monitoring guidelines for future monitoring of the renewable energy project should be used as guideline by Birdlife SA.**

6 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE AVIFAUNA

The impact of the proposed thermal power plant, powerline and gas pipeline corridors will be adjacent to already existing power line servitudes or secondary roads along linear lines. The vegetation varies from being in a pristine to degraded state.

The impact of the proposed development will only be on a relatively small footprint area in relation to the larger area of the Fynbos Biome, especially considering that larger areas of the vegetation on site is already in a degraded and / or modified state.

Two general types of local impacts to birds have been demonstrated at existing renewable energy facilities and powerlines: (1) direct mortality from collisions and (2) indirect impacts from avoidance of an area, habitat disruption, reduced nesting/breeding density, habitat abandonment, loss of refugia, habitat unsuitability, and behavioral effects (Stewart et al. 2004).

The following section deals with the impacts on avifauna and mitigation measures needed for the development of the Vortum Thermal Power Plant and associated infrastructure.

6.1 Direct habitat destruction

6.1.1 Description of impact:

The construction of the Thermal Power Plant, power line and associated infrastructure will result in loss of and damage to natural bird habitats. Habitat destruction and degradation still remains the greatest threat to avifaunal diversity within the Western Cape. While certain species such as the blue crane have adapted to manmade habitats and have increased in numbers others like the southern black korhaan that require natural vegetation have declined both in numbers and in distribution.

During the construction phase and maintenance of this infrastructure, some habitat modification and alteration inevitably takes place. However re-growth of grass and dwarf shrubs under the powerline corridors will take place. The lower vegetation layer underneath the servitudes should preferably not be slashed. Slashing or vegetation clearing will have a direct impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Rehabilitation of some of these areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction of the thermal power plant and power line.

Poor vegetation management under and in close proximity to power lines is one of the main causes of loss of birdlife associated with power lines. Vegetation is often brush cut or mowed unnecessarily resulting in a loss of diversity over time. During construction of the powerlines, substantial amount of vegetation may be impacted on and result in further fragmentation of the

landscape.

6.1.2 Mitigation measures:

- The removal of vegetation should only occur on the footprint area of the development and not over the larger area. The clearing and damage of plant growth in these areas should be restricted to the footprint way leave area.
- There should be minimal (preferably no) brush cutting or removal of vegetation underneath powerline corridors, other than alien invasive species which should definitely not be left on site due to the possibility of the seeds establishing themselves as well additional fire risk.
- Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area.
- Monitoring should be implemented during the construction phase of the Thermal Power Plant and powerlines to ensure that minimal impact is caused to the avifauna of the area. The impact of power line and specific placement of the poles should be restricted to the proposed line and not over the larger area;
- Construction of the power line close to existing power lines should to a certain extent eliminate the need for new access roads and gates etc. This would reduce the level of disturbance and habitat destruction. In addition, birds in the immediate vicinity of the existing power line would already be relatively tolerant of disturbance as a result of maintenance activities on the already established lines;
- Landscape management at the site needs to consider different objectives, including
    - Maintaining pre-existing land uses;
    - Conserving and restoring natural habitats;
    - Managing land for priority species;
    - Hunting of birdlife should be prohibited on site.
    - Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance, discussed with stakeholders, and recorded within the project's Environmental Management Plan.

6.2 Habitat fragmentation

6.2.1 Description of impact:

The development will have a relatively small impact on the natural movement patterns and fragmentation of avifauna habitats. Such impacts would however be temporary on the already degraded thermal power plant development site.

6.2.2 Mitigation measures:

- Use existing facilities (e.g., access roads) to the extent possible to minimize the amount of new disturbance.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to sensitive bird habitats during construction.
- During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.

6.3 Electrocutions

6.3.1 Description of impact:

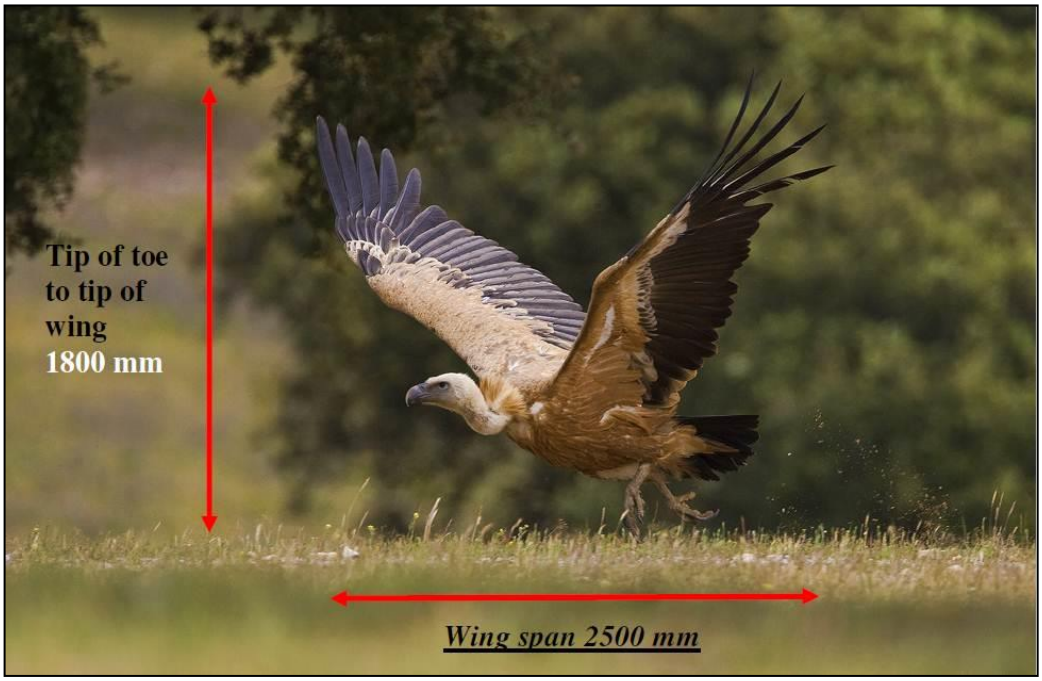
Electrocution of birds on overhead line connections associated with the Thermal Power Plant is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. However, in the context of overhead lines, electrocutions are not a major issue. Electrocution refers to the scenario 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). Due to the large size of the clearances on most overhead lines in the area, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. In fact, transmission lines have proven to be beneficial to many birds, including species such as Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreaux's Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004). Cape Vultures have also taken to roosting on power lines in certain areas in large numbers (van Rooyen 2004a), while Lappet-faced Vultures are known to use power lines as roosts, especially in areas

where large trees are scarce.

Electrocution on the proposed power line is improbable given the adequate clearances and will only apply during the operational phase of the proposed development.

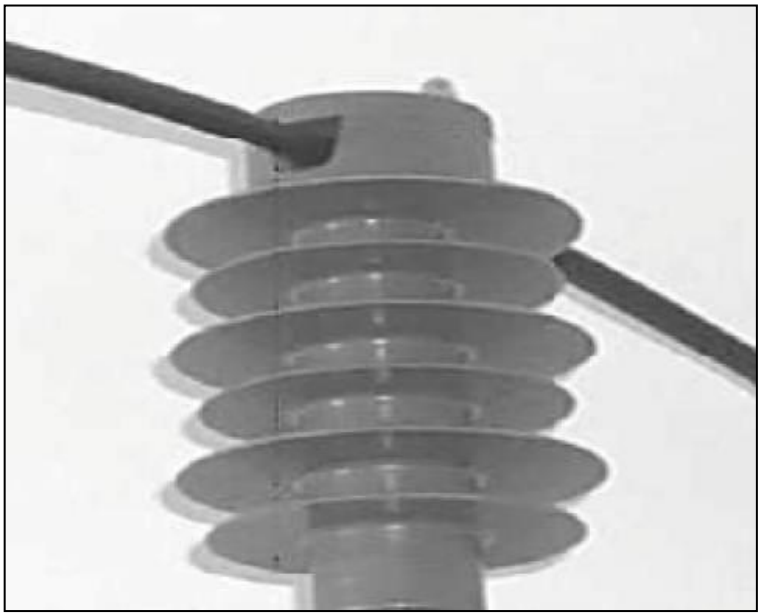
6.3.2 Mitigation measures

- Power line structures can present electrocution hazards to birds when less than adequate separation exist between energized conductors or between energized conductors and grounded conductors. Avian-safe facilities can be provided by one or more of the following mitigation measures as stipulated by Prinsen et al. (2011):
    - Increasing separation between abovementioned conductors to achieve adequate separation for the species involved (larger birds, raptors). To mitigate for bird electrocution, distances between electric conductors (or phases) and distances between conductors and grounded hardware should be separated over a larger distance than the wrist-to-wrist or head-to-foot distance of a bird (Photograph 1). When the power line is located within the distribution area of large raptors or species such as cranes in the study area, this distance should be increased to 1.4 m (or even 1.8 m in the case of vultures, see below). Because dry feathers provide insulation, the distance between fleshy parts, such as skin, feet or bill, is generally the critical factor to determine if a power line construction is safe for perching birds. Note, however, that wet bird feathers provide less insulation, therefore, in wet climates safe distances between energised parts should be based on wingspan and toe-to-wing tip distances of the largest perching protected species in the area.



Photograph 1. A Cape Vulture (*Gyps fulvus*) indicating distances between outstretched wings and head-to-toe distances (Source: Prinsen *et al*. 2011). Although cape vultures do not occur in the study area this is only used as a presentation for future reference

- Insulation: covering energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered. The length of insulated chains should be higher than 0.70 m. Retrofitting (polymer) insulation may be carried out on ground wires, phase conductors (Photograph 2), cross arms (Photograph 3) and jumper wires (Photograph 4), both at tap and dead end locations, especially where bare energised wires connect transformers. By insulating the wires altogether, the insulators will no longer be required, and the wires can be directly attached to the poles.



Photograph 2. Example of an insulated conductor wire (black wire) (source: Podonyi, 2011)

Photograph 3. Cross-arm insulation (source: Horvath et al., 2011)

Photograph 4. A safe strain pole structure, with insulated jumper wires (black arrows) and sufficiently long insulators (broken arrow) (Photo: EWT-WEP)

- Applying perch managing techniques such as conspicuous objects and support roosting sites along the power line that would allow large raptors and bustards to safely roost. An “avian-safe” power pole is a configuration designed to minimise bird electrocution risk by providing sufficient separation between energised phase conductors (also-called ‘phases’) and between phases and grounded hardware to accommodate at least the wrist-to-wrist or head-to-foot distance of a bird. Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be proximate to energised wires. This happens often by exclusion devices, or perch discouragers, but often these cause even more problems than benefits. Because the birds still try to perch on the constructions and the space is even more limited, birds have a higher chance to contact the energised wires. There has been considerable success achieved by providing artificial bird safe perches (Photograph 5) and nesting platforms (Photograph 6), which are placed at a safe distance from the energised parts (Bayle, 1999; Goudie, 2006).

Photograph 5. A Pale Chanting Goshawk (*Melierax canorus*) perched safely on a 'Bird Perch' (Photo: EWT-WEP)

Photograph 6. Nesting Osprey on artificial platform in medium voltage transmission line (Photo; Bureau Waardenburg)

6.4 Collisions with power lines

6.4.1 Description of impact:

Collisions are the biggest single threat posed by transmission lines to 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).

Despite the increase in blue crane numbers, collisions with the numerous powerlines traversing the Province is a concern and while it is been addressed it is done on a reactive basis. Attempts in the past to proactively implement mitigation measures have not been successful as it is difficult to predict where the problem sites are and there is some scepticism about the effectiveness of the mitigation devices. Ludwig's bustard is very susceptible to powerline collisions and it may be the reason for the recent decline in the species population. Studies by the Percy FitzPatrick Institute are being undertaken to look into this issue. Pre-construction monitoring helps predict where possible issues will arise and informs the developer on the actual configuration of the tower layout, while post-construction monitoring alerts one to issues not identified during the pre-construction period.

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. This impact will only apply during the operational phase of the proposed development.

6.4.2 Mitigation measures:

- Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species. Please refer to section on previous results from avifauna studies in the area as reference;
- Mitigation of this risk involves the careful selection of low impact alignments for new power lines relative to bird movements and avoidance of concentrations of high risk

species. Where this cannot be avoided, the use of static or dynamic marking devices to make the lines, (in particular the narrow earth wires at the top of the cable network), more conspicuous are needed. While various marking devices have been used globally, many remain untested in terms of reducing collisions. Those that have been are only partially effective (Drewitt & Langston 2008, Jenkins et al. 2010).

- Land management practices should not attract raptors or other species vulnerable to collision. Structures should be designed to reduce the availability of perching sites.
- Ensure that sites are close to existing power lines, so that few new lines are required;
- The impact of collision of birds is partially mitigated for by placing new infrastructure close to existing lines for the reason that the more overhead power lines and other associated infrastructure there are together, the more visible they would be to the birds in the area (Avian Power Line Interaction Committee - 1994).
- Specialist advice should be sought in devising effective avian deterrents to minimize associated damage.
- The high risk sections of line should be marked with suitable anti-collision marking devices (Photograph 7) on the earth wire as per the Eskom guidelines. Since the assumption is that birds collide with overhead cables because they cannot see them, fitting the cables with devices in order to make them more visible to birds in flight has become the preferred mitigation option worldwide. Besides thickening, coating or colouring the often least visible thin ground wires, a wide range of potential 'line marking' devices has evolved over the years, including: spheres, swinging plates, spiral vibration dampers, strips, swan flight diverters, Firefly Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags, fishing floats, aviation balls and crossed bands. The design and technical aspects of using devices on the power line should consider the following:
    - Line markers should be as large as possible, and increase the visible thickness of the line by at least 20 cm, for a length of at least 10-20cm;
    - Spacing of devices should be not more than 5-10 m apart;
    - Line markers should incorporate as much contrast with relevant backgrounds as possible;
    - Colour is probably less important than contrast;
    - Movement of the device is likely to be important;
    - Markers that protrude vertically both above and below the cable are likely

important;

- Since we suspect that many collisions may occur at night, devices that are nocturnally visible (through illumination, ultraviolet radiation and other means) would be advantageous. Also bear in mind what is known about birds being attracted to illuminated objects.

Photograph 7. High tension (150 kV) power line in the Netherlands with bird flappers (see arrows) placed at regular intervals in both ground wires as bird flight diverters, see also Box 1 (Photo: Bureau Waardenburg)

- Line design: Although different bird species fly at different heights above the ground, there is general consensus that the lower power line cables are to the ground, the better for preventing bird collision (Photograph 8). There is also consensus that less vertical separation of cables is preferred as it poses less of an 'obstacle' for birds to collide with. Horizontal separation of conductors is therefore preferred (Photograph 8).

Photograph 8. A 400 kV line, with all conductor wires in the same horizontal plane (Photo: EWT-WEP)

6.5 Disturbance through human activities, noise and fires

6.5.1 Description of impact:

Construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. An increase in human activity on the site and surrounding areas is anticipated, especially during the construction phase of the power line. Birds will move out of the area during construction activities as a result of noise disturbance. The presence of a large number of construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires which might cause loss of bird diversity when ground-living birds are killed in the fires or their nests destroyed.

6.5.2 Mitigation measures:

- Care should always be taken to disturb the receiving environment as little as possible. Careful control of construction workers movements must be maintained at all times.
- Staff that will stay on site should be accommodated in one location of the site to ensure that the impact will be minimal on the larger area.
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
- Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the

affected residents.

- Educate workers regarding the occurrence of important resources in the area and the importance of protection.
- Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
- Camp fires at construction sites must be strictly controlled to ensure that no veld fires are caused.
- Noise levels will be kept within acceptable limits by:
    - Limiting of speed of haulage vehicles/tippers;
    - Compliance with appropriate noise legislation must take place.

7 IMPACT ASSESSMENT MATRIX

Table 4 indicate the impacts described above and specific ratings of significance the impact will potentially have on the avifauna during the thermal power plant, power line and associated infrastructure development:

Table 4. Impact assessment Matrix

Impacts	Probability	Duration	Scale	Magnitude (WOM)	Magnitude (WM)	Scoring (WOM)	Scoring (WM)
1. Direct habitat destruction	5	5	2	8	2	75 (High)	45 (Moderate)
2. Habitat fragmentation (birds)	4	5	2	8	2	60 (Moderate)	36 (Low)
3. Electrocution	1	5	2	6	2	13 (Negligible)	9 (Negligible)
4. Collisions	4	4	2	8	6	64 (High)	48 (Moderate)
5. Disturbances through human activities, noise and fires	5	3	2	6	2	55 (Moderate)	35 (Low)

8 DISCUSSION

Considering the proposed development of the Vortum Thermal Power Plant and associated infrastructure the following key findings was made from an avifauna impact perspective:

- About 130 hectares of natural bird habitats will be modified through the development of the thermal power plant if one considers the vegetation types associated with the larger area, while more habitat will be modified through the development of powerline and gas pipeline corridors;
- The following bird habitats were identified in the study area during the field surveys that formed part of the avifauna scoping study:
    - Strandveld habitat;
    - Sand Fynbos habitat
    - Agricultural fields / degraded grassland habitat;
- The project area supports varying densities of priority species such as secretary bird, blue cranes, Ludwigs Bustard and lanner falcons. The presence of these birds could cause collisions and increase mortality rate of these species and subsequently no additional power lines should be constructed other than the already established corridors;
- The impact associated with the proposed development include the following:
    - Habitat destruction, fragmentation and human disturbances (Indirect impacts);
    - Electrocutions and collisions (direct impacts);
- The implementation of the mitigation measures should be considered a requirement for the proposed development if approved by authorities;
- Baseline monitoring should be implemented on the avifauna during the pre-construction, construction and operational phase of the Vortum Thermal Power Plant and associated infrastructure (including powerline and gas / fuel pipeline corridors. This is one of the main recommended conditions of approval for renewable energy facilities to monitor and reduce potential impacts on avifauna by Birdlife South Africa and Endangered Wildlife Trust;

9 CONCLUSION

The proposed development of the Vortum Thermal Power Plant and associated infrastructure would have some impact on the avian habitats of the area, and strict mitigation should be implemented to limit the impacts where possible. Considering the layout and design of the proposed development as well as the impact assessment; the extent of the habitat that will be affected could be reduced by mitigation and design principles. However, even if all the mitigation measures and recommendations in this report are adhered to, it is likely that the proposed development could have a long-term impact on the local avifauna, and therefore strict monitoring should be implemented during the pre- and post-construction phases to prevent any significant losses of species of conservation concern.

10 REFERENCES

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa: Johannesburg.

Bredenkamp, G.J. & Brown, L.R. 2001. Vegetation – A reliable ecological basis for environmental planning. Urban Greenfile Nov-Dec 2001: 38-39.

Enpat, 2000.Environmental Potential Atlas.Department of Environmental Affairs and Tourism, Pretoria.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V., and Brown, C.J. (1997).The Atlas of Southern African Birds.Vol 1 & 2. BirdLife South Africa, Johannesburg.

Hobbs, J.C.A. & Ledger J.A. 1986b. "Power lines, Birdlife and the Golden Mean." Fauna and Flora, 44, pp 23-27.

Ledger, J. 1983. Guidelines for Dealing with Bird Problems of Transmission Lines and Towers. Escom Test and Research Division Technical Note TRR/N83/005.

Ledger, J.A. & Annegarn H.J. 1981. "Electrocution Hazards to the Cape Vulture (Gyps coprotheres) in South Africa". Biological Conservation, 20, pp15-24.

Mucina L., Rutherford M.C. & Powrie L.W. (eds) (2005). Vegetation Map of South Africa, Lesotho and Swaziland, 1:1000000 scale sheet maps.

Van Rooyen, C.S. 1999. An overview of the Eskom - EWT Strategic Partnership in

South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

Van Rooyen, C.S. 2000. "An overview of Vulture Electrocutions in South Africa." Vulture News, 43, pp 5-22. Vulture Study Group: Johannesburg, South Africa.

Van Rooyen, C.S. 2003. Mitigation programme for Avian Collisions with Eskom Transmission Lines. Unpublished Progress Report, September 2003. Endangered Wildlife Trust, Johannesburg, South Africa.

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

Van Rooyen, C.S. & Taylor, P.V. 1999. Bird Streamers as probable cause of electrocutions in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina)

WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa. UNESCO, Paris, France.

11 APPENDIX A: BIRD SPECIES LIST FOR COMBINED QDS (SABAP2, BIRDLIFE SA)

Common_name	Taxon_name
Apalis, Bar-throated	*Apalis thoracica*
Avocet, Pied	*Recurvirostra avosetta*
Barbet, Acacia Pied	*Tricholaema leucomelas*
Batis, Cape	*Batis capensis*
Bee-eater, European	*Merops apiaster*
Bishop, Southern Red	*Euplectes orix*
Bishop, Yellow	*Euplectes capensis*
Bittern, Little	*Ixobrychus minutus*
Bokmakierie, Bokmakierie	*Telophorus zeylonus*
Boubou, Southern	*Laniarius ferrugineus*
Bulbul, Cape	*Pycnonotus capensis*
Bunting, Cape	*Emberiza capensis*
Bunting, Lark-like	*Emberiza impetuani*
Bustard, Ludwig's	*Neotis ludwigii*
Buzzard, Jackal	*Buteo rufofuscus*
Buzzard, Steppe	*Buteo vulpinus*
Canary, Black-headed	*Serinus alario*
Canary, Brimstone	*Crithagra sulphuratus*
Canary, Cape	*Serinus canicollis*
Canary, White-throated	*Crithagra albogularis*
Canary, Yellow	*Crithagra flaviventris*
Chat, Anteating	*Myrmecocichla formicivora*
Chat, Familiar	*Cercomela familiaris*
Chat, Karoo	*Cercomela schlegelii*
Chat, Sickle-winged	*Cercomela sinuata*
Cisticola, Cloud	*Cisticola textrix*
Cisticola, Grey-backed	*Cisticola subruficapilla*
Cisticola, Levaillant's	*Cisticola tinniens*
Cisticola, Zitting	*Cisticola juncidis*
Coot, Red-knobbed	*Fulica cristata*
Cormorant, Bank	*Phalacrocorax neglectus*
Cormorant, Cape	*Phalacrocorax capensis*
Cormorant, Crowned	*Phalacrocorax coronatus*
Cormorant, Reed	*Phalacrocorax africanus*
Cormorant, White-breasted	*Phalacrocorax carbo*
Coucal, Burchell's	*Centropus burchellii*
Crake, Black	*Amaurornis flavirostris*
Crane, Blue	*Anthropoides paradiseus*
Crombec, Long-billed	*Sylvietta rufescens*
Crow, Cape	*Corvus capensis*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Crow, Pied	*Corvus albus*
Cuckoo, Diderick	*Chrysococcyx caprius*
Cuckoo, Klaas's	*Chrysococcyx klaas*
Curlew, Eurasian	*Numenius arquata*
Darter, African	*Anhinga rufa*
Dove, Laughing	*Streptopelia senegalensis*
Dove, Namaqua	*Oena capensis*
Dove, Red-eyed	*Streptopelia semitorquata*
Dove, Rock	*Columba livia*
Drongo, Fork-tailed	*Dicrurus adsimilis*
Duck, African Black	*Anas sparsa*
Duck, Domestic	*Anas platyrhynchos*
Duck, Maccoa	*Oxyura maccoa*
Duck, Mallard	*Anas platyrhynchos*
Duck, White-backed	*Thalassornis leuconotus*
Duck, Yellow-billed	*Anas undulata*
Eagle, Booted	*Aquila pennatus*
Eagle, Martial	*Polemaetus bellicosus*
Eagle, Verreaux's	*Aquila verreauxii*
Eagle-owl, Cape	*Bubo capensis*
Eagle-owl, Spotted	*Bubo africanus*
Egret, Cattle	*Bubulcus ibis*
Egret, Great	*Egretta alba*
Egret, Little	*Egretta garzetta*
Egret, Yellow-billed	*Egretta intermedia*
Falcon, Lanner	*Falco biarmicus*
Falcon, Peregrine	*Falco peregrinus*
Fiscal, Common (Southern)	*Lanius collaris*
Fish-eagle, African	*Haliaeetus vocifer*
Flamingo, Greater	*Phoenicopterus ruber*
Flamingo, Lesser	*Phoenicopterus minor*
Flufftail, Red-chested	*Sarothrura rufa*
Flycatcher, African Dusky	*Muscicapa adusta*
Flycatcher, Fairy	*Stenostira scita*
Flycatcher, Fiscal	*Sigelus silens*
Flycatcher, Spotted	*Muscicapa striata*
Francolin, Grey-winged	*Scleroptila africanus*
Gannet, Cape	*Morus capensis*
Godwit, Bar-tailed	*Limosa lapponica*
Godwit, Hudsonian	*Limosa haemastica*
Goose, Domestic	*Anser anser*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Goose, Egyptian	*Alopochen aegyptiacus*
Goose, Spur-winged	*Plectropterus gambensis*
Goshawk, African	*Accipiter tachiro*
Goshawk, Southern Pale Chanting	*Melierax canorus*
Grassbird, Cape	*Sphenoeacus afer*
Grebe, Black-necked	*Podiceps nigricollis*
Grebe, Great Crested	*Podiceps cristatus*
Grebe, Little	*Tachybaptus ruficollis*
Greenshank, Common	*Tringa nebularia*
Guineafowl, Helmeted	*Numida meleagris*
Gull, Common Black-headed	*Larus ridibundus*
Gull, Grey-headed	*Larus cirrocephalus*
Gull, Hartlaub's	*Larus hartlaubii*
Gull, Kelp	*Larus dominicanus*
Hamerkop, Hamerkop	*Scopus umbretta*
Harrier, Black	*Circus maurus*
Harrier, Montagu's	*Circus pygargus*
Harrier-Hawk, African	*Polyboroides typus*
Heron, Black-headed	*Ardea melanocephala*
Heron, Goliath	*Ardea goliath*
Heron, Grey	*Ardea cinerea*
Heron, Purple	*Ardea purpurea*
Honeyguide, Greater	*Indicator indicator*
Honeyguide, Lesser	*Indicator minor*
Hoopoe, African	*Upupa africana*
House-martin, Common	*Delichon urbicum*
Ibis, African Sacred	*Threskiornis aethiopicus*
Ibis, Glossy	*Plegadis falcinellus*
Ibis, Hadeda	*Bostrychia hagedash*
Ibis, Hadeda	*Bostrychia hagedash*
Jaeger, Parasitic	*Stercorarius parasiticus*
Kestrel, Greater	*Falco rupicoloides*
Kestrel, Lesser	*Falco naumanni*
Kestrel, Rock	*Falco rupicolus*
Kingfisher, Giant	*Megaceryle maximus*
Kingfisher, Malachite	*Alcedo cristata*
Kingfisher, Pied	*Ceryle rudis*
Kite, Black & Yellow-billed	*Milvus migrans*
Kite, Black-shouldered	*Elanus caeruleus*
Kite, Yellow-billed	*Milvus aegyptius*
Knot, Red	*Calidris canutus*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Korhaan, Southern Black	*Afrotis afra*
Lapwing, Blacksmith	*Vanellus armatus*
Lapwing, Crowned	*Vanellus coronatus*
Lark, Cape Clapper	*Mirafra apiata*
Lark, Cape Long-billed	*Certhilauda curvirostris*
Lark, Karoo	*Calendulauda albescens*
Lark, Karoo Long-billed	*Certhilauda subcoronata*
Lark, Large-billed	*Galerida magnirostris*
Lark, Red-capped	*Calandrella cinerea*
Longclaw, Cape	*Macronyx capensis*
Lovebird, Rosy-faced	*Agapornis roseicollis*
Marsh-harrier, African	*Circus ranivorus*
Martin, Banded	*Riparia cincta*
Martin, Brown-throated	*Riparia paludicola*
Martin, Rock	*Hirundo fuligula*
Martin, Sand	*Riparia riparia*
Masked-weaver, Southern	*Ploceus velatus*
Moorhen, Common	*Gallinula chloropus*
Mousebird, Red-faced	*Urocolius indicus*
Mousebird, Speckled	*Colius striatus*
Mousebird, White-backed	*Colius colius*
Neddicky, Neddicky	*Cisticola fulvicapilla*
Night-Heron, Black-crowned	*Nycticorax nycticorax*
Nightjar, Fiery-necked	*Caprimulgus pectoralis*
Olive-pigeon, African	*Columba arquatrix*
Openbill, African	*Anastomus lamelligerus*
Osprey, Osprey	*Pandion haliaetus*
Ostrich, Common	*Struthio camelus*
Owl, Barn	*Tyto alba*
Owl, Marsh	*Asio capensis*
Oystercatcher, African Black	*Haematopus moquini*
Oystercatcher, Eurasian	*Haematopus ostralegus*
Paradise-flycatcher, African	*Terpsiphone viridis*
Pelican, Great White	*Pelecanus onocrotalus*
Penduline-tit, Cape	*Anthoscopus minutus*
Penguin, African	*Spheniscus demersus*
Petrel, White-chinned	*Procellaria aequinoctialis*
Phalarope, Red-necked	*Phalaropus lobatus*
Pigeon, Speckled	*Columba guinea*
Pipit, African	*Anthus cinnamomeus*
Pipit, Long-billed	*Anthus similis*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Pipit, Plain-backed	*Anthus leucophrys*
Plover, Caspian	*Charadrius asiaticus*
Plover, Chestnut-banded	*Charadrius pallidus*
Plover, Common Ringed	*Charadrius hiaticula*
Plover, Grey	*Pluvialis squatarola*
Plover, Kittlitz's	*Charadrius pecuarius*
Plover, Lesser Sand	*Charadrius mongolus*
Plover, Pacific Golden	*Pluvialis fulva*
Plover, Three-banded	*Charadrius tricollaris*
Plover, White-fronted	*Charadrius marginatus*
Pochard, Southern	*Netta erythrophthalma*
Prinia, Karoo	*Prinia maculosa*
Quail, Common	*Coturnix coturnix*
Quelea, Red-billed	*Quelea quelea*
Rail, African	*Rallus caerulescens*
Raven, White-necked	*Corvus albicollis*
Redshank, Common	*Tringa totanus*
Reed-warbler, African	*Acrocephalus baeticatus*
Robin-chat, Cape	*Cossypha caffra*
Rock-thrush, Cape	*Monticola rupestris*
Ruff, Ruff	*Philomachus pugnax*
Rush-warbler, Little	*Bradypterus baboecala*
Sanderling, Sanderling	*Calidris alba*
Sandgrouse, Namaqua	*Pterocles namaqua*
Sandpiper, Broad-billed	*Limicola falcinellus*
Sandpiper, Common	*Actitis hypoleucos*
Sandpiper, Curlew	*Calidris ferruginea*
Sandpiper, Marsh	*Tringa stagnatilis*
Sandpiper, Terek	*Xenus cinereus*
Sandpiper, Wood	*Tringa glareola*
Saw-wing, Black (Southern race)	*Psalidoprocne holomelaena*
Scrub-robin, Karoo	*Cercotrichas coryphoeus*
Secretarybird, Secretarybird	*Sagittarius serpentarius*
Seedeater, Streaky-headed	*Crithagra gularis*
Shelduck, South African	*Tadorna cana*
Shoveler, Cape	*Anas smithii*
Shrike, Red-backed	*Lanius collurio*
Siskin, Cape	*Crithagra totta*
Snipe, African	*Gallinago nigripennis*
Sparrow, Cape	*Passer melanurus*
Sparrow, House	*Passer domesticus*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Sparrow, Southern Grey-headed	*Passer diffusus*
Sparrowhawk, Black	*Accipiter melanoleucus*
Sparrowlark, Grey-backed	*Eremopterix verticalis*
Spoonbill, African	*Platalea alba*
Spurfowl, Cape	*Pternistis capensis*
Starling, Common	*Sturnus vulgaris*
Starling, Pied	*Spreo bicolor*
Starling, Red-winged	*Onychognathus morio*
Starling, Wattled	*Creatophora cinerea*
Stilt, Black-winged	*Himantopus himantopus*
Stint, Little	*Calidris minuta*
Stonechat, African	*Saxicola torquatus*
Stork, Black	*Ciconia nigra*
Stork, White	*Ciconia ciconia*
Sugarbird, Cape	*Promerops cafer*
Sunbird, Dusky	*Cinnyris fuscus*
Sunbird, Malachite	*Nectarinia famosa*
Sunbird, Orange-breasted	*Anthobaphes violacea*
Sunbird, Southern Double-collared	*Cinnyris chalybeus*
Swallow, Barn	*Hirundo rustica*
Swallow, Greater Striped	*Hirundo cucullata*
Swallow, Pearl-breasted	*Hirundo dimidiata*
Swallow, White-throated	*Hirundo albigularis*
Swamphen, African Purple	*Porphyrio madagascariensis*
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*
Swift, African Black	*Apus barbatus*
Swift, Alpine	*Tachymarptis melba*
Swift, Common	*Apus apus*
Swift, Horus	*Apus horus*
Swift, Little	*Apus affinis*
Swift, White-rumped	*Apus caffer*
Teal, Cape	*Anas capensis*
Teal, Red-billed	*Anas erythrorhyncha*
Tern, Antarctic	*Sterna vittata*
Tern, Arctic	*Sterna paradisaea*
Tern, Black	*Chlidonias niger*
Tern, Caspian	*Sterna caspia*
Tern, Common	*Sterna hirundo*
Tern, Little	*Sterna albifrons*
Tern, Sandwich	*Sterna sandvicensis*
Tern, Swift	*Sterna bergii*

Vortum Thermal Power Plant Avifauna Study

Common_name	Taxon_name
Tern, Whiskered	*Chlidonias hybrida*
Tern, White-winged	*Chlidonias leucopterus*
Thick-knee, Spotted	*Burhinus capensis*
Thick-knee, Water	*Burhinus vermiculatus*
Thrush, Karoo	*Turdus smithi*
Thrush, Olive	*Turdus olivaceus*
Tit, Grey	*Parus afer*
Tit, Southern Black	*Parus niger*
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*
Tit-babbler, Layard's	*Parisoma layardi*
Turnstone, Ruddy	*Arenaria interpres*
Turtle-dove, Cape	*Streptopelia capicola*
Wagtail, Cape	*Motacilla capensis*
Warbler, Namaqua	*Phragmacia substriata*
Warbler, Rufous-eared	*Malcorus pectoralis*
Waxbill, Common	*Estrilda astrild*
Weaver, Cape	*Ploceus capensis*
Wheatear, Capped	*Oenanthe pileata*
Wheatear, Mountain	*Oenanthe monticola*
Whimbrel, Common	*Numenius phaeopus*
White-eye, Cape	*Zosterops virens*
Whydah, Pin-tailed	*Vidua macroura*
Woodpecker, Cardinal	*Dendropicos fuscescens*

12 APPENDIX B: THREATENED BIRD SPECIES LIST FOR SOUTH AFRICA (SABAP2, BIRDLIFE SA)

Red Data (RD); Regional*, Global

CR = Critically Endangered

EN = Endangered

VU = Vulnerable

NT = Near Threatened

LC = Least Concern

EX = Extinct (regionally)

DD= Data Deficient

NR= Not Recognised by BirdLife International

NA = Not Assessed

§ = Refer to footnote

* = Endemic

(*) = Near Endemic

SLS = Endemic to South Africa, Lesotho and Swaziland

BSLS = Breeding South Africa, Lesotho and Swaziland endemic

**The 2014 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*

Alphabetical Name	Scientific Name	RD (Regional, Global)	Status	Endemism
Albatross, Amsterdam	*Diomedea amsterdamensis*	NA, CR	V	
Albatross, Atlantic Yellow-nosed	*Thalassarche chlororhynchos*	EN, EN		
Albatross, Black-browed	*Thalassarche melanophrys*	EN, EN		
Albatross, Buller's	*Thalassarche bulleri*	NA, NT	V	
Albatross, Chatham	*Thalassarche eremita*	NA, VU	V	
Albatross, Grey-headed	*Thalassarche chrysostoma*	EN, EN	V	
Albatross, Indian Yellow-nosed	*Thalassarche carteri*	EN, EN		
Albatross, Laysan	*Phoebastria immutabilis*	NA, NT	V	
Albatross, Light-mantled	*Phoebetria palpebrata*	NT , NT	V	
Albatross, Northern Royal	*Diomedea sanfordi*	EN, EN		
Albatross, Salvin's	*Thalassarche salvini*	NA, VU	V	
Albatross, Shy	*Thalassarche cauta*	NT, NT		
Albatross, Sooty	*Phoebetria fusca*	EN , EN	V	
Albatross, Southern Royal	*Diomedea epomophora*	VU, VU		
Albatross, Tristan	*Diomedea dabbenena*	CR, CR		
Albatross, Wandering	*Diomedea exulans*	VU, VU		
Barbet, Green	*Stactolaema olivacea*	EN, LC		
Bateleur	*Terathopius ecaudatus*	EN, NT		
Blackcap, Bush	*Lioptilus nigricapillus*	VU, NT		SLS
Broadbill, African	*Smithornis capensis*	VU, LC		
Bustard, Black-bellied	*Lissotis melanogaster*	NT, LC		
Bustard, Denham's	*Neotis denhami*	VU, NT		
Bustard, Kori	*Ardeotis kori*	NT, NT		
Bustard, Ludwig's	*Neotis ludwigii*	EN, EN		
Buttonquail, Black-rumped	*Turnix nanus*	VU, LC		
Buttonquail, Hottentot	*Turnix hottentottus*	EN, LC		*
Canary, Lemon-breasted	*Crithagra citrinipectus*	NT , LC		

Vortum Thermal Power Plant Avifauna Study

Cormorant, Bank	*Phalacrocorax neglectus*	EN, EN		
Cormorant, Cape	*Phalacrocorax capensis*	EN, EN		
Cormorant, Crowned	*Phalacrocorax coronatus*	NT, NT		
Courser, Burchell's	*Cursorius rufus*	VU, LC		
Courser, Double-banded	*Rhinoptilus africanus*	NT, LC		
Crane, Blue	*Anthropoides paradiseus*	NT, VU		
Crane, Grey Crowned	*Balearica regulorum*	EN, EN		
Crane, Wattled	*Bugeranus carunculatus*	CR, VU		
Curlew, Eurasian	*Numenius arquata*	NT, NT		
Dowitcher, Asiatic	*Limnodromus semipalmatus*	NA, NT	V	
Duck, Maccoa	*Oxyura maccoa*	NT, NT		
Eagle, Crowned	*Stephanoaetus coronatus*	VU, NT		
Eagle, Martial	*Polemaetus bellicosus*	EN, VU		
Eagle, Southern Banded Snake	*Circaetus fasciolatus*	CR, NT		
Eagle, Tawny	*Aquila rapax*	EN, LC		
Eagle, Verreauxs'	*Aquila verreauxii*	VU, LC		
Egret, Slaty	*Egretta vinaceigula*	NA, VU	V	
Falcon, Lanner	*Falco biarmicus*	VU, LC		
Falcon, Red-footed	*Falco vespertinus*	NT, NT		
Falcon, Sooty	*Falco concolor*	NA, NT	V	
Falcon, Taita	*Falco fasciinucha*	CR, NT		
Finfoot, African	*Podica senegalensis*	VU, LC		
Flamingo, Greater	*Phoenicopterus roseus*	NT, LC		
Flamingo, Lesser	*Phoeniconaias minor*	NT, NT		
Flufftail, Striped	*Sarothrura affinis*	VU, LC		
Flufftail, White-winged	*Sarothrura ayresi*	CR, CR		
Gannet, Cape	*Morus capensis*	VU, VU		
Godwit, Black-tailed	*Limosa limosa*	NA, NT	V	
Goose, African Pygmy	*Nettapus auritus*	VU, LC		
Harrier, African Marsh	*Circus ranivorus*	EN, LC		
Harrier, Black	*Circus maurus*	EN, VU		(*)
Harrier, Pallid	*Circus macrourus*	NT, NT		
Hawk, Bat	*Macheiramphus alcinus*	EN, LC		
Heron, White-backed Night	*Gorsachius leuconotus*	VU, LC		
Hornbill, Southern Ground-	*Bucorvus leadbeateri*	EN, VU		
Ibis, Southern Bald	*Geronticus calvus*	VU, VU		SLS
Jacana, Lesser	*Microparra capensis*	NT, LC		
Kingfisher, Half-collared	*Alcedo semitorquata*	NT, LC		
Kingfisher, Mangrove	*Halcyon senegaloides*	EN, LC		
Korhaan, Blue	*Eupodotis caerulescens*	LC, NT		SLS
Korhaan, Karoo	*Eupodotis vigorsii*	NT, LC		
Korhaan, Southern Black	*Afrotis afra*	VU, VU		*

Korhaan, White-bellied	*Eupodotis senegalensis*	VU, LC		
Lark, Agulhas Long-billed	*Certhilauda brevirostris*	NT, NR		*
Lark, Barlow's	*Calendulauda barlowi*	NT, LC		
Lark, Botha's	*Spizocorys fringillaris*	EN, EN		*
Lark, Melodious	*Mirafra cheniana*	LC, NT		(*)
Lark, Red	*Calendulauda burra*	VU, VU		*
Lark, Rudd's	*Heteromirafra ruddi*	EN, VU		*
Lark, Sclater's	*Spizocorys sclateri*	NT, NT		(*)
Lark, Short-clawed	*Certhilauda chuana*	NT, LC		
Longclaw, Rosy-throated	*Macronyx ameliae*	NT, LC		
Nightjar, Swamp	*Caprimulgus natalensis*	VU, LC		
Owl, African Grass	*Tyto capensis*	VU, LC		
Owl, Pel's Fishing	*Scotopelia peli*	EN, LC		
Oystercatcher, African Black	*Haematopus moquini*	LC, NT		
Painted-snipe, Greater	*Rostratula benghalensis*	VU, LC		
Parrot, Cape	*Poicephalus robustus*	EN, NR		*
Pelican, Great White	*Pelecanus onocrotalus*	VU, LC		
Pelican, Pink-backed	*Pelecanus rufescens*	VU, LC		
Penguin, African	*Spheniscus demersus*	EN, EN		
Penguin, King	*Aptenodytes patagonicus*	NT, LC	V	
Penguin, Macaroni	*Eudyptes chrysolophus*	VU, VU	V	
Penguin, Northern Rockhopper	*Eudyptes moseleyi*	NA, EN	V	
Penguin, Southern Rockhopper	*Eudyptes chrysocome*	EN, VU	V	
Petrel, Atlantic	*Pterodroma incerta*	NA, EN	V	
Petrel, Barau's	*Pterodroma baraui*	NA, EN	V	
Petrel, Black-bellied Storm	*Fregetta tropica*	NT, LC	V	
Petrel, Blue	*Halobaena caerulea*	NT, LC	V	
Petrel, Great-winged	*Pterodroma macroptera*	NT, LC		
Petrel, Grey	*Procellaria cinerea*	VU, NT	V	
Petrel, Grey-backed Storm	*Garrodia nereis*	NT, LC	V	
Petrel, Kerguelen	*Lugensa brevirostris*	NT, LC	V	
Petrel, Leach's Storm	*Oceanodroma leucorhoa*	CR, LC		
Petrel, Matsudaira's Storm	*Oceanodroma matsudairae*	NA, DD	V	
Petrel, Northern Giant	*Macronectes halli*	NT, LC		
Petrel, Soft-plumaged	*Pterodroma mollis*	NT, LC		
Petrel, Southern Giant	*Macronectes giganteus*	NT, LC		
Petrel, Spectacled	*Procellaria conspicillata*	VU, VU		
Petrel, White-chinned	*Procellaria aequinoctialis*	VU, VU		
Pigeon, Eastern Bronze-naped	*Columba delegorguei*	EN, LC		
Pipit, African Rock	*Anthus crenatus*	NT, LC		SLS
Pipit, Mountain	*Anthus hoeschi*	NT, LC		SLS
Pipit, Short-tailed	*Anthus brachyurus*	VU, LC		

Pipit, Yellow-breasted	*Anthus chloris*	VU, VU		*
Plover, Chestnut-banded	*Charadrius pallidus*	NT, NT		
Pratincole, Black-winged	*Glareola nordmanni*	NT, NT		
Prion, Fairy	*Pachyptila turtur*	NT, LC	V	
Prion, Salvin's	*Pachyptila salvini*	NT, LC	V	
Rockjumper, Cape	*Chaetops frenatus*	NT, LC		*
Roller, European	*Coracias garrulus*	NT, NT		
Sandgrouse, Yellow-throated	*Pterocles gutturalis*	NT, LC		
Sandpiper, Buff-breasted	*Tryngites subruficollis*	NA, NT	V	
Secretarybird	*Sagittarius serpentarius*	VU, VU		
Shearwater, Sooty	*Puffinus griseus*	NT, NT		
Skimmer, African	*Rynchops flavirostris*	NA, NT	V	
Skua, Subantarctic	*Stercorarius antarctica*	EN, LC		
Snipe, Great	*Gallinago media*	NA, NT	V	
Stork, Abdim's	*Ciconia abdimii*	NT, LC		
Stork, Black	*Ciconia nigra*	VU, LC		
Stork, Marabou	*Leptoptilos crumeniferus*	NT, LC		
Stork, Saddle-billed	*Ephippiorhynchus senegalensis*	EN, LC		
Stork, Yellow-billed	*Mycteria ibis*	EN, LC		
Sunbird, Neergaard's	*Cinnyris neergaardi*	VU, NT		
Swallow, Blue	*Hirundo atrocaerulea*	CR, VU		
Tern, Antarctic	*Sterna vittata*	EN, LC		
Tern, Caspian	*Sterna caspia*	VU, LC		
Tern, Damara	*Sterna balaenarum*	CR, NT		
Tern, Roseate	*Sterna dougallii*	EN, LC		
Thrush, Orange Ground	*Zoothera gurneyi*	NT, LC		
Thrush, Spotted Ground	*Zoothera guttata*	EN, EN		
Vulture, Bearded	*Gypaetus barbatus*	CR, LC		
Vulture, Cape	*Gyps coprotheres*	EN, VU		
Vulture, Egyptian	*Neophron percnopterus*	NA, EN	V	
Vulture, Hooded	*Necrosyrtes monachus*	EN, EN		
Vulture, Lappet-faced	*Torgos tracheliotos*	EN, VU		
Vulture, Rüppell's	*Gyps rueppelli*	NA, EN	V	
Vulture, White-backed	*Gyps africanus*	EN, EN		
Vulture, White-headed	*Aegypius occipitalis*	EN, VU		
Warbler, Knysna	*Bradypterus sylvaticus*	VU, VU		*
Woodpecker, Knysna	*Campethera notata*	NT, NT		*

13 PHOTOGRAPHIC GUIDE

Photograph 9. Strandveld habitat

Photograph 10.Old fields / degraded grassland Habitat

Photograph 11. Fynbos habitat in the project area

Photograph 12. Exotic bush clumps