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AN ECOLOGICAL IMPACT ASSESSMENT 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

EOH

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

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ECOLOGICAL REPORT

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

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

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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

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1. ASSIGNMENT

Exigo Sustainability was appointed by AGES Limpopo on behalf of VORTUM ENERGY (PTY) LTD to conduct an EIA phase study on the ecological components (fauna and flora) 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.

This report will include detailed impact assessment of the proposed development on the biodiversity of the site. This assessment is essential as it will contribute to meeting the requirements of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998).

The assignment is interpreted as follows: Compile an ecological study on the flora (vegetation units), fauna and general ecology of the site and determine the potential impacts of the proposed development on the fauna and flora of the area as well as proposed mitigation measures. The study will be done according to guidelines and criteria set by the Western Cape Western Cape Department of Environmental Affairs and Development Planning and Cape Nature for biodiversity studies. The study will include an impact assessment and mitigation measures to limit potential negative impacts to a minimum. In order to compile this, the following had to be done:

1.1 INFORMATION SOURCES

The following information sources were obtained:

1. All relevant topographical maps, aerial photographs and information (previous studies and environmental databases) related to the ecological components in the study area;
2. Requirements regarding the fauna and flora survey as requested by Cape Nature;
3. Legislation pertaining to the fauna and flora study as relevant;
4. Red data species list from the South African National Biodiversity Institute (SANBI).
5. Information on plant and animal species recorded for the various Quarter Degree Squares intersected by the power line corridors was extracted from the SABIF/SIBIS database hosted by SANBI and the faunal databases hosted by the Animal Demography Unit (ADU). This includes is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the

fact that the site itself has not been well sampled in the past.

6. Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
7. Critical Biodiveristy Areas were obtained from the various coverages produced by the Cape Fine Scale Planning Project (Pence 2007).

1.2 REGULATIONS GOVERNING THIS REPORT

1.2.1 National Environmental Management Act Regulation 982 Section 33

This report has been prepared in terms of Regulation 33 of the National Environmental Management Act (No. 107 of 1998) Regulations GN 33306 GNR 982 for environmental impact assessment. Regulation 33 states that a specialist report must contain:

1. An applicant 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;
        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 the 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; and
j. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

1.2.2 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act regulates the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

1.2.3 National Environmental Management Biodiversity Act (NEMBA: Act 10 0f 2004)

The following aspects of the NEMBA (2004) are important to consider in the compilation of an ecological report. It:

- Lists ecosystems that are threatened or in need of national protection;
- Links to Integrated Environmental Management processes;
- Must be taken into account in EMP and IDPs;
- The Minister may make regulations to reduce the threats to listed ecosystems.

1.2.4 The National Forest Act (Act 84 of 1998)

The National Forest Act:

- Promotes the sustainable management and development of forests for the benefit of all;
- Creates the conditions necessary to restructure forestry in State Forests;
- Provide special measures for the protection of certain forests and protected trees;
- Promotes the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.
- Promotes community forestry.

1.2.5 Western Cape Nature Conservation Laws Amendment act, 2000

The Western Cape Nature Conservation Laws Amendment act, 2000 deals with the following:

- To provide for the sustainable utilisation and protection of biodiversity within the provinces;
- To provide for professional hunting;
- To provide for the preservation of caves and cave formations;
- To provide for the establishment of zoos and similar institutions;
- To provide for the appointment of nature conservators;
- To provide for the issuing of permits and other authorisations;
- To provide for offences and penalties for contravention of the Act;

To implement the provisions of the Act; and to provide for matters connected therewith.

1.3 TERMS OF REFERENCE

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.

1.3.1 Objectives

1. The primary aim of this project is to investigate options for enhancing and / or maintaining biodiversity to mitigate the impact of the proposed development and related infrastructure with the overall objective of preventing further loss of biodiversity. The end product would be a tool for promoting and lobbying for the recognition of the importance of species habitat and habitat conservation. Options available to maintain the current level of floral diversity include:
    a. Protection of native vegetation restored elsewhere in return for unavoidable clearing;

b. Minimisation of habitat fragmentation;

c. Minimisation of any threats to the native flora and fauna and their habitats during the construction and operational phases of the developments and;

d. Rehabilitation to establish plant communities / landscaping that will provide future habitat values.

2. To produce a clear and agreed species and habitat priorities for conservation actions. This includes the following:

   i. Determine the potential ecological impacts and actions the developments will have on the biodiversity on a species and habitat level;

   ii. Conduct a risk analyses of the impacts identified to determine the significance of the impacts on the fauna and flora of the study area;

   iii. Protection and enhancement of vegetation / habitats of high conservation value;

   iv. The retention of a substantial amount of native vegetation / habitat of adequate size and configuration to promote the conservation of the existing flora communities;

   v. The retention and / or creation of vegetation links, wildlife corridors and vegetation buffers wherever possible, subject to the appropriate bush fire risk management; and

   vi. The protection of water quality in the locality so as not to threaten native aquatic flora that rely on the watercourse for survival.

3. Provide recommendations on the ecological mitigation measures to be implemented by the developer and the way forward.

1.3.2 Scope

1. Detailed flora survey – in each vegetation type/plant community on site:
   a. After studying the aerial photograph identify specific areas to be surveyed and confirm location by making use of a Geographical Positioning System (GPS).

   b. Conduct a site visit and list the plant species (trees, shrubs, grasses, succulents and other herbaceous species of special interest) present for plant community and ecosystem delimitation.

   c. Identify potential red data plant species, possible encroacher species, medicinal plants of value and exotic plant species.

d. Indicate suitable plant species that can be used for the landscaping around the proposed developments.

2. Plant community delimitation and description
    a. Process data (vegetation and habitat classification) to determine vegetation types on an ecological basis.
    b. Describe the habitat and vegetation.

3. Fauna scoping
    a. List the potential fauna (mammal species, red data birds, reptiles, amphibians, invertebrates) present linked to the specific potential habitats that occur as identified in the vegetation survey.
    b. Analyse the data and identify potential red data fauna species, as well as other endemic or protected species of importance.
    c. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the fauna of the area.

4. General
    a. Identify and describe ecologically sensitive areas. Create a sensitivity map to indicate specific sensitive areas based on various environmental parameters such as natural vegetation in a good condition, rockiness, slopes, flood lines etc.
    b. Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, degraded areas, reclamation areas.
    c. Make recommendations, impact ratings and risk assessments for each specific impact.

1.3.3 Limitations and assumptions

- In order to obtain a comprehensive understanding of the dynamics of the flora of the study area, surveys should ideally be replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible and this floral study was conducted over two seasons;
- 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, homogenous sections of vegetation units, as well as general observations, aerial photograph analysis, generic data and a desktop analysis;

- The surveys were focused on the proposed footprint areas as well as areas in close proximity to the access point in the south. The northern vegetation units were broadly identified through a drive through survey.
- Visibility proved to be a constraint in encroached areas where plant species might have been missed beneath the densely overgrown and obstructed by surface vegetation;
- The vegetation was in a moderate to poor condition and some species might have been missed as a result of the below average rainfall recived during the season. A botanical specialist familiar with the area must conduct a detailed walk down of all the powerline servitudes prior to construction during late winter/early spring.

Thus, even though it might be assumed that survey findings are representative of the ecosystem of the project area, it should be stated that the possibility exists that individual plants species might have been missed due to the nature of the terrain (dense vegetation). Therefore, maintaining due cognisance of the integrity and accuracy of the ecological survey, it should be stated that the ecological resources identified during the study do not necessarily represent all the ecological resources present on the property.

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. Terrestrial resources are rapidly disappearing however, due to conversion of natural habitat to farmland, forestry, human settlement, and industrial development. Some species are under threat from over-collection for medicinal, ornamental, and horticultural purposes.

Today it is widely recognised that it is of utmost importance to conserve natural resources in order to maintain ecological processes and life support systems for plants, animals and humans. Recent policies, international conventions, and community-based initiatives being carried out are aimed at improved conservation and more sustainable use of natural resources in future. To ensure that sustainable development takes place, it is therefore important that the environment is considered before local authorities approve any development.

All components of any of the ecosystems (physical environment, vegetation, animals) of a site are interrelated and interdependent. A holistic approach is therefore imperative to effectively include any proposed development, utilisation and where necessary conservation of the given natural resources in an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001). Ideally the area should be developed so that the quality of the resources does not decrease, as this would inevitably lead to ecosystem degradation and lower productivity. It is therefore necessary to make a thorough inventory of the plant communities at the site of the proposed development, their biota and their associated habitats (=ecosystems), in order to evaluate its potential for development, or conservation. This inventory should then serve as a scientific and ecological basis for the planning exercises.

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 is 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 as part of the development.

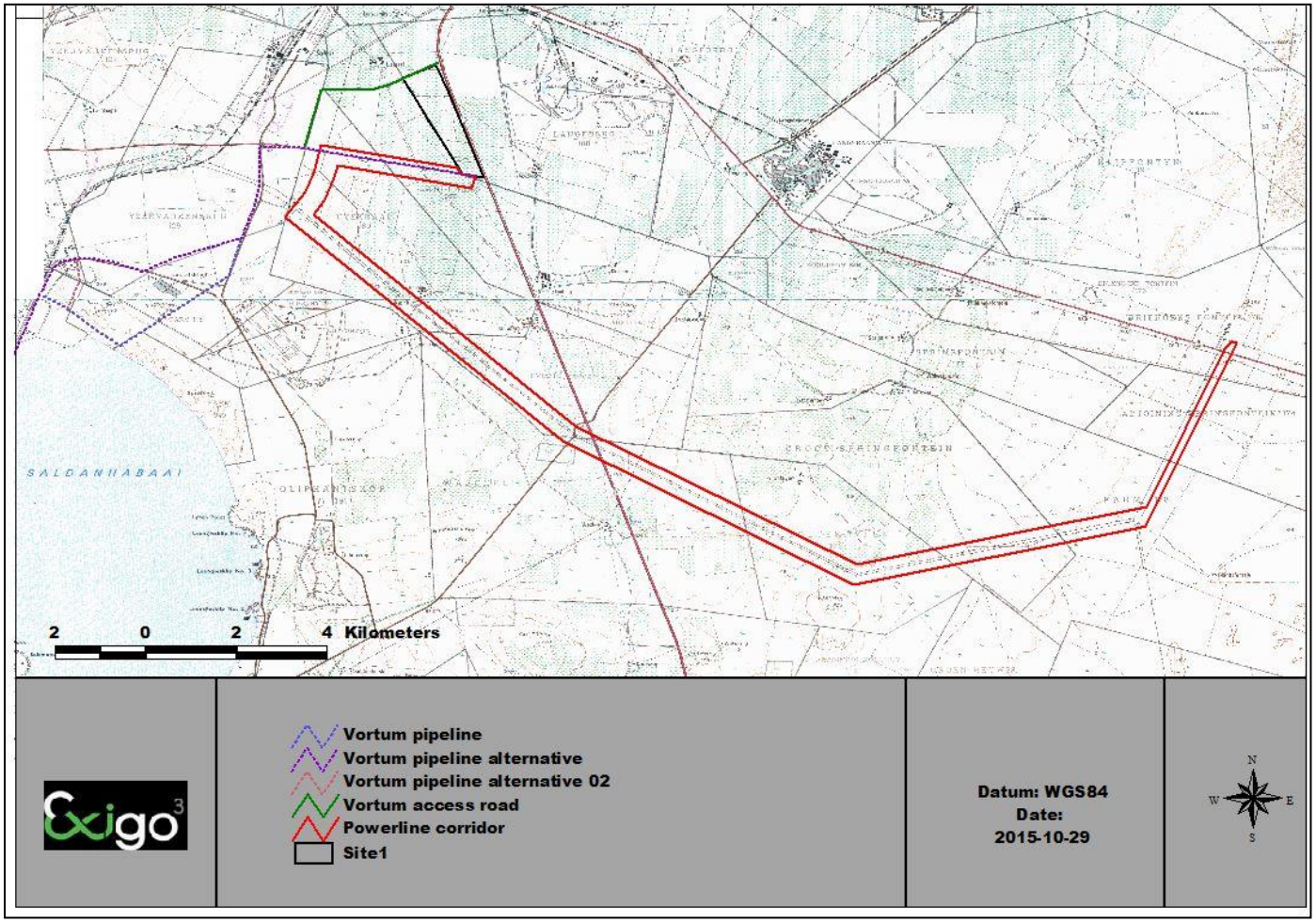

Figure 1. Regional Location Map

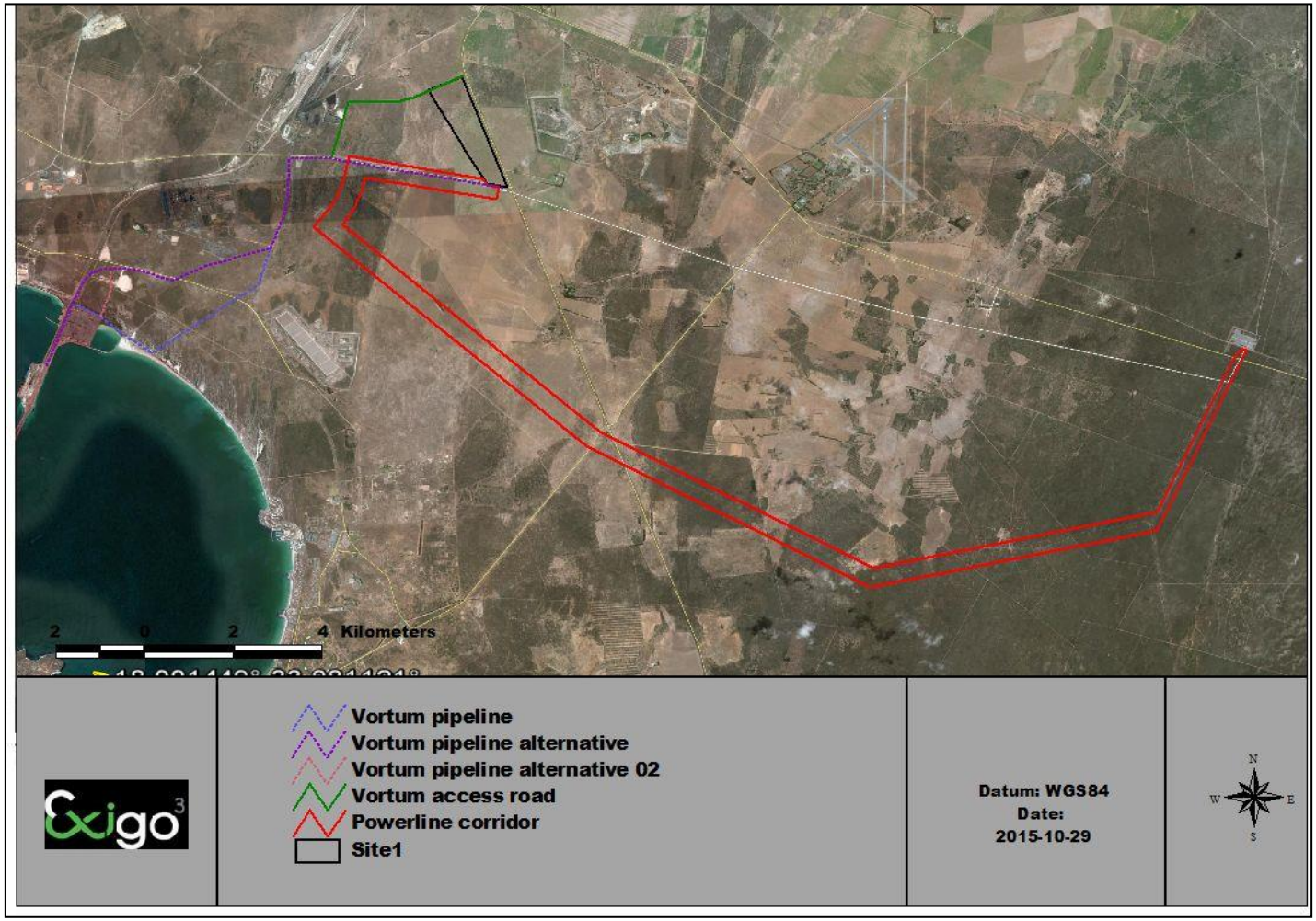

Figure 2. Satelite image showing the project area (Google Pro, 2010)

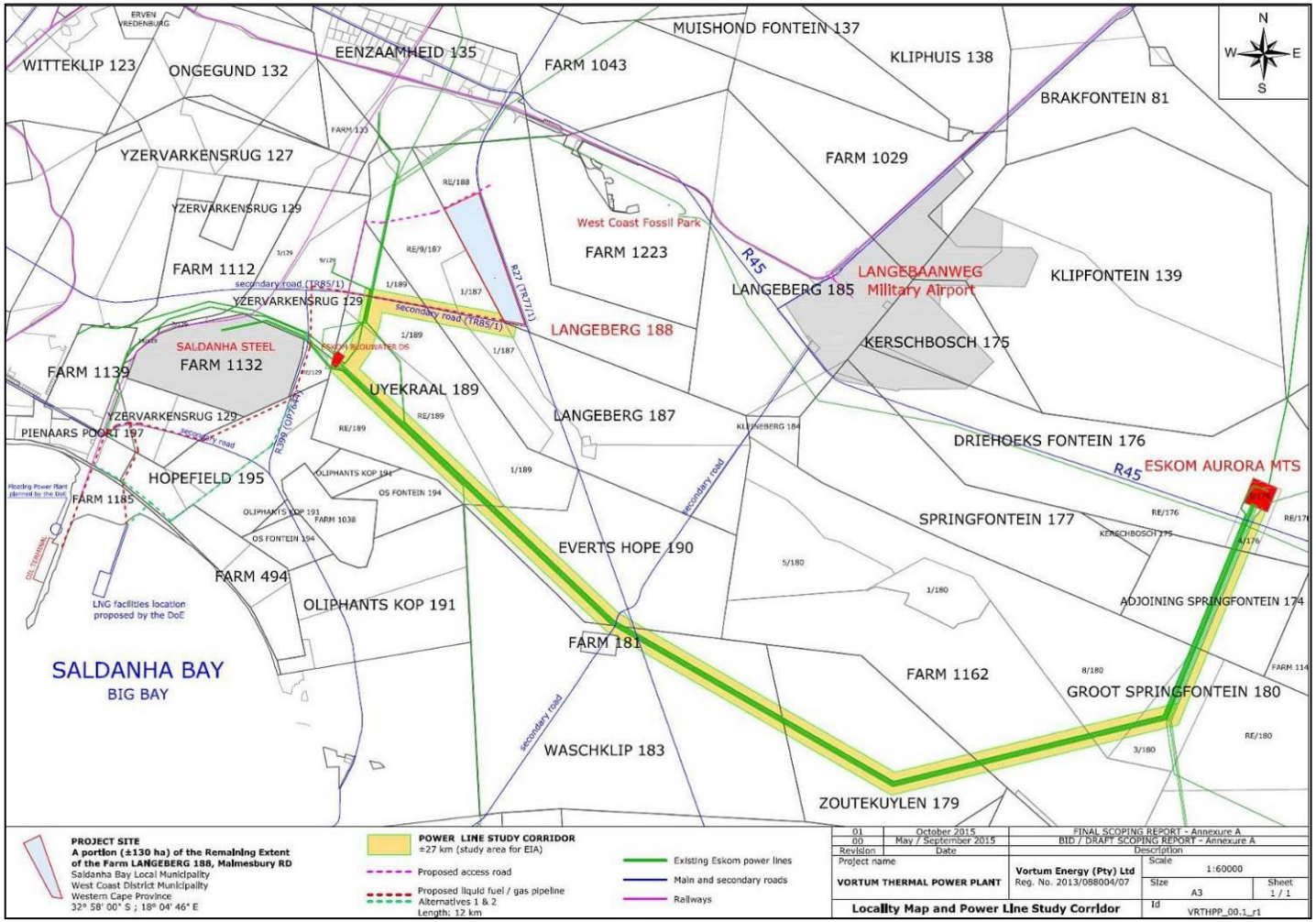

Figure 3. Layout Map of the proposed Vortum Thermal Power Plant and associated powerline and gas / fuel pipelines

3.2 CLIMATE

Climate in the broad sense is a major determinant of the geographical distribution of species and vegetation types. However, on a smaller scale, the microclimate, which is greatly influenced by local topography, is also important. Within areas, the local conditions of temperature, light, humidity and moisture vary greatly and it is these factors which play an important role in the production and survival of plants (Tainton, 1981). The climate for the region can be described as warm-temperate. In terrestrial environments, limitations related to water availability are always important to plants and plant communities.

The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987).

The Saldanha Bay area is characterised by a semi-arid Mediterranean climate which is strongly influenced by the cold Benguela Current and coastal berg wind conditions. The dry summer months occur from October to April while the majority of precipitation occurs during the winter months (May to September). Rainfall averages from 260 – 280 per year (www.weathersa.co.za, accessed 23 May 2007), although Awad et al. (2004) report lower figures. Seasonal temperature variations are slight, with maximum temperatures ranging from 20 – 30ºC and minimum temperatures ranging from 5 – 15°C throughout the year. The climate is strongly influenced by the cold Benguela Current and coastal berg wind conditions.

The prevailing winds are predominantly from the south-west during summer and from the north and south west during winter. Summer winds can exceed 30 km/hr for more than 20% of the time but winter winds are not as strong. Berg wind conditions can exceed 30 km/hr for more than 15% of the time during winter (CSIR, 1995). Due to the orientation of the entrance channel to the port of Saldanha in a more northerly direction, the predominant wind direction will be quartering (about 45 degrees) relative to the entrance channel. The predominant southwesterly wind in summer will blow towards Saldanha, into Small Bay. The north-westerly wind in winter will blow towards Langebaan, into Big Bay.

3.3 VEGETATION TYPES

3.3.1 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.

3.3.1.1 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.

3.3.1.2 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.

3.3.1.3 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.

3.3.2 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 means 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.

The study area is also part of the greater West Coast region, and lies within what could be termed the Saldanha Peninsula bioregion. This bioregion has a fairly distinct flora, and a particularly high number of locally and regionally endemic plant species, as well as plant Species of Conservation Concern (Helme & Koopman 2007).

3.3.3 CAPE NATURE FINE SCALE PROJECT VEGETATION MAP: SALDANHA LOCAL MUNICIPALITY

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.

Helme indicate the following with regards to the Hopefield Sand Fynbos:

Key areas requiring conservation: This vegetation type is very poorly conserved, with large areas transformed by agriculture and invaded by aliens. However, large intact areas still remain and these should be the focus of conservation efforts, especially where these include ecotonal elements (such as clay lenses and Renosterveld contact zones, and upland elements such as near Aurora), and where they border existing public or private conservation areas.

Management Guidelines: Major pressures are agriculture (potatoes, rooibos, wheat), alien plant invasions (mainly Acacia saligna and A. cyclops, and Pinus), pine plantations, and silica sand quarrying (Elandsfontein). These all require different management approaches, but certainly one of the most rewarding tasks would be to control the spread of invasive alien plants, and limit the invasions to core areas of high alien density whilst removing the outlying, actively spreading populations. The West Coast National Park should be encouraged to expand northeast to incorporate elements of this vegetation type. Various private nature reserves should be careful not to overstock with game, or to stock game not originally permanently present in the area, as this could lead to overgrazing, trampling, and subsequent erosion issues. Expansion of private pine plantations should not be allowed, and owners of the existing ones should have to actively control and prevent the spread of the seedlings into adjacent natural vegetation. No further transformation of good quality examples of this vegetation type should be authorised, unless offset by significant conservation gains, in accordance with the latest regional guidelines for biodiversity offsets (Department of Environmental Affairs and Development Planning 2007). These guidelines suggest that for every 1ha of intact habitat lost at least 15ha of the same quality should be conserved.

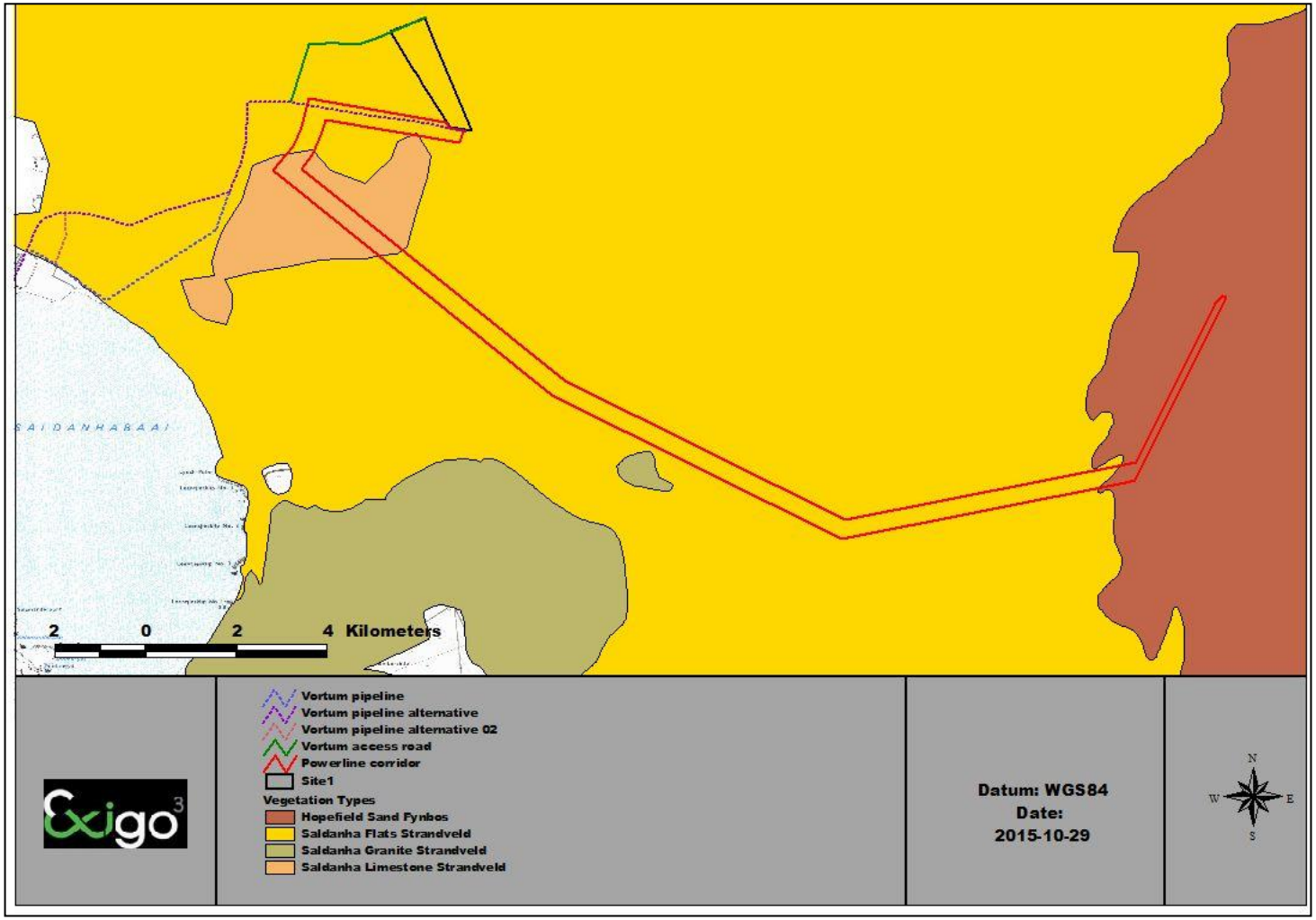

Figure 4. Vegetation Types of the study area (Mucina & Rutherford, 2006)

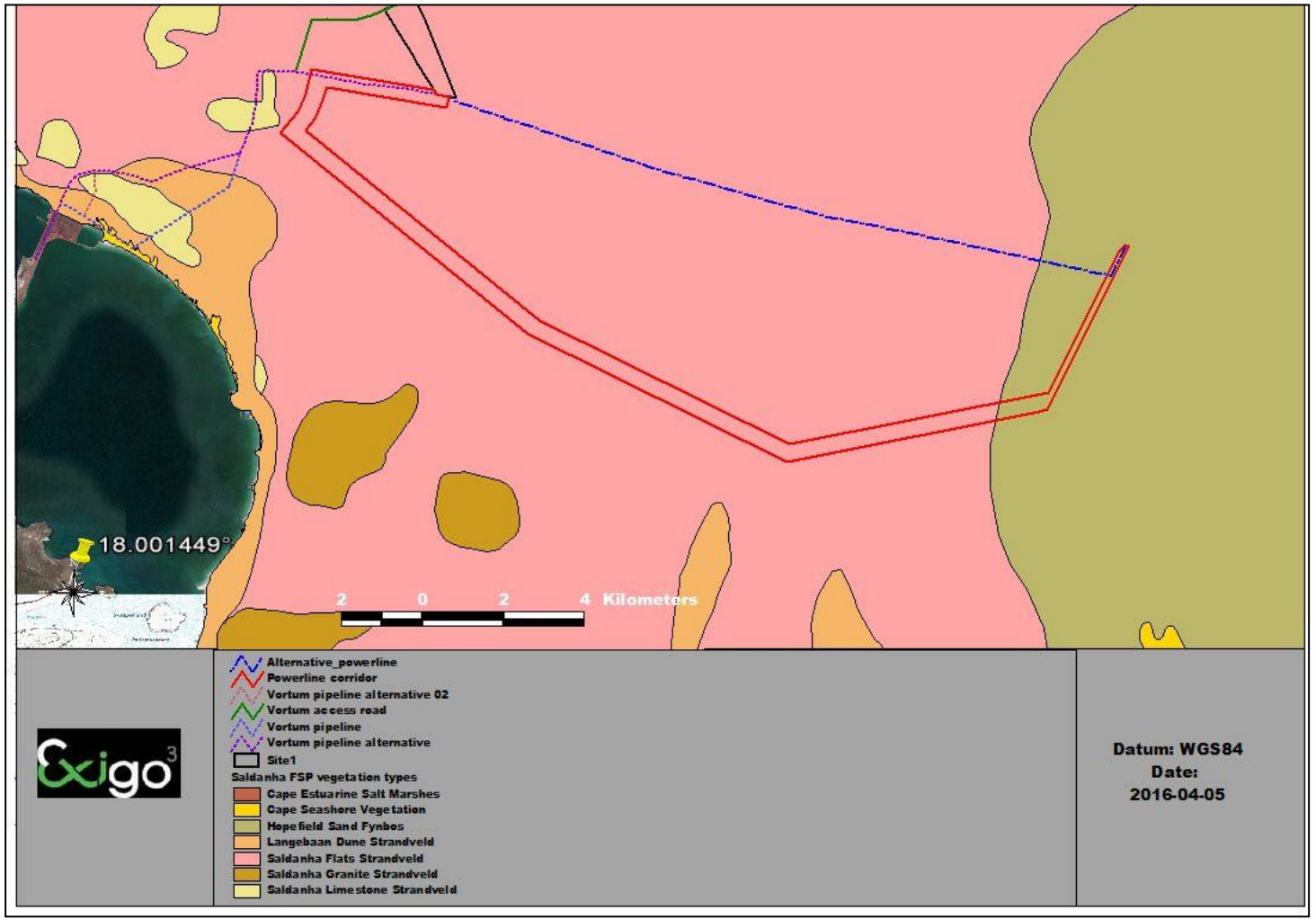

Figure 5. Vegetation types as classified by Cape Nature FSP for the Saldanha Local Municipality

3.4 GEOLOGY AND SOIL TYPES

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land types, geology and associated soil types is presented in Table 1 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Table 1. Land types, geology and dominant soil types of the proposed development site

Land type	Soils	Geology
Db299	Prismacutanic and/or pedocutanic diagnostic horizons dominant B horizons mainly not red	Aeolian sand with limestone and calcrete of the Langebaan Formation and greywacke phyllite and quartz schist with thin lenses of limestone and grit; Malmesbury Group.
Hb22	Grey regic sands and other soils	Limestone and calcrete of the Langebaan Formation with some granite of the Vredenburg Pluton; Cape Granite Suite.
Ha13	Grey regic sands dominant	Mainly Quaternary quartz sand of the Springfontein and limestone and calcrete of the Langebaan Formations.
Hb22	Grey regic sands and other soils	Limestone and calcrete of the Langebaan Formation with some granite of the Vredenburg Pluton; Cape Granite Suite.
Hb23	Grey regic sands and other soils	Mainly Quaternary limestone and calcrete of the Langebaan and quartz sand of the Springfontein Formations; occasional granite outcrops and deposits of the weathering products of granite of the Langebaan-Saldanha Pluton Cape Granite Suite.
Hb14	Grey regic sands and other soils	Limestone and calcrete of the Langebaan Formation with granite of the Vredenburg Pluton; Cape Granite Suite.
Fc108	Glenrosa and/or Mispah forms (other soils may occur) lime generally present in the entire landscape	Mainly Quaternary limestone and calcrete of the Langebaan Formation as well as quartz sand of the Springfontein Formation; occasional outcrops of granite of the Langebaan-Saldanha Pluton Cape Granite Suite.
Fc738	Glenrosa and/or Mispah forms (other soils may occur) lime generally present in the entire landscape	Mainly granite and deposits of the weathering products of granite of the Langebaan-Saldanha Pluton Cape Granite Suite as well as Quaternary quartz sand of the Springfontein Formation.

Soils associated with the site are mostly shallow sands overlying calcrete.

3.5 TOPOGRAPHY & DRAINAGE

The surrounding area is characterised by a gently undulating coastal plain with low hills. The highest points in the area include Malgaskop (173 m above mean sea level) to the west, Karringberg (175 m above mean sea level) to the east, and Postberg on the Langebaan Peninsula (192.8 m above mean sea level) to the south. Several smaller hills and outcrops of granite boulders are also evident in the surrounding area.

The site is located within the G10M quaternary catchment and is situated in the Berg River Water Management Area. Drainage occurs as sheet-wash towards the major river namely the Great Berg River to the north of the site and the Sout River to the East.

3.6 LAND USE AND EXISTING INFRASTRUCTURE

The current land-use of the proposed development site is grazing by livestock. Neighbouring farms are being used for livestock grazing and game farming, with industrial site also located in close vicinity of the Saldanha Port.

The major land use of the study area as classified by the Environmental Potential Atlas of South Africa (2000) is vacant / unspecified land.

3.7 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 6.

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

Vortum Thermal Power Plant Ecological Study

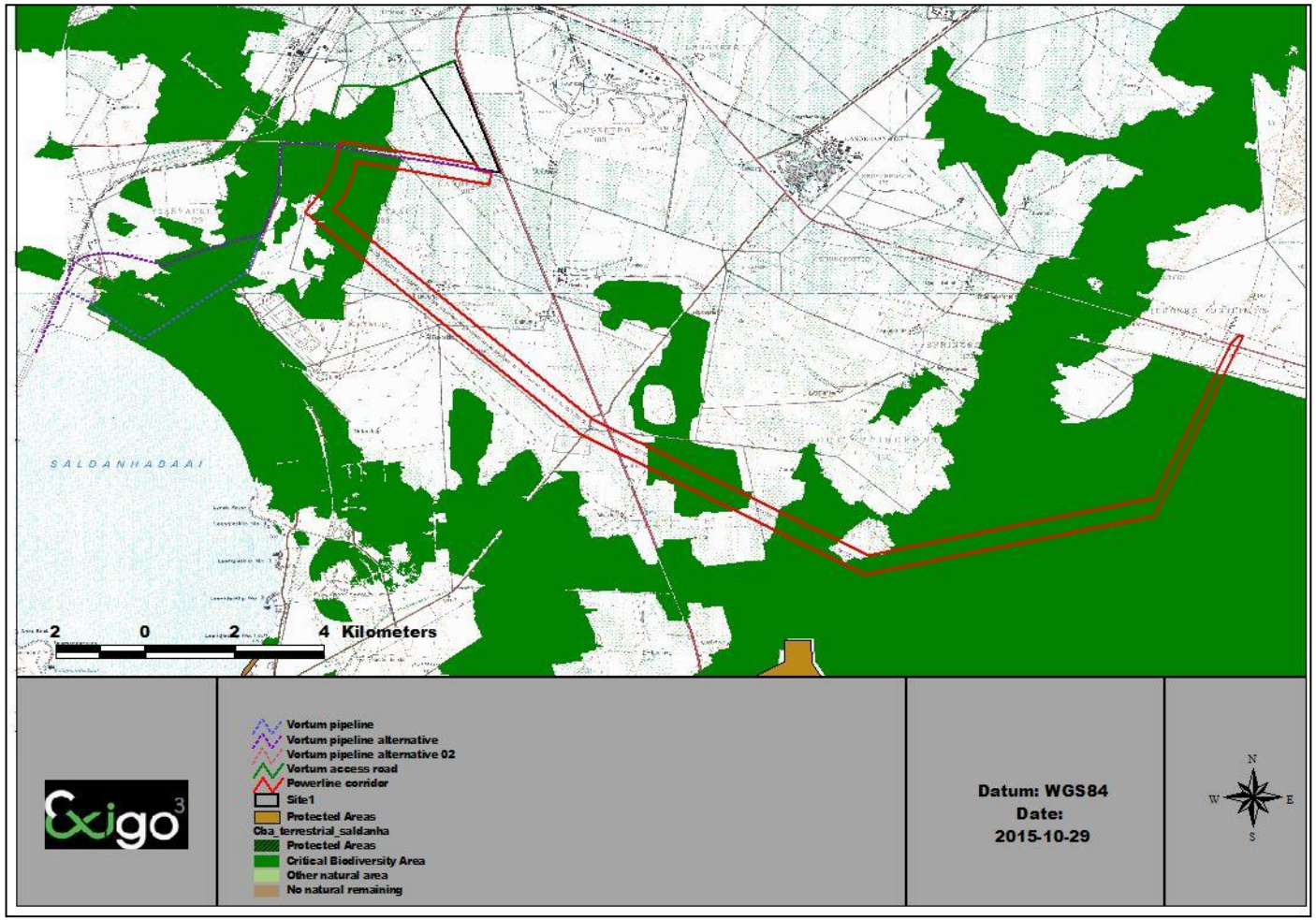

Figure 6. Terrestrial CBA areas of the study area

4 METHODS

4.1 VEGETATION SURVEY

Two basic methods were used during the vegetation survey:

- Line transects were walked on the site surveyed to record the plant species present. Rare and threatened plant species and any botanically sensitive sites or habitats were searched for in the various vegetation units.
- The Braun-Blanquet survey technique to describe plant communities as ecological units was also used for this study. It allows for the mapping of vegetation and the comparison of the data with similar studies in the area.

The vegetation survey was conducted on site during November 2015. The vegetation was in a moderate to poor condition and some species might have been missed as a result of the below average rainfall recived during the season. **A botanical specialist familiar with the area must conduct a detailed walk down of all the powerline servitudes prior to construction during late winter/early spring.**

4.1.1 Data recorded:

Plant names used in this report are in accordance with Arnold & De Wet (1993), with the exception of a few newly revised species. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence as well as potential fauna habitat that might occur.

4.1.2 Species of conservation concern (SCC)

The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2015).

4.1.3 Protected trees

A species list of the protected tree species was obtained from the Department of Forestry. These trees are listed by the NFA (Act 84 of 1998) as protected.

4.1.4 Protected plants

A list of protected and specially protected plants was obtained from Cape Nature and the POSA (Plants of Southern Africa) database of Sanbi..

4.1.5 Data processing

A classification of vegetation data was done to identify, describe and map vegetation types.

The descriptions of the vegetation units include the tree, shrub and herbaceous layers.

Conservation priority of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Western Cape, as well as the vegetation types of the area and the Fynbos Biome of South Africa.

The following four conservation priority categories were used for each vegetation unit:

- High: Ecologically sensitive and valuable land with high species richness that should be conserved and no development allowed.
- Medium: Land that should be conserved but on which low impact development could be considered with the provision of mitigation measures.
- Medium-low: Land that has some conservation value but on which development could be considered with limited impact on the vegetation / ecosystem. It is recommended that certain sections of the vegetation be maintained.
- Low: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation / ecosystem.

4.2 FAUNA SURVEY

The fauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the vegetation units. Fauna observed on site or any specific indication of species was noted as confirmed in the species lists.
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area. Lists of avifauna, mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and ADU databases). Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.

4.2.1 Data recorded:

A list of all species of fauna 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.

4.2.2 Red data species lists

The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 2014.2 and where species have not been assessed under

these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

A species list of the red data species of the different faunal classes was obtained from the following references:

- Red Data Book of the Mammals of South Africa (Friedman & Daly, 2004)
- The Atlas of the Southern African Birds - digital data on quarter degree grid data (Avian Demography Unit, University of Cape Town); as well as the SABAP 2 database of Birdlife SA;
- Atlas and red data book of the frogs of South Africa, Lesotho and Swaziland (Minter et al. 2004)
- South African Red Data Book – Reptiles and Amphibians. National Scientific Programmes Report no. 151;

4.2.3 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the faunal species. In addition to species observed on the site, lists of the potential mammal, bird, reptile, amphibian and insect species were compiled and mitigating measures recommended if needed.

4.3 SENSITIVITY ASSESSMENT

The ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity.

4.3.1 Ecological function

The ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

4.3.2 Conservation importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems

protected by legislation.

4.3.3 Sensitivity scale

- High – sensitive ecosystem with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems or with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected;
- Medium – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems or ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species;
- Low – Degraded and highly disturbed / transformed systems with little ecological function and which are generally very poor in species diversity.

4.4 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 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:

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
	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 VEGETATION UNITS

The proposed development is planned on a landscape that varies from slightly undulating plains to slightly undulating low dunes. The importance to survey the area as a whole to have a better understanding of the ecosystem and the potential impact of the development on the natural environment was identified as a key factor, and subsequently the property was completely surveyed. The site for the thermal power plant is currently managed as a livestock farm, while the remainder of the area for the powerline corridor and pipelines has varying land-uses (industrial, game farming, livestock grazing etc.). The vegetation units on the site vary according to soil characteristics, topography and land-use. The site itself is characterised by short degraded grassland that represent old cultivated fields. Vegetation units were identified and can be divided into 5 distinct vegetation units according to soil types and topography as indicated in Figure 6.

Cape Nature has noted the following with regards to the powerline corridor:

- It was noted that the power plant will require one or more 400kV power lines to transmit electricity to Aurora substation. Linear activities such as power lines and roads are cumulatively contributing significantly to loss of natural habitat in the Saldanha region and routes should aim to avoid sensitive areas. Even though power line corridors are mostly brush-cut (mowed) and not completely stripped, the brush-cutting activity favours the regrowth of certain species over others leading to loss of diversity and fragmentation.
- The first section of power line crossing portion 1 of Farm 189 is of concern as it will impact on an area determined as Critical Biodiversity Area (CBA) which is known to contain several Species of Conservation Concern (SCC). The section of power line running south through the remainder of Farm 189 is also of concern for similar reasons. Alternative routes for the power line must be put forward and assessed by a botanical specialist who has experience working in the habitats in this area.

Considering the abovementioned comments, an alternative powerline corridor were identified. The corridor follows a pipeline corridor and is not too close to the airfield, considering that another powerline corridor runs closer to the airfield to the north of the identified alternative.

The vegetation communities identified on the proposed development site are classified as physiographic physiognomic units, where physiognomic refers to the

outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are divided in terms of the land-use, plant species composition, topographical and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics and detailed descriptions of vegetation units are included in the following section. A species list for the site is included in Appendix A, while a plant species list for the quarter degree grid square (QDS) is included in Appendix B. Photographs of each unit is included in the next section to illustrate the grass layer, woody structure and substrate (soil, geology etc.). The following vegetation units were identified during the survey.

1. *Zygophyllum – Euphorbia - Searsia* strandveld
    - On shallow calcareous soils;
    - On grey regic sands;
2. Slightly degraded sand fynbos
3. Old fields;
4. Degraded strandveld shrubveld;
5. Exotic bushclumps;

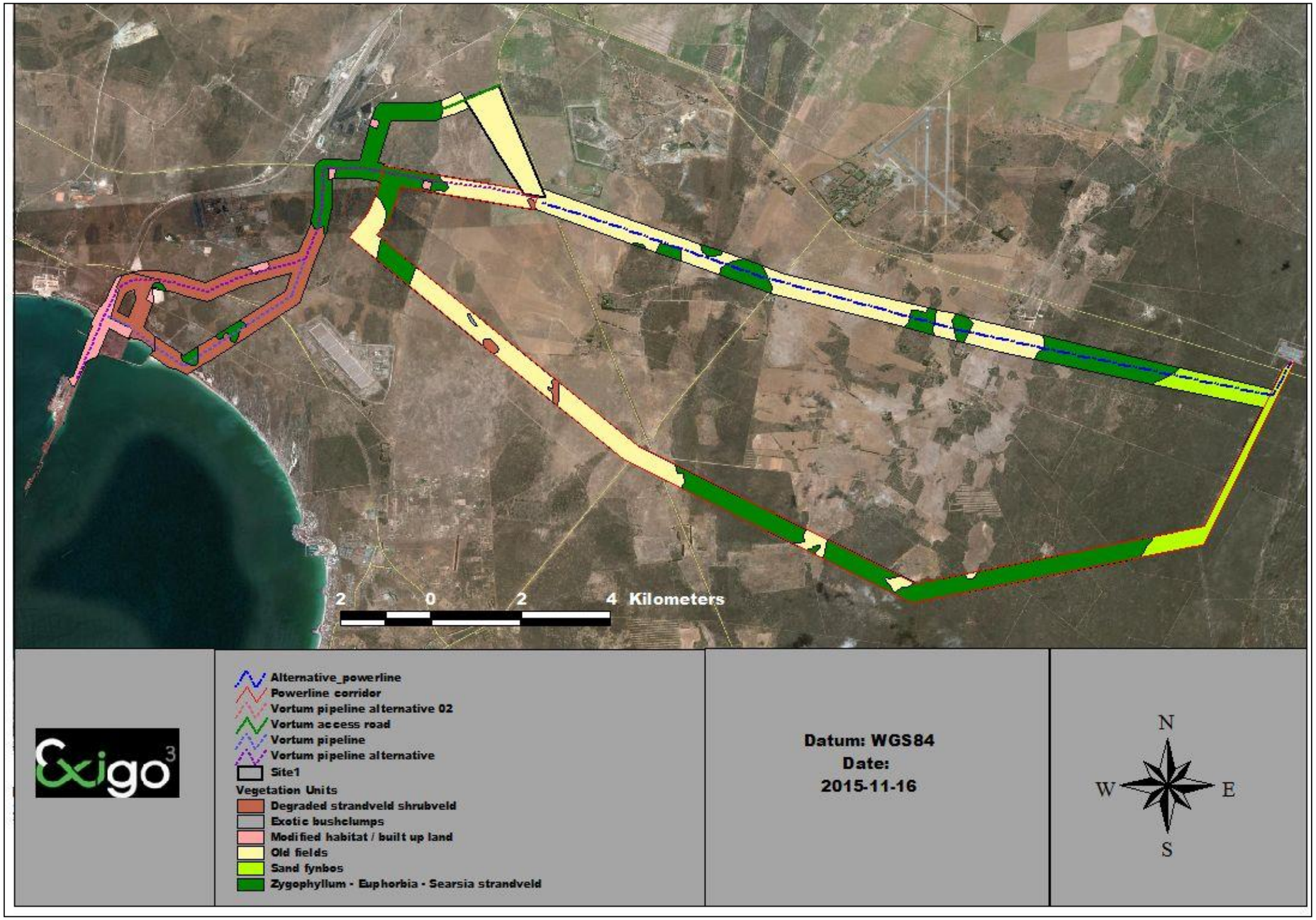

Figure 7. Vegetation Map

5.1.1 *ZYGOPHYLLUM – EUPHORBIA - SEARSIA* STRANDVELD

This vegetation unit has two variations according to the substrate (on shallow calcareous soils and grey regic sands) and occurs along sections of the powerline and pipeline corridors. The woody structure is dense shrubveld dominated by species such as *Zygophyllum morgsana, Z. cordifolium, Euclea racemosa, Pteronia divaricata, Searsia glauca, Exomis microphylla, Nylandtia spinosa, Euphorbia mauritanica* and *Euphorbia burmanni*. Grass species and restionaceae species typical of the area include *Bromus pectinatus, Ehrharta calycina, E. villosa*, Wildenowia incurvata and *Stabera distachyos*. Many endemic species and succulent species also occur typical of the Saldanha Limestone Strandveld and Saldanha Flats Strandveld, although the location of the corridors adjacent to already existing roads and powerline corridors, makes the area slightly more degraded compared to the natural state of the strandveld habitats. The characteristics of this vegetation unit are summarized in Table 2, while the state of the vegetation indicated in photographs 1 and 2.

Table 3. Botanical analysis and characteristics of *Zygophyllum – Euphorbia - Searsia* strandveld

State of the vegetation:	Natural shrubveld in a slightly degraded state
Need for rehabilitation	Medium-Low
Conservation priority	Medium
Characteristics	Dense shrubveld component on shallow calcareous soils or regic sands dominated by various shrubs typical of the strandveld vegetation types of the larger Saldanha area
Soils & Geology	Deep, red Aeolian (wind-blown) sands
Dominant spp.	*Zygophyllum morgsana, Z. cordifolium, Euclea racemosa, Pteronia divaricata, Searsia glauca, Exomis microphylla, Nylandtia spinosa, Euphorbia mauritanica* and *Euphorbia burmanni*. Grass speces and restionaceae species typical of the area include *Bromus pectinatus, Ehrharta calycina, E. villosa*, Wildenowia incurvata and *Stabera distachyos*
Density of woody layer	Trees: 1-2% (avg. height: 3-6m) Shrubs: 40-50% (avg. height: 1-3m)
Density of herbaceous layer	Grasses: 20-30% (avg. height: 0.8-1.2m) Forbs: 5-10% (avg. height: 0.8m)
Sensitivity	Medium
Red data species	None observed
Protected species	All species of the families Amaryllidaceae , Ericaceae, Mesembryanthemaceae, Iridaceae and Genus *Aloe*

The following specific recommendations for the area should be adhered to

- The vegetation unit is classified as having a medium sensitivity due to the location adjacent to the exiting powerlines and roads. The vegetation is therefore considered slightly more degraded than expected;
- Mitigation should be implemented to prevent erosion in these areas considering the high erodibility of the soils at the foot of the rocky ridge which causes a consequent high energy water flow dominating after rainfall events;
- The development can be supported provided that a licence is obtained from Cape nature for the eradication of the protected species.

Photograph 1. *Zygophyllum – Euphorbia - Searsia* strandveld in the project area on shallow calcareous soils

Photograph 2. *Zygophyllum – Euphorbia - Searsia* strandveld in the project area on sandy soils

5.1.2 SLIGHTLY DEGRADED SAND FYNBOS

This vegetation unit occurs in the western section of the proposed powerline corridor and the alternative powerline corridor identified. The area is underlied by grey regic sands and the soil is in a highly leached acidic state. The vegetation is typical fynbos shrubveld (moderately tall ericoid-leaved shrubland with dense herbaceous stratum of aphyllous hemicryptophytes) representing the Hopefield Sandy Fynbos, although being in a slightly degraded state along the existing powerline corridors. The fynbos type is mostly asteraceous and restoid fynbos. The specific area along the powerline corridors is dominated by species such *Erica mammosa, Leucadendron foedum, Leucadendron salignum, Grisebachia incana, Salaxis axillaris, Stoebe plumosa, Passerina vulgaris* and *Euclea racemosa.* Typical restionaceae species include *Wildenowia incurvata* and *Stabera cernoa.*

The habitat type can be considered slightly degraded. No red data species occurs; probably as a result of the habitat being degraded beneath the powerline corridor. The state of the vegetation is indicated in photograph 3, while the characteristics of the variations of this vegetation unit are summarized in Table 3.

Table 4. Botanical analysis and characteristics of Slightly degraded sand fynbos

State of the vegetation:	Slightly degraded
Need for rehabilitation	Medium
Conservation priority	High
Characteristics	Asteraceous and restoid fynbos dominated by typical species of the Hopefield Sand Fynbos vegetation type on grey regic sands
Soils & Geology	Deep, acidic, tertiary sands
Dominant spp.	*Erica mammosa, Leucadendron foedum, Leucadendron salignum, Grisebachia incana, Salaxis axillaris, Stoebe plumosa, Passerina vulgaris* and *Euclea racemosa.* Typical restionaceae species include *Wildenowia incurvata* and *Stabera cernoa.*
Density of woody layer	Trees: <1% (avg. height: 3-6m) Shrubs: 40-60% (avg. height: 1-2m)
Density of herbaceous layer	Graminoids: 30-40% (avg. height: 0.8-1.2m) Forbs: 10-20% (avg. height: 0.8m)
Sensitivity	High
Red data species	None observed – although a botanical walk though survey should be done pre-construction if development is aaproved
Protected species	All species of the families Amaryllidaceae , Ericaceae, Mesembryanthemaceae, Iridaceae and Genus *Aloe*

Photograph 3. Slightly degraded sand fynbos in the project area

The following specific recommendations for the area should be adhered to

- The vegetation unit is classified as having a HIGH sensitivity due to the potential endemic and red listed species occurring in the direct area of the Aurora Substation in the sandveld fynbos along the powerline corridor.
- No slashing of any fynbos benath the powerline corridor should be allowed for a period of 5 years, while any alien invasive species should be strictly controlled in the area;
- **A botanical specialist familiar with the area must therefore conduct a detailed walk down of all the powerline servitudes prior to construction during late winter/early spring.**

5.1.3 OLD FIELDS

The entire study area has been previously cultivated, and consequently this area supports a plant community that is species poor and typical of such habitats. The lands have not been cultivated for some time, and minor natural rehabilitation has thus taken place, particularly by annuals. The original natural vegetation in this area is likely to have been Saldanha Flats Strandveld (Helme & Koopman 2007), which is restricted to the region, and which is regarded as a Vulnerable vegetation type (DEA 2011).

This vegetation unit is the most prominent in the area and utilised as livestock grazing. The vegetation structure is short, degraded grassland on grey regic sands. The old fields occur throughout the area and vary between primary and secondary old fields (Photograph 4). 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, forb and succulent shrub species (Moll, 1965). Different stages of succession occur in the old fields. The landscape and vegetation features of the primary old fields on the proposed development site include slightly undulating plains with a high grass and forb cover (70-80%) The old fields are dominated by the grass species *Cynodon dactylon, Bromus pectinatus* and *Ehrharta calycina.*

Overall plant species diversity in the study area is less than 15% of what it would have been prior to disturbance, and all the species currently present are resilient, weedy or pioneer species that have reestablished since the disturbance ceased (Helme, 2014).

No red data species were found as a result of the degraded state of the vegetation. The following general ecological observations and recommendations were made for the area:

- The old fields do not have any conservation importance due to the impact from previously cultivated land, overgrazing and agricultural activities by the local communities. Much of the area is disturbed and used for grazing and cultivation purposes. The area has a Low Sensitivity;

Photograph 4. Old fields on the proposed thermal plant development site

5.1.4 DEGRADED STRANDVELD SHRUBVELD

The areas closer to the Saldanha Port and the surrounding industries represent a more open degraded starndveld shrubveld. These areas have often become invaded by alien invasive species such as *Acacia cyclops* and *Acacia saligna* (Photograph 5). Most of the common indigenous species of the strandveld habitat such as *Zygophyllum* species, *Searsia glauca* and *Euclea racemosa* occur in this vegetation unit.

The characteristics of this vegetation unit are summarized in Table 4, while the state of the vegetation indicated in photograph 5.

Table 5. Botanical analysis and characteristics of the Degraded strandveld shrubveld

Vegetation unit characteristics	
State of the vegetation:	Degraded shrubveld
Need for rehabilitation	Medium-High
Conservation priority	Medium-low
Characteristics	Open shrubveld component invaded by *Acacia cyclops* and *Acacia saligna.*
Soils & Geology	Shallow calcareous soils and grey regic sands typical of the strandveld habitat type
Dominant spp.	*Acacia cyclops, Zygophyllum species, Euclea racemose, Searsia glauca*
Density of woody layer	Trees: 5-10% (avg. height: 3-6m) Shrubs: 15-20% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 40-50% (avg. height: 0.8-1.2m) Forbs: 5-10% (avg. height: 0.8m)
Sensitivity	Medium-low
Red data species	None observed
Protected species	All species of the families Amaryllidaceae , Ericaceae, Mesembryanthemaceae, Iridaceae and Genus *Aloe*

The following specific recommendations for the degraded strandveld shrubveld on site should be adhered to

- The anthropogenic influences and high abundances of alien species present in this unit have compromised the ecosystem services that this unit provides to fauna and flora components of the region resulting in it being classed as mostly a medium-low sensitivity score. No red data species occurs in this vegetation unit; probably as a result of the degraded state of the habitat.;
- The development can be supported provided that a licence is obtained from Cape nature for the eradication of the protected species.

Photograph 5. Degraded strandveld shrubveld associated with the powerline and pipeline corridors in the project area

5.1.5 EXOTIC BUSHCLUMPS

Small pockets of areas dominated by homogenous stands of exotic tree species occur in the project area (Photograph 6). These areas have been completely modified and the herbaceous layer underneath these dense stands of woody species is completely absent. The "sterile" soils underneath the exotic bushclumps have also been acidified to such an extent that little or no plants can survive under these conditions.

An exotic bushclump of *Eucalyptus grandis* occur along the powerline corridor (Photograph 6), although no impact on the stand of trees is anticipated. The following is recommended regarding development in these degraded bushclumps and encroached areas:

Areas where the exotic bushclumps occurs can be developed without any limitations. The removal of exotic trees can be considered as an offset and will contribute to increase baseflow in the streams on the project area

Photograph 6. Exotic bushclumps in the project area

5.2 FLORA: SPECIES LEVEL ASSESSMENT

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. The major threats to plants in the study area are urban expansion, non-sustainable harvesting, collecting, overgrazing/browsing, mining and agriculture. The objective of this section was to compile a list of plant species for which there is conservation concern. This included threatened, rare, declining, protected and endemic species.

More than 7000 species are known from the quarter degree square which are intersected by the power line routes, including more than 675 species of high conservation concern. This is an exceptionally high number and illustrates the potential sensitivity of the affected area. The quarter degree squares with the highest number of species are however largely on the periphery of the study area and only marginally impacted by the power line routes. This is because areas of exceptional diversity include the Swartland, which is only marginally impacted as well as areas that have been well studied such as around Langebaan. However, as the number of species known from an area is heavily dependent on the historical sampling intensity, which is not evenly spread, not a lot of weight should be attributed to these differences. What is however important to note is that there is a relatively high number of species of high conservation concern present throughout the study area and as a result, any impacts on currently intact habitat are likely to pose some threat to some species. An impact on such species is best avoided through avoiding sensitive areas as mapped in this study as much as possible, followed by a preconstruction walk-through of the final route in order to avoid specific features of

concern that may be present within the development footprint. The walk thorugh should bne conducted by a local specialist.

5.2.1 SPECIES OF CONCERVATION CONCERN

The latest data from the Threatened Species Program which compiles the Red List for South Africa is that 67% of the rare or threatened plant species in the country occur only in the southwestern Cape, and these total over 1800 species (Raimondo et al – 2009)! It should thus be clear that the southwestern Cape is a major national and global conservation priority, and is quite unlike anywhere else in the country in terms of the number of threatened plant species. Developments in this area thus need to take this into account.

The conservation importance of the Saldanha Peninsula plant life, particularly the calcrete flats, has been recognised as extremely high and this was verified by Low and Pond (2001). The dwarf thicket on calcrete in the area is widely regarded as unique and threatened with 7.5% of species (12 out of 160) being on the Red Data List (SaSFlora, 1998 – 2007).

Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient – Insufficient Information (DDD). It should also be noted that not all species listed as protected are threatened or vice versa.

Helme specifically indicated the Hopefield Sand Fynbos as a priority habitat in terms of ther Finescale vegetation map for the Saldanha Local Municipality. The following plant species are considered as Species of Conservation Concern. SCC listed Proteaceae in this area (north of the Berg River) includes L*eucospermum rodolentum* (widespread in west coast area), *L. hypophyllocarpodendron ssp. canaliculatum* (Aurora to Milnerton), *Leucadendron foedum* (mainly Hopefield area), *Serruria decipiens* (Graafwater to Melkbos), and *Serruria fucifolia* (Gifberg to Hopefield). Other rare/threatened or endemic species include *Aspalathus albens, A. ternata, Lachnaea capitata, Lachnaea grandiflora, Phylica harveyi, Phylica thunbergiana, Metalasia adunca, Nemesia strumosa, Lampranthus explanatus, Relhania rotundifolia* (often in clay lenses), *Oxalis suavis* (common but very local endemic around Hopefield), and *Lepidium flexuosum* (poorly known). *Metalasia capitata* shared with neighbouring Sand Fynbos types.

A list of SCC plant species previously recorded in the study area in which the proposed development is planned was obtained from the Plants of Southern Africa (POSA) database of SANBI. Figure 8 indicates the classification system used by Sanbi for SCC:

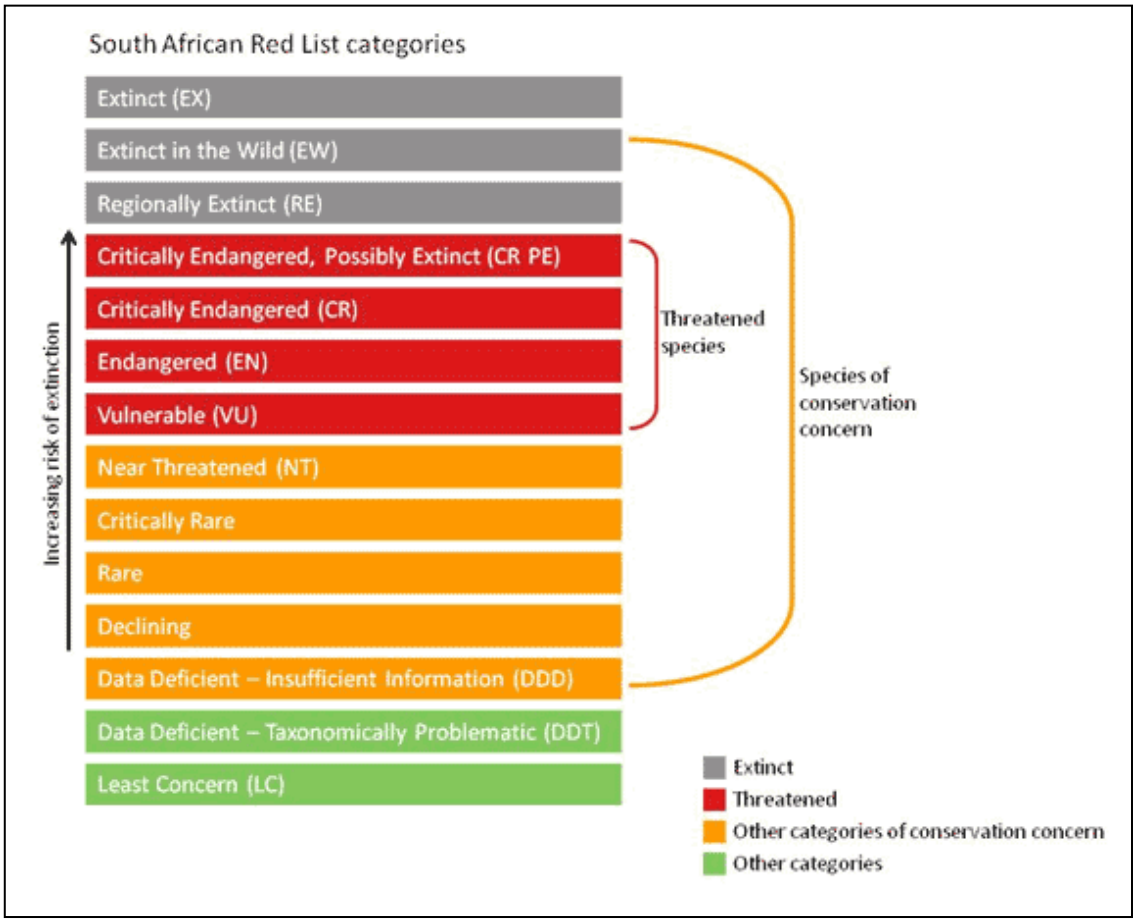

Figure 8. South African red list categories indicating the categories to be used for Species of Conservation Concern

The following species can potentially occur in the project area as indicated in Table 7:

Table 6. Potential SCC occurring in the project area

Family	*Species*	Threat status
ASPHODELACEAE	*Aloe microstigma Salm-Dyck subsp. framesii (L.Bolus) Glen & D.S.Hardy*	Near threatened
ASTERACEAE	*Amellus capensis (Walp.) Hutch.*	Vulnerable
FABACEAE	*Amphithalea ericifolia (L.) Eckl. & Zeyh. subsp. erecta Granby*	Critically endangered
APIACEAE	*Arctopus dregei Sond.*	Near threatened
FABACEAE	*Argyrolobium velutinum Eckl. & Zeyh.*	Endangered
IRIDACEAE	*Babiana angustifolia Sweet*	Near threatened
IRIDACEAE	*Babiana hirsuta (Lam.) Goldblatt & J.C.Manning*	Near threatened
IRIDACEAE	*Babiana tubiflora (L.f.) Ker Gawl.*	Declining
FABACEAE	*Calobota lotononoides (Schltr.) Boatwr. & B.-E.van Wyk*	Near threatened
APIACEAE	*Capnophyllum africanum (L.) Gaertn.*	Near threatened
APIACEAE	*Capnophyllum leiocarpon (Sond.) Manning & Goldblatt*	Declining
ASTERACEAE	*Cotula duckittiae (L.Bolus) K.Bremer & Humphries*	Vulnerable
ASTERACEAE	*Cotula eckloniana (DC.) Levyns*	Endangered
ASTERACEAE	*Cotula filifolia Thunb.*	Critically endangered

Family	*Species*	Threat status
CRASSULACEAE	*Crassula decumbens Thunb. var. brachyphylla (Adamson) Toelken*	Near threatened
APIACEAE	*Cynorhiza meifolia (Eckl. & Zeyh.) Magee*	Data Deficient
HYACINTHACEAE	*Daubenya zeyheri (Kunth) J.C.Manning & A.M.van der Merwe*	Vulnerable
BORAGINACEAE	*Echiostachys spicatus (Burm.f.) Levyns*	Endangered
BORAGINACEAE	*Echiostachys spicatus (Burm.f.) Levyns*	Endangered
HYPOXIDACEAE	*Empodium veratrifolium (Willd.) M.F.Thomps.*	Endangered
ERICACEAE	*Erica trichostigma Salter*	Vulnerable
ASTERACEAE	*Felicia elongata (Thunb.) O.Hoffm.*	Vulnerable
ASTERACEAE	*Felicia elongata (Thunb.) O.Hoffm.*	Vulnerable
IRIDACEAE	*Ferraria densepunctulata M.P.de Vos*	Vulnerable
IRIDACEAE	*Ferraria foliosa G.J.Lewis*	Near threatened
IRIDACEAE	*Geissorhiza lewisiae R.C.Foster*	Vulnerable
IRIDACEAE	*Geissorhiza monanthos Eckl.*	Endangered
AMARYLLIDACEAE	*Gethyllis ciliaris (Thunb.) Thunb. subsp. ciliaris*	Near threatened
ASTERACEAE	*Helichrysum bachmannii Klatt*	Vulnerable
ASTERACEAE	*Helichrysum cochleariforme DC.*	Near threatened
ASTERACEAE	*Helichrysum tricostatum (Thunb.) Less.*	Near threatened
MALVACEAE	*Hermannia procumbens Cav. subsp. myrrhifolia (Thunb.) De Winter*	Endangered
IRIDACEAE	*Hesperantha erecta (Baker) Benth. ex Baker*	Near threatened
AMARYLLIDACEAE	*Hessea mathewsii W.F.Barker*	Critically endangered
FABACEAE	*Indigofera platypoda E.Mey.*	Endangered
HYACINTHACEAE	*Lachenalia mathewsii W.F.Barker*	Critically endangered
HYACINTHACEAE	*Lachenalia mediana Jacq. var. mediana*	Vulnerable
HYACINTHACEAE	*Lachenalia pustulata Jacq.*	Near threatened
HYACINTHACEAE	*Lachenalia viridiflora W.F.Barker*	Critically endangered
FABACEAE	*Lebeckia plukenetiana E.Mey.*	Endangered
FABACEAE	*Liparia splendens (Burm.f.) Bos & de Wit subsp. splendens*	Vulnerable
FABACEAE	*Otholobium bolusii (H.M.L.Forbes) C.H.Stirt.*	Near threatened
FABACEAE	*Otholobium venustum (Eckl. & Zeyh.) C.H.Stirt.*	Vulnerable
HYPOXIDACEAE	*Pauridia longituba M.F.Thomps.*	Endangered
GERANIACEAE	*Pelargonium chelidonium (Houtt.) DC.*	Endangered
FABACEAE	*Podalyria sericea (Andrews) R.Br. ex Aiton f.*	Vulnerable
FABACEAE	*Podalyria sericea (Andrews) R.Br. ex Aiton f.*	Vulnerable
IRIDACEAE	*Romulea barkerae M.P.de Vos*	Endangered
IRIDACEAE	*Romulea saldanhensis M.P.de Vos*	Endangered
CARYOPHYLLACEAE	*Silene ornata Aiton*	Data Deficient
ASTERACEAE	*Steirodiscus tagetes (L.) Schltr.*	Vulnerable
AMARYLLIDACEAE	*Strumaria chaplinii (W.F.Barker) Snijman*	Endangered
ASTERACEAE	*Tripteris calcicola J.C.Manning & Goldblatt*	Vulnerable
FABACEAE	*Wiborgia fusca Thunb. subsp. macrocarpa R.Dahlgren*	Endangered
FABACEAE	*Xiphotheca reflexa (Thunb.) A.L.Schutte & B.-E.van Wyk*	Endangered

Family	*Species*	Threat status
FABACEAE	*Xiphotheca reflexa (Thunb.) A.L.Schutte & B.-E.van Wyk*	Endangered

No red data species was documented during the surveys probably as a result of the time of season (low average rainfall) and degraded state of the vegetation on the footprint site of the thermal power plant and the corridors for the pipelines and powerlines. The potential however still exist that a species might have been missed and subsequently monitoring should be implemented during construction. The monitoring should be conducted bi-annually for a period of at least 2-3 years after construction.

A botanical specialist familiar with the area must therefore conduct a detailed walk down of all the powerline servitudes prior to construction during late winter/early spring.

5.2.2 PROTECTED SPECIES

Plant species are also protected according to the (NEMBA: Act 10 0f 2004), Northern Cape Nature Conservation Act (NCNCA), No. 9 of 2009 and the Western Cape Nature Conservation Laws Amendment act, 2000. According to these Acts, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. The Appendices to the Acts provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species, if they are expected to be affected by the proposed project.

After a detailed survey was conducted the following protected plants were found during the surveys as stipulated in the NCNCA, Act no. 9 of 2009. (Table 8). No other protected flora listed in NEMBA (2004) was documented during the surveys from the NEMBA (2004) lists.

Table 7. Protected plants documented during the survey

Species
Aloe perfoliata (Photograph 8)
Berkheya rigida
Boophane haemanthoides (Photograph 7)
Carpobrotus edulis
Chrysanthemoides incana
Conicosia pugioniformis
Cotyledon orbiculata
Dimorphotheca sinuata
Drosanthemum spp.
Erica mammosa

Species
Eriocephalus africanus
Felicia filifolia
Felicia heterophylla
Felicia tenella
Jordaaniella dubia
Mesembryanthemum crystallinum
Mesembryanthemum gueriachum
Ruschia macowani
Salaxis axillaris
Tylecodon wallichiii

Photograph 7. The protected geophyte *Boophane haemanthoides was documented along the powerline corridor*

Photograph 8. The succulent *Aloe perfoliata* on shallow soils in the project area

A permit should be obtained from the authorities before any of these plants could be eradicated. These plants should form part of a rescue and relocation programme should the development activities impact on populations.

Search and rescue should be considered only as a last resort and sensitive areas and SCC should be avoided first. If search and rescue is deemed necessary, a safe receiving environment must be identified first, in collaboration with Cape Nature.

If considered as viable, a detailed species rescue, relocation and re-introduction plan should be developed and implemented by a qualified person before any excavations or disturbance commence. Red data or localized endemic or protected plant species are habitat-specific. This makes search and rescue efforts and relocation of these species difficult and often unsuccessful. The following specific management measures and guidelines should however be implemented for red data species and other species protected by law on other lists and acts found in the quarter degree grids and related areas:

- A detailed species rescue, relocation and re-introduction plan should be developed and implemented by a qualified person before any excavations or disturbance commence. This plan should at the least address the following:
    - Establishment of an ex-situ nursery;
    - Harvesting of seeds from herbaceous and woody vegetation to be used in

the ex situ nursery and future rehabilitation.

- Intact removal of protected plant species under permit. Permits should be obtained from the Western Cape Environmental authorities where red data or protected flora is to be disturbed or relocated. Plant material that is to be "rescued" must be potted up into bags utilising local soil. Adequate root systems per plant material type must be carefully excavated and retained in order for plant material to remain viable. Search and Rescue activities would include the removal of grass clumps, smaller transplantable shrubs and trees and endangered species such as geophytes and succulents should be placed into bags using local soil.

- Options to be considered for the above-mentioned protected and general floral specimens:
  - Suitable translocation areas: e.g. protected areas such as West Coast National Park;
  - Translocation to suitable areas earmarked for restoration and rehabilitation, both on and off-site;
  - Use of removed plants in an indigenous nursery for future restoration and rehabilitation programs;
  - Translocation to other areas suitable for survival of the removed specimens.
- Proper habitat suitability assessments before reintroductions to reduce the risk of mortalities in both source and destination populations;
- Compile a Protected Plant policy for the project area. This should list those species under threat, reasons for their demise and measures that must be taken to ensure for their continued existence, including access to adequate and appropriate areas of suitable habitat condition;

Conservation initiatives could also be developed between the developer group and conservation institutions to improve the habitat of the endemic plant species listed.

5.2.3 PROTECTED TREE SPECIES (NFA)

The National Forest Act (no.84 of 1998: National Forest Act, 1998) provides a list of tree species that are considered important in a South African perspective as a result of

scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DWAF (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys, no protected tree tree species occur in the area.

5.2.4 INVASIVE ALIEN SPECIES

Invasive alien plants pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate.

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act (10/2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones

The fight against invasive alien plants is spearheaded by the Working for Water (WfW) programme, launched in 1995 and administered through the DWA. This programme works in partnership with local communities, to whom it provides jobs, and also with Government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, provincial departments of agriculture, conservation and environment, research foundations and private companies.

WfW currently runs over 300 projects in all nine of South Africa's provinces. Scientists and field workers use a range of methods to control invasive alien plants. These include:

- Mechanical methods - felling, removing or burning invading alien plants.
- Chemical methods - using environmentally safe herbicides.
- Biological control - using species-specific insects and diseases from the alien plant's country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species.
- Integrated control - combinations of the above three approaches. Often an integrated approach is required in order to prevent enormous impacts.

Vehicles often transport many seeds and some may be of invader species, which may become established along the roads through the area, especially where the area is disturbed. The construction phase of the development will almost certainly carry the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. The following alien invasive and exotic plant species were recorded on the site during the surveys (Table 9) although no eradication is needed since these species do not occur on the proposed development footprint:

Table 8. List of exotic plant species of the study area

Species	Category
Argemone ochroleuca	1b
Acacia cyclops	1b
Acacia saligna	1b
Eucalyptus spp.	1b

Species	Category
Opuntia ficus-indica	1b

5.2.5 GENERAL

An important aspect relating to the proposed development should be to protect and manage the biodiversity (structure and species composition) of the Saldanha Limestone Strandveld, Saldanha Flats Strandveld and Hopefiled Sand Fynbos vegeation types which are represented in the project area. Natural vegetation removal should be kept to a minimum during any future construction activities and only vegetation on the footprint areas should be removed. The unnecessary impact on the surrounding vegetation types and riverine ecosystems should be avoided as far as possible.

Considering the footprint area to form part of an area that is degraded (powerline corridors, old fields etc.), the impact on the vegetation of the larger area would be medium. Mitigation measures and bi-annual monitoring should therefore be implemented should the development be approved.

5.3 FAUNAL ASSESSMENT

5.3.1 OVERVIEW

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 animals 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. If any rare or endangered species are discovered in the desktop study that will be negatively influenced by the proposed development, specialist surveys will be conducted.

5.3.2 RESULTS OF DESKTOP SURVEY AND SITE VISITS DURING NOVEMBER 2015

A survey was conducted during Novembher 2015 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the QDS. The area represents microphyllous woodland with some broadleaf elements in isolated areas. Detailed fauna species list for the area is included in Appendix C (birds), D (mammals) and E (herpetofauna).

During the site visits mammals, birds, reptiles, and amphibians were identified by visual sightings through random transect walks. In addition, mammals were also recognized as present by means of spoor, droppings, burrows or roosting sites. The 500 meters of adjoining properties were scanned for important fauna habitats.

The cultivated nature of the primary development area, and the associated loss of natural vegetation and habitat, means that the faunal diversity is much reduced in this area relative to intact, natural veld. The expansion of industrial development in the region is slowly forcing out many of the more disturbance sensitive species that were once present in the area, such as Bateared Foxes (*Otocyon megalotis*), korhaans and harriers (Helme, 2014).

a. Mammal Habitat Assessment

Fynbos cannot support herds of large mammals since the nutrient poor soils on which it grows do not provide enough nitrogen for the protein requirements of large mammals. However, smaller mammals common to fynbos are chacma baboons, klipspringers, grysbok, dassies, mongooses, and the striped mouse.

Large mammals such as black rhino that occurred historically at the site, are absent from the area, owing to anthropogenic impacts in recent centuries. Many of the larger species have disappeared naturally. Today we know that elephants, hippopotami, black rhino, eland, buffalo, hartebeest and lion did occur here, but were driven away by humans.

Species such as the quagga, bluebuck and Cape lion have become extinct. The leopard, brown hyena and mountain zebra are three endangered species which are found in very limited numbers in fynbos. Larger game species is today confined to game reserves and national parks in South Africa and therefore will not occur naturally in the study area. This loss of large species means that the mammal diversity at the site is far from its original natural state not only in terms of species richness but also with regards to functional roles in the ecosystem.

Typical species that are still found abundantly in fynbos areas are the bontebok, grysbok (totally dependent on the fynbos for survival), klipspringer, baboons, black- backed jackal, caracal and grey rhebuck. Species that occur in limited numbers because they move from adjoining veld types are the bush-pig, kudu, red rhebuck, oribi, duiker, steenbok, bushbuck and blue duiker. As far as small mammals are concerned, there are quite a few endangered and endemic species in fynbos.

The following mammal species of Conservation Concern could potentially occur on site, or more likely in the Medium conservation value areas of natural vegetation along the corridors: White-tailed Rat *Mystromys albicaudatus* (Endangered); Grant's Golden Mole *Eremitalpa granti* (Vulnerable) and Cape Golden Mole *Chrysochloris asiatica* (Data Deficient). The likelihood of any of these species occurring in viable numbers in the study area is deemed to be very low.

b. Avifaunal Habitat Assessment

The avifauna is currently fairly typical of the agricultural landscape in this region, and two Species of Conservation Concern (SCC) have 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).

Three bird habitats was identified in the area namely fynbos, starndveld and agricultural fields. Isolated exotic bushclumps are often used as perches or breeding areas for the birds of prey in the area, although only a few stands was observed.

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

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.

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. Blue Cranes, Black Korhaan and Common Quail 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.

c. Reptiles and Amphibians Assessment

Typical species associated with arid and semi-arid habitat types occur in the study area. Venomous species such as the puff adder and cape cobra was confirmed for the project area, although the presence of these snakes is dependant on the presence of their prey species (rodents, frogs etc.). The general habitat type for reptiles consists of shrubveld with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks and other reptiles. The region supports large populations of Angulate Tortoise (Chersina angulata; Least Threatened), and quite a few young tortoises were seen in the study area and nearby during the site visit.

There are no confirmed records of threatened reptiles from the exact footprint area, and it is unlikely that any persist, due to the history of cultivation. The following Species of Conservation Concern could potentially occur on site, or more likely in the Medium conservation value areas of natural vegetation along the corridors: Cape Sand Snake *Psammophis leightoni* (Vulnerable; Bates et al 2014); Kasner's Dwarf Burrowing Skink *Scelotes kasneri* (west-coast endemic; Near Threatened; Bates et al 2014); Gronovi's Dwarf Burrowing Skink *Scelotes gronovii* (west-coast endemic; Near Threatened; Bates et al 2014); Blouberg Dwarf Burrowing Skink *Scelotes montispectus* (Near Threatened; Bates et al 2014); Southern Adder *Bitis armata* (Vulnerable; Bates et al 2014). The likelihood of any of these species occurring in viable numbers in the study area is deemed to be very low.

Although fynbos is not particularly rich in reptiles and amphibians, many of the species living there are both endemic and threatened. The very rare geometric tortoise is found in only a few surviving fynbos areas and is regarded as the world's second rarest tortoise.

The Cape has more than half of South Africa's frog species. Furthermore, of the 62 different frogs occuring here, 29 are endemic being found nowhere else on earth. The Table Mountain ghost frog lives only in the mountain's fast-flowing rocky streams. The tiny micro frog and Cape platanna are restricted to a few surviving vleis in the south-west Cape. Besides these, a number of other endemic frogs also occur in fynbos. However, the amphibians appear to be poorly represented on site considering that nbo drainage channels or pans occur in the area. Small dams and the Langebaan lagoon represent the most suitable habitat for the few amphibian species that could occur in the area.

d. Red data species

According to the existing databases and field survey the following number of fauna species included in the IUCN red data lists can potentially be found in the study area (Table 10):

Table 9. Red data list of potential fauna for the study area

English Name	Conservation status
AVIFAUNA	
African Marsh-Harrier	Vulnerable
African Penguin	Endangered
Antarctic tern	Endangered
Bank Cormorant	Endangered
Black Harrier	Endangered
Black stork	Vulnerable
Blue Crane	Vulnerable
Cape Cormorant	Endangered
Cape gannet	Vulnerable
Caspian tern	Vulnerable
Chestnut-banded plover	Near Threatened
Crowned cormorant	Near Threatened
Eurasian curlew	Near Threatened
Great White Pelican	Vulnerable
Greater Flamingo	Near Threatened
Lanner Falcon	Vulnerable
Lesser Flamingo	Near Threatened
Ludwig's Bustard	Endangered
Macoa Duck	Endangered
Martial Eagle	Endangered
Peregrine Falcon	Near Threatened
Secretarybird	Vulnerable
Southern Black Korhaan	Vulnerable
Verreauxs' Eagle	Vulnerable
White chinned petrel	Vulnerable
MAMMALS	
Bontebok	Vulnerable
Cape Golden Mole	Data Deficient
Grant's Golden Mole	Vulnerable
Reddish-gray Musk Shrew	Data Deficient
Greater Red Musk Shrew	Data Deficient
Forest Shrew	Data Deficient
Lesser Dwarf Shrew	Data Deficient

English Name	Conservation status
Herpetofauna	
Black Girdled Lizard	Near Threatened (SARCA 2014)
Bloubergstrand Dwarf Burrowing Skink	Near Threatened (SARCA 2014)
Cape Caco	Vulnerable
Cape Dwarf Chameleon	Vulnerable (SARCA 2014)
Cape Sand Snake	Vulnerable (SARCA 2014)
Gronovi's Dwarf Burrowing Skink	Near Threatened (SARCA 2014)
Kasner's Dwarf Burrowing Skink	Near Threatened (SARCA 2014)
Large-scaled Girdled Lizard	Near Threatened (SARCA 2014)

The following general observations with regards to the study area can be made. Recommendations and mitigating measures need to be implemented to ensure the survival of these species other fauna habitats and feeding grounds:

- The impact of the proposed development on the red data and other mammal species will mostly have a medium probability as a result of the following:
    - Large sections of the project area have been modified by agriculture and do not represent optimal habitat for many of the red data species listed above;
    - The habitat of the red data species such as waterbirds and birds associated with the Langebaan Lagoon and Coastline is off site and will not be impacted on by the development.
    - 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 (blue crane), although other species with large home ranges (e.g martial eagle) are not directly threatened by habitat loss. The impact of development on the red data species would therefore be less than predicted.
    - Larger mammal species such as black rhino and roan antelope no longer occur naturally in the area and are confined to nature reserves;
    - The development would not have a significant impact on the above mentioned red data fauna since the herbaceous layer will be preserved below the powerline corridor while adequate natural habitat/vegetation would be available on the peripheral habitats outside the study areas.
    - The habitats of the fauna will not be significantly fragmented since the area below the powerline and pipeline corridors will still be available for

fauna to move through. Development also won't influence the natural feeding and movement patterns of the existing fauna in the area. Peripheral impacts on the larger area should however still be avoided.

- The protection of different habitat types in the area will be important to ensure the survival of the different animals due to each species' individual needs and requirements. Sufficient natural corridor sections should be protected around the proposed development footprints to allow fauna to move freely between the different vegetation units on the property. In this regard the surrounding shrubveld and fynbos outside the footprint of the thermal power plant and associated infrastructure that will be preserved beneath the powerline corridors, will be more than sufficient as corridors.

The following general mitigation and management actions taken on site, the impact on faunal populations should be low.

- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process;
- No animals may be poached during the construction of the Thermal Power Plant. Many animals are protected by law and poaching or other interference could result in a fine or jail term;
- Do not feed any wild animals on site;
- Waste bins and foodstuffs should be made scavenger proof;
- Roads in the area should be designed without pavements to allow for the movement of small mammals;
- Power line structures on the site that are associated with the Thermal Power Plant 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:
    - Increasing separation between conductors to achieve adequate separation for the species involved (larger birds, raptors);
    - Covering energized parts and / or covering grounded parts with materials appropriate for providing incidental contact protection to birds;
    - 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;

- A detailed avifauna study should address the impact of the power line on birds in more detail.

- Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the construction and operational phases. Monitoring of specific 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.

6 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE FAUNA AND FLORA

An environmental impact is defined as a change in the environment, be it the physical/chemical, biological, cultural and or socio-economic environment. Any impact can be related to certain aspects of human activities in this environment and this impact can be either positive or negative. It could also affect the environment directly or indirectly and the effect of it can be cumulative. There are three major categories of impacts on biodiversity namely:

- Impacts on habitat resulting in loss, degradation and / or fragmentation.
- Direct impacts on fauna and flora and species, for example plants and animals that are endemic / threatened / special to a particular habitat will not be able to survive if that habitat is destroyed or altered by the development.
- Impact on natural environmental processes and ecosystem functioning. This can lead to an accumulated effect on both habitat and species.

There are three levels at which biodiversity can be approached - namely the genetic, the species and the ecosystem levels. Genetic diversity refers to the variation of genes within species. Species diversity refers to the variety and abundance of species within a geographic area. Ecosystem diversity can refer to the variety of ecosystems within a certain political or geographical boundary (National Environmental Management Biodiversity Act, 2004). This biodiversity assessment focused on the description of ecosystem- and species-related biodiversity. It can be expected that if ecosystem diversity is managed effectively, species and genetic diversity should also be protected. Emphasis was therefore placed on the ecosystem diversity (landscape/habitat types) within the proposed development area, with reference to biota observed and expected to utilise these landscapes or habitat types.

6.1 POTENTIAL IMPACTS

6.1.1 Direct habitat destruction

6.1.1.1 Description of impact:

The construction of the thermal power plant and associated infrastructure will result in loss of and damage to natural habitats. During the construction phase and maintenance of this infrastructure, some habitat modification and alteration inevitably takes place. The areas below the powerlines will have to be cleared (slashed) of excess vegetation at regular intervals in order to allow access to the area for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the power line

conductors and to minimize the risk of fire which can result in electrical flashovers. These activities will have an 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 infrastructure.

6.1.1.1.1 Destruction or loss of floral diversity or vegetation communities

The following major impacts of the development will potentially impact on the flora of the site:

- Loss of threatened, “near-threatened” and endemic taxa: The anticipated loss of some of the woodland habitats that support endemic species will result in the local displacement of endemic listed flora;
- The construction will lead to the loss of individual plants such as trees and shrubs that will be cleared on the footprint area;
- The construction activities can impact on surrounding vegetation by dust and altered surface run-off patterns;
- The disturbance of the area could lead to an increase in the growth of alien vegetation;

6.1.1.1.2 Loss of faunal diversity through migration and decline in animal numbers

The following major impacts of the development will potentially impact on the faunal habitats of the site:

- The construction activities by heavy vehicles and back-actors could cause fauna mortalities and even impact on small populations of rare / threatened fauna species (e.g. amphibian species in small wetlands);
- Habitat loss and construction activities will force animals out of the area and animal numbers will decrease. This impact could also take place because of hunting and snaring of animals in natural areas.
- When the area is rehabilitated and the new habitats begin to establish, animals will start to return to the area.
- Changes in the community structure: It is expected that the faunal species composition will shift, due to an anticipated loss in habitat surface area. In addition, it is predicted that more generalist species (and a loss of functional guilds) will dominate the study area. Attempts to rehabilitate will attract taxa with unspecialized and generalist life-histories. It is predicted that such taxa will persist

for many years before conditions become suitable for succession to progress.

6.1.1.2 Mitigation measures:

- 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 fauna 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;
- Creation of new tracks must be minimised within the servitudes. Creation of new access tracks should be minimised in all high sensitivity areas shown in ecological sensitivity map.
- A botanist should undertake a walkthrough survey prior to construction in order to ensure that the proposed pylon positions are appropriate, and must confirm in writing that the positions are appropriate and do in fact minimise botanical impact.
- The servitude should not be bush-cut more than once every five years.
- All woody alien invasive vegetation must be removed from the servitude within one year of power line construction, and follow-ups conducted once every two years thereafter.
- An ECO should be on site at least weekly during the construction phase and must be responsible for ensuring compliance with all environmental conditions imposed.
- Construction should ideally take place during the dry season (November to May) to minimise impacts on bulbs and annuals.
- Search and rescue should be considered only as a last resort and sensitive areas and SCC should be avoided first. If search and rescue is deemed necessary, a safe receiving environment must be identified first, in collaboration with Cape Nature. Where protected flora will need to be cleared permits should be obtained from the relevant authority.
- Peripheral impacts around the footprint area on the surrounding vegetation of the area should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the

rehabilitation of the site should be prioritised after the construction has been completed. Monitoring should be conducted bi-annually for a period of at least 3 years to ensure the site is successfully rehabilitated.

- 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. The sensitive habitats include the sand fynbos and natural stardnveld habitats.
- All development activities should be restricted to specific recommended areas. The Environment Control Officer (ECO) should control these areas. Storage of equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. The entire development footprint should be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area. This would only be applicable to the construction phase of the proposed development.
- The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation.
- Where holes for poles pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling during planting of the poles along the lines.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors 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.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna and flora of the area.

6.1.2 Habitat fragmentation

6.1.2.1 Description of impact:

The construction of the thermal power plant, access road, pipeline corridor and power line will result in natural movement patterns being disrupted for a limited period of time and, to a varying degree depending on how different species react to these barriers will result in the fragmentation of natural populations, although the impact will be minimal and restricted to the construction phase.

6.1.2.2 Mitigation measures:

- The actual construction of the thermal power plant will not have a direct significant impact on the fauna and flora 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 directly impact on clearing of plant species of conservation concern 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 fauna species 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, although Cape Nature could also provide specific guidance with regards to future developments;
- 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 the sensitive features such as fynbos 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.

6.1.3 Increased Soil erosion and sedimentation

6.1.3.1 Description of impact:

The construction activities associated with the development may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora.

6.1.3.2 Mitigation measures:

The following mitigation measures should be implemented to prevent erosion along slopes and drainage channels during trench excavation:

- When possible, topsoil stripping and excavation activities should be scheduled for the low rainfall season (winter).
- The project should be divided into as many phases as possible, to ensure that the exposed areas prone to erosion are minimal at any specific time.
- Cover disturbed soils as completely as possible, using vegetation or other materials. Topsoil should not be stored for longer than 3 months otherwise any seedbank that may be contained will not be viable.
- Have both temporary (during construction) and permanent erosion control plans:
    - Temporary control plans should include:
        - Brush-packing of exposed areas to prevent overgrazing and subsequent erosion;
        - Silt fencing;
        - Temporary silt trap basins;
        - Short term seeding or mulching of exposed soil areas (particularly on slopes);
        - Limitations on access for heavy machinery and the storage of

materials to avoid soil compaction;

- Permanent erosion control plans should focus on the establishment of stable native vegetation communities.

- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.
- Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth.
- Gravel roads must be well drained in order to limit soil erosion.

6.1.4 Soil and water pollution

6.1.4.1 Description of impact:

Construction work for the proposed development will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora. During the constructional phase heavy machinery and vehicles as well as sewage and domestic waste from workers would be the main contributors to potential pollution problems.

6.1.4.2 Mitigation measures:

- Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. The ECO should enforce this rule rigorously.
- Chemicals to be stored on an impervious surface protected from rainfall and storm water run-off.
- Spill kits should be on-hand to deal with spills immediately;
- Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance;
- All construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.

6.1.5 Air pollution

6.1.5.1 Description of impact:

The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development are primarily related to human health and ecosystem damage. The proposed development will typically comprise the following sources and associated air quality pollutants:

- Stockpiling (particulate matter);
- Materials handling operations (truck loading & unloading, tipping, stockpiling);
- Vehicle entrainment on paved and unpaved roads;
- Windblown dust-fugitive emissions (stockpiles).

One of the primary impacts on the biophysical environment is linked to emission of dusts and fumes from both the transportation system. Dust pollution will impact the most severe during the construction phase. Construction vehicles and equipment are the major contributors to the impact on air quality. Dust is generated during site clearance for the construction of infrastructure. Diesel exhaust gasses and other hydrocarbon emissions all add to the deterioration in air quality during this phase. Vehicles travelling at high speeds on dirt roads significantly aggravate the problem.

Although the potential for severe fugitive dust impacts is greatest within 100 m of dust-generating activities, there is still the potential for dust to affect vegetation up to five kilometres or more downwind from the source. Dust deposited on the ground may cause changes in soil chemistry (chemical effects), and may over the long-term result in changes in plant chemistry, species composition and community structure. Sensitivities to dust deposition of the various plant species present in the area are not known. It is therefore difficult to predict which species may be susceptible.

Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions.

6.1.5.2 Mitigation measures:

- Topsoil should not be stored for longer than 3 months otherwise any seedbank that may be contained will not be viable. Only locally indigenous grass species and shrubs should be used for rehabilitation purposes;
- Dust suppression must be undertaken in conjunction with a dust monitoring programme that places dust deposition gauges or receiving buckets, directional dust collection receptacles, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the

mine and in adjacent areas. An air quality management programme must be implemented to ensure compliance with the National Environmental Management: Air Quality Act 39 of 2004. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution;

- Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation;
- A speed limit (preferably 40 km/hour) should be enforced on dirt roads.

6.1.6 Spread and establishment of alien invasive species

6.1.6.1 Description of impact:

The construction of the thermal power plant almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

6.1.6.2 Mitigation measures:

- Topsoil should not be stored for longer than 3 months otherwise any seedbank that may be contained will not be viable. Only locally indigenous grass species and shrubs should be used for rehabilitation purposes.
- Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. The Argentine ant is nearly impossible to eradicate once it has established itself.
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.

- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Specific “problem areas” where clearing needs to be done with extreme caution to prevent impact on surrounding natural vegetation include:
    - Sand fynbos areas
    - Natural strandveld habitats
- Ongoing, annual alien plant management must be undertaken in the High and Medium sensitivity sections of the servitudes. Methodology used must comply with DWAF methodology for control of Acacia saligna and Acacia cyclops
- Key elements include: alien clearing must be undertaken by well trained teams using the right equipment; all stems must be cut by hand (not heavy machinery); all cut stumps must immediately (within 5 minutes) be painted with a suitable herbicide that contains a visible dye (in order to prevent resprouting, and to ensure that all stems are painted); no spraying of herbicide; cut stems must be neatly stacked at the outside edges of the servitudes, or preferably removed from the servitudes to an approved organic waste dump site. Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
- Bi-annual monitoring should be undertaken by an independent consultant to ensure that alien vegetation is being cleared appropriately from the High sensitivity areas, and to ensure that these areas are not being bushcut more than once every ten years.

6.1.7 Negative effect of human activities and road mortalities

6.1.7.1 Description of impact:

An increase in human activity on the site and surrounding areas is anticipated. The risk of snaring, killing and hunting of certain faunal species is increased. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. 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 arising from cooking fires, improperly disposed cigarettes etc.

Large numbers of fauna are also killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle

itself in the case of avifauna or flying invertebrates. The impact is intensified at night, especially for flying insects, as result of their attraction to the lights of vehicles.

6.1.7.2 Mitigation measures:

- The minimum staff should be accommodated on the site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site.
- The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals.
- Maintain proper firebreaks around entire development footprint.
- Educate construction workers regarding risks and correct disposal of cigarettes.
- More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 40 km/hour). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences).
- Travelling at night should be avoided or limited as much as possible.

6.2 IMPACT ASSESSMENT MATRIX

Table 11 indicate the impacts described above and specific ratings of significance the impact will potentially have on the ecological components of the study area:

Table 10. Impact assessment Matrix

Impacts	Probability	Duration	Scale	Magnitude (WOM)	Magnitude (WM)	Scoring (WOM)	Scoring (WM)
1. Direct habitat destruction	5	5	1	8	6	70 (High)	60 (Moderate-High)
2. Habitat fragmentation	5	5	2	8	6	75 (Very High)	65 (High)
3. Soil erosion	4	4	3	8	2	60 (High)	36 (low)
4. Soil and water pollution	4	4	3	6	2	52 (moderate)	36 (low)
5. Air pollution (dust)	5	4	3	8	2	75 (High)	45 (Moderate)
6. Spread and establishment of alien invasives	3	4	2	6	2	36 (Low)	24 (Low)
7. Negative effect of human activities	4	3	2	6	2	44 (Moderate)	28 (Low)

7 SENSITIVITY ANALYSIS AND ALTERNATIVE ASSESSMENT

Following the ecological surveys, the classification of the study area into different sensitivity classes and development zones was based on information collected at various levels on different environmental characteristics. Factors which determined sensitivity classes were as follows:

- Presence, density and potential impact of development on rare, endemic and protected plant species;
- Conservation status of vegetation units;
- Soil types, soil depth and soil clay content;
- Previous land-use;
- State of the vegetation in general as indicated by indicator species.

Below included is the sensitivity map for the proposed development site which also includes the powerline alternative corridor (Figure 7). Only criteria applicable to the specific vegetation units were used to determine the sensitivity of the specific unit.

Table 12 compared the different powerline corridor route options.

Table 11. Preferred and alternative powerline corridors for the proposed Vortum Thermal Plant

Options	Positives	Negatives	Recommendation
Preferred route	• Adjacent to existing powerline corridor	• Longer route with more sloping terrain and more erodible soils (limestone) • More impact on natural starndveld vegetation and sand fynbos • Higher cost due to longer installation line	Medium Suitability, although will have HIGHER impact on vegetation amd LOWER impact on avifauna compared to alternative.
Alternative route	• Shorter route; • Less impact on natural vegetation; • Bisecting large areas of degraded old fields (low sensitivity) • Less sloping terrain	• Not following corridor of other powerlines, potential impact on avifauna more prominent	High Suitability. although will have LOWER impact on vegetation and fauna habitats amd HIGHER impact on avifauna compared to alternative

Table 11 indicate the sensitivity and suitability of the gas pipeline corridors. Any of the alternative pipeline corridors is considered more suitable compared top the preferred pipeline corridor that follows the seashore vegetation for a short stretch of the route.

Table 12. Preferred and alternative gas pipeline corridors for the proposed Vortum Thermal Plant

Options	Positives	Negatives	Recommendation
Preferred route	• Mostly through slightly degraded to degraded terrain	• Longer route with more sloping terrain and more erodible soils (limestone) • More impact on natural strandveld vegetation and seashore vegetation • Higher cost due to longer installation line	Medium Suitability, although will have HIGHER impact on vegetation compared to alternative.
Alternative route 1 & 2	• Shorter route; • Less impact on natural vegetation; • Bisecting large areas of degraded old fields (low sensitivity) • Less sloping terrain • Following already impacted roadside servitudes	• None	High Suitability. although will have LOWER impact on vegetation and fauna habitats

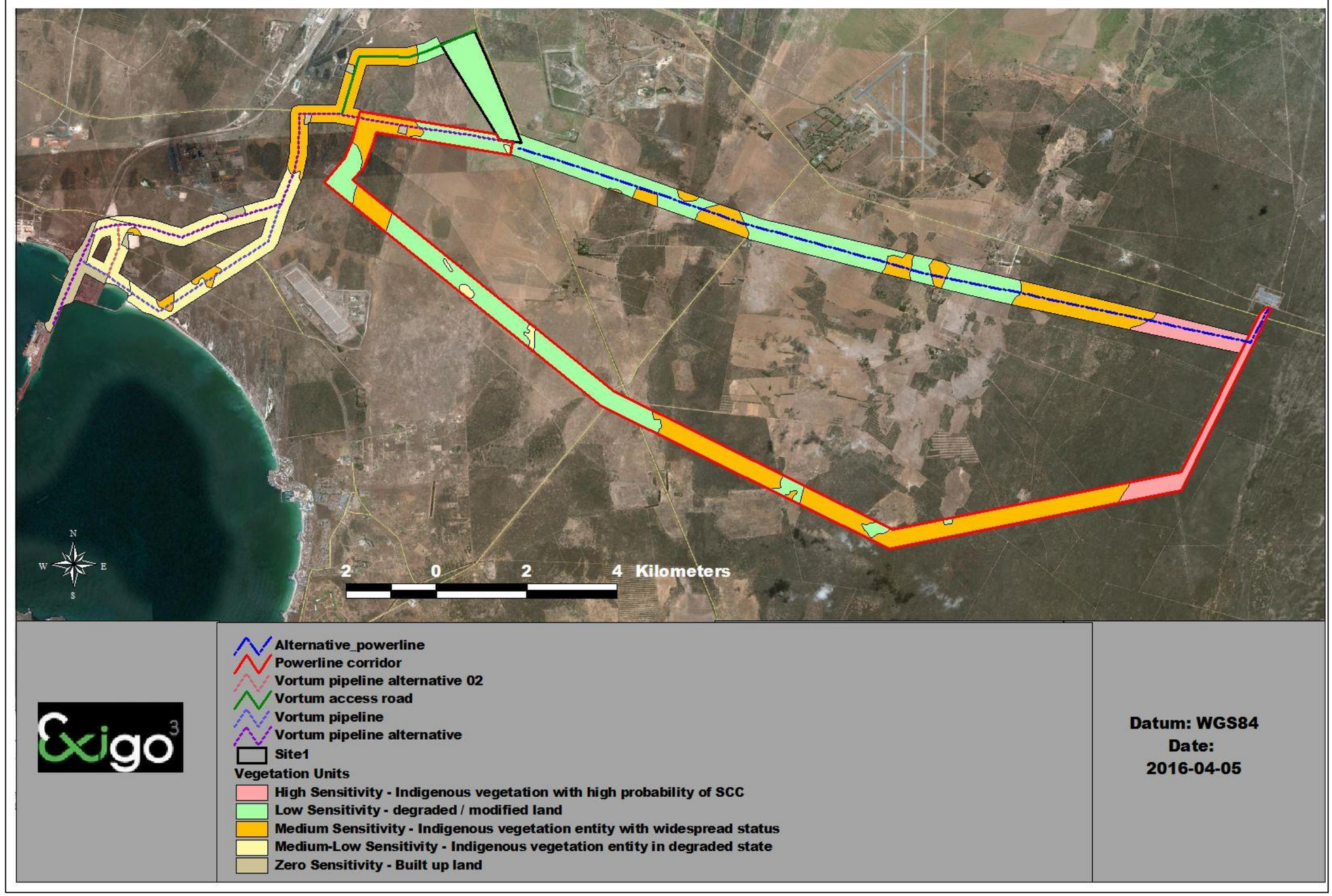

Figure 9. Sensitivity Map of the proposed development site and alternative option for the powerline corridor and gas pipelines

8 DISCUSSION

Most development has an impact on the environment. In this case the area on which the proposed Vortum Thermal Plant and associated infrastructure (powerline, pipelines etc.) will be built will be cleared, therefore directly impacting on the environment. Most of the vegetation will be completely modified during the construction or slashed (powerlines). Detailed ecological (fauna habitat & flora) surveys were conducted during November 2015 to verify the ecological sensitivity and ecological components of the site at ground level.

The development will have a medium to high impact on the vegetation and general ecology of the area, due to the indigenous vegetation along the powerline corridors, and therefore an alternative was identified for the powerline corridor as recommended by Cape Nature.

Considering the results from the field surveys, mitigation needs to be implemented to prevent any negative impacts on the ecosystem, since some sections along the powerline and pipeline corridors is in a natural state. A sensitivity analyses was conducted to identify the most suitable site for the development. From these investigation and ecological surveys the following main observations was made:

- The old fields and other degraded areas (exotic bushclumps, built-up land) have a low sensitivity. These areas are highly suitable for the proposed developments. The Vortum Thermal Plant site is on old cultivated fields, while sections of the preferred and alternative powerline corridor is also located on these low sensitivity areas;
- The areas in close proximity to rural and industrial areas where alien species such as *Acacia cyclops* have invaded the natural vegetation have a Medium-Low Sensitivity. The development of the pipelines and powerlines through these areas can be supported;
- The natural vegetation associated with the Strandveld areas along the powerline corridors has a Medium Sensitivity. Mitigation is needed for the preservation of some sections of this natural vegetation entity, and the main mitigation would be to obtain a licence from the Western Cape authorities for the eradication or translocation of the protected flora . Erosion prevention should be implemented in the highly erodible calcareous soils associated with limestone bedrock. The herbaceous layer should preferably be preserved below the powerline corridor and managed through slashing during the entire lifetime of the project;
- The Sand Fynbos has a High Sensitivity due to t5he potential species of conservation concern occurring in the area. DFevelopment can only be supported in this area provided strict mitigation measures are implemented as stipulated in

this report.

Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat will be low. Specific mitigation relating to red data fauna includes the following:

- Disturbances in close vicinity of the development (periphery) should be limited to the smallest possible area in order to protect species habitat;
- Corridors between the development zones are also important to allow fauna to move freely between the areas of disturbance. The preservation of the shrub layer below the powerlines will play an important role in this regard and therefore habitat fragmentation for smaller mammals, birds and herpetofauna will be minimal.

A number of ecological potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance, including the following:

- Destruction or disturbance to ecosystems leading to reduction in the overall extent of a particular habitat;
- Impairment of the movement and/or migration of animal species resulting in genetic and/or ecological impacts (habitat fragmentation);
- Increased soil erosion;
- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species;
- Establishment and spread of declared weeds and alien invader plants;
- Soil and water pollution due to spillages;
- Air pollution as a result of dust;
- Negative effect of human activities and road mortality.

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. A monitoring plan is recommended for the construction phase of the development should the proposed application be approved.

9 CONCLUSION

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. If we can bring about a more integrated approach to living within our ecosystems, we are much more likely to save the fundamental structure of biodiversity. Positive contributions can be made even on a small scale such as within the proposed Vortum Thermal Power Plant and associated infrastructure. All stakeholders need to be involved to avoid a loss of biodiversity in the area.

The proposed development site will partially modify the natural vegetation and faunal habitats, although the shrub and herbaceous layer will be preserved below the powerline corridors. The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the development phase should be considered a high priority.

The proposed development should avoid sensitive areas such as natural sections of fynbos or areas with dense stands of protected flora.

Where sensitive areas of natural vegetation cannot be avoided, a number of mitigation measures have been recommended to minimise impacts (licence application for eradication of protected species). Negative impacts can be minimised by strict enforcement and compliance with an Environmental Management Plan which takes into account the recommendations for managing impacts detailed above.

Provided that the proposed development is consistent with the sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned development can be supported.

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APPENDIX A. PLANT SPECIES LIST FOR SITE

Tree & shrub species	Grass species	Dwarf shrubs, Forbs, succulents & geophytes
Acacia cyclops	*Avena sp*	*Agrimonia procera*
Acacia saligna	*Bromus diandrus*	*Aloe perfoliata*
Arctotheca calendula	*Bromus pectinatus*	*Argemone ochroleuca*
Aspalathus hispida	*Cynodon dactylon*	*Asparagus aethiopicus L.*
Buddleja glomerata	*Ehrharta calycina*	*Asparagus capensis*
Chrysanthemoides incana	*Ehrhasrta villosa*	*Asparagus exuvialis*
Clutia daphnoides	*Festuca scabra*	*Asparagus fasciculatus*
Didelta spinose	*Fingerhutia africana*	*Athanasia rugulosum*
Erica mammosa	*Lolium perennae*	*Berkheya rigida*
Eriocephalus africanus	*Stabera distachyos*	*Boophane haemanthoides*
Eucalyptus spp.	*Vulpia myuros*	*Brassica tournefortii*
Euclea racemose	*Wildenowia incurvata*	*Carpobrotus edulis*
Euphorbia burmanni		*Chamaesyce inaquiletera*
Euphorbia mauritanica		*Chrysanthemoides incana*
Exomis microphylla		*Conicosia pugioniformis*
Gymnosporia spp.		*Conicosia pugioniformis*
Leucadendrom foedulum		*Cotyledon orbiculata*
Leucadendron salignum		*Dimorphotheca pluvialis*
Lycium ferrocissium		*Dimorphotheca sinuata*
Maytenus heterophylla		*Dorotheanthus bellidiformis*
Medicago polymorpha		*Drosanthemum hispidum*
Muraltia spinosa		*Drosanthemum spp.*
Muraltia spinosa		*Echium plantagineum*
Nylandtia spinosa		*Ehrharta villosa*
Olea capensis		*Erica mammosa*
Olea europaeae		*Eriocephalus africanus*
Osyris compressa		*Erodium moschatum*
Passerina vulgaris		*Felicia filifolia*
Pteronia divaricata		*Felicia heterophylla*
Putterlicka pyracantha		*Felicia tenella*
Ruschia spp.		*Galenia fruticose*
Searsia dissecta		*Helichrysum niveum*
Searsia glauca		*Helichrysum niveum*
Searsia laevigata		*Hermannia prismatocarpa*
Staavia radiatas		*Hermannia prismatocarpa*
Stachys ballota		*Jordaaniella dubia*

Tree & shrub species	Grass species	Dwarf shrubs, Forbs, succulents & geophytes
Tetragonia fruticosa		*Limeum aethiopicum*
Thesium capitatum		*Mesembryanthemum crystallinum*
Zygophyllum cordifolium		*Mesembryanthemum gueriachum*
Zygophyllum morgsana		*Oedera uniflora*
		Oncosiphon frutticosum
		Opuntia ficus-indica
		Oxalis pes-caprae
		Oxalis versicolor
		Pelargonium myrrhifolium
		Pelargonium myrrhifolium
		Raphanus rapistrum
		Ruschia macowani
		Salaxis axillaris
		Senecio burchellii
		Senecio elegans
		Senecio elegans
		Solanum supinum
		Torilis arvensis
		Trachyandra divaricata
		Tylecodon wallichiii
		Zalusianskya villosa

APPENDIX B. PLANT SPECIES LIST FOR QDS GRID SQUARES

Family	*Species*	Threat status	SA Endemic
AIZOACEAE	*Aizoon paniculatum L.*	LC	No
AIZOACEAE	*Galenia africana L.*	LC	No
AIZOACEAE	*Tetragonia fruticosa L.*	LC	No
AIZOACEAE	*Tetragonia rosea Schltr.*	LC	No
AMARYLLIDACEAE	*Amaryllis belladonna L.*	LC	No
AMARYLLIDACEAE	*Boophone haemanthoides F.M.Leight.*	LC	No
AMARYLLIDACEAE	*Brunsvigia orientalis (L.) Aiton ex Eckl.*	LC	No
AMARYLLIDACEAE	*Gethyllis afra L.*	LC	No
AMARYLLIDACEAE	*Gethyllis ciliaris (Thunb.) Thunb. subsp. ciliaris*	NT	No
AMARYLLIDACEAE	*Gethyllis lanuginosa Marloth*	LC	No
AMARYLLIDACEAE	*Haemanthus pubescens L.f. subsp. pubescens*	LC	No
AMARYLLIDACEAE	*Hessea mathewsii W.F.Barker*	CR	No
AMARYLLIDACEAE	*Strumaria chaplinii (W.F.Barker) Snijman*	EN	No
AMARYLLIDACEAE	*Strumaria tenella (L.f.) Snijman subsp. tenella*	LC	No
ANACARDIACEAE	*Searsia dissecta (Thunb.) Moffett*	LC	No
ANACARDIACEAE	*Searsia glauca (Thunb.) Moffett*	LC	No
ANACARDIACEAE	*Searsia laevigata (L.) F.A.Barkley var. laevigata forma laevigata*	Not Evaluated	No
ANACARDIACEAE	*Searsia pterota (C.Presl) Moffett*	LC	No
ANACARDIACEAE	*Searsia undulata (Jacq.) T.S.Yi, A.J.Mill. & J.Wen*	LC	No
ANTHERICACEAE	*Chlorophytum comosum (Thunb.) Jacques*	LC	No
ANTHERICACEAE	*Chlorophytum triflorum (Aiton) Kunth*	LC	No
APIACEAE	*Annesorhiza grandiflora (Thunb.) M.Hiroe*	LC	No
APIACEAE	*Annesorhiza macrocarpa Eckl. & Zeyh.*	LC	No
APIACEAE	*Arctopus dregei Sond.*	NT	No
APIACEAE	*Arctopus echinatus L.*	LC	No
APIACEAE	*Berula thunbergii (DC.) H.Wolff*	LC	No
APIACEAE	*Capnophyllum africanum (L.) Gaertn.*	NT	No
APIACEAE	*Capnophyllum leiocarpon (Sond.) Manning & Goldblatt*	Declining	No
APIACEAE	*Centella affinis (Eckl. & Zeyh.) Adamson var. affinis*	LC	No
APIACEAE	*Cynorhiza meifolia (Eckl. & Zeyh.) Magee*	DDD	No
APIACEAE	*Cynorhiza typica Eckl. & Zeyh.*	LC	No
APIACEAE	*Dasispermum hispidum (Thunb.) Magee & B.-E.van Wyk*	LC	No
APIACEAE	*Lichtensteinia obscura (Spreng.) Koso-Pol.*	LC	No
APIACEAE	*Torilis arvensis (Huds.) Link*	Not Evaluated	No
APOCYNACEAE	*Asclepias crispa P.J.Bergius var. crispa*	LC	No
APOCYNACEAE	*Cynanchum obtusifolium L.f.*	LC	No
APOCYNACEAE	*Microloma sagittatum (L.) R.Br.*	LC	No
APOCYNACEAE	*Orbea variegata (L.) Haw.*	LC	No

Family	*Species*	Threat status	SA Endemic
ASPARAGACEAE	*Asparagus aethiopicus L.*	LC	No
ASPARAGACEAE	*Asparagus capensis L. var. capensis*	LC	No
ASPARAGACEAE	*Asparagus declinatus L.*	LC	No
ASPARAGACEAE	*Asparagus exuvialis Burch. forma exuvialis*	Not Evaluated	No
ASPARAGACEAE	*Asparagus fasciculatus Thunb.*	LC	No
ASPARAGACEAE	*Asparagus kraussianus (Kunth) J.F.Macbr.*	LC	No
ASPARAGACEAE	*Asparagus lignosus Burm.f.*	LC	No
ASPARAGACEAE	*Asparagus retrofractus L.*	LC	No
ASPARAGACEAE	*Asparagus rubicundus P.J.Bergius*	LC	No
ASPARAGACEAE	*Asparagus undulatus (L.f.) Thunb.*	LC	No
ASPHODELACEAE	*Aloe microstigma Salm-Dyck subsp. framesii (L.Bolus) Glen & D.S.Hardy*	NT	No
ASPHODELACEAE	*Aloe perfoliata L.*	LC	No
ASPHODELACEAE	*Bulbine annua (L.) Willd.*	LC	No
ASPHODELACEAE	*Bulbine favosa (Thunb.) Schult. & Schult.f*	LC	No
ASPHODELACEAE	*Bulbine minima Baker*	LC	No
ASPHODELACEAE	*Bulbine praemorsa (Jacq.) Spreng.*	LC	No
ASPHODELACEAE	*Bulbine sedifolia Schltr. ex Poelln.*	LC	No
ASPHODELACEAE	*Bulbinella cauda-felis (L.f.) T.Durand & Schinz*	LC	No
ASPHODELACEAE	*Bulbinella nutans (Thunb.) T.Durand & Schinz subsp. nutans*	LC	No
ASPHODELACEAE	*Bulbinella triquetra (L.f.) Kunth*	LC	No
ASPHODELACEAE	*Kniphofia uvaria (L.) Oken*	LC	No
ASPHODELACEAE	*Trachyandra ciliata (L.f.) Kunth*	LC	No
ASPHODELACEAE	*Trachyandra divaricata (Jacq.) Kunth*	LC	No
ASPHODELACEAE	*Trachyandra hispida (L.) Kunth*	LC	No
ASPHODELACEAE	*Trachyandra revoluta (L.) Kunth*	LC	No
ASPHODELACEAE	*Trachyandra scabra (L.f.) Kunth*	LC	No
ASTERACEAE	*Amellus asteroides (L.) Druce subsp. asteroides*	LC	No
ASTERACEAE	*Amellus capensis (Walp.) Hutch.*	VU	No
ASTERACEAE	*Amellus tenuifolius Burm.*	LC	No
ASTERACEAE	*Anthemis cotula L.*	Not Evaluated	No
ASTERACEAE	*Arctotheca calendula (L.) Levyns*	LC	No
ASTERACEAE	*Arctotheca populifolia (P.J.Bergius) Norl.*	LC	No
ASTERACEAE	*Arctotis hirsuta (Harv.) Beauverd*	LC	No
ASTERACEAE	*Arctotis revoluta Jacq.*	LC	No
ASTERACEAE	*Berkheya rigida (Thunb.) Erwart, Jean White & B.Rees*	LC	No
ASTERACEAE	*Chrysanthemoides incana (Burm.f.) Norl.*	LC	No
ASTERACEAE	*Chrysocoma ciliata L.*	LC	No
ASTERACEAE	*Conyza canadensis (L.) Cronquist*	Not Evaluated	No
ASTERACEAE	*Cotula coronopifolia L.*	LC	No
ASTERACEAE	*Cotula duckittiae (L.Bolus) K.Bremer & Humphries*	VU	No

Family	*Species*	Threat status	SA Endemic
ASTERACEAE	*Cotula eckloniana (DC.) Levyns*	EN	No
ASTERACEAE	*Cotula filifolia Thunb.*	CR	No
ASTERACEAE	*Cotula turbinata L.*	LC	No
ASTERACEAE	*Didelta carnosa (L.f.) Aiton var. carnosa*	LC	No
ASTERACEAE	*Didelta carnosa (L.f.) Aiton var. tomentosa (Less.) Roessler*	LC	No
ASTERACEAE	*Dimorphotheca sinuata DC.*	LC	No
ASTERACEAE	*Dimorphotheca tragus (Aiton) B.Nord.*	LC	No
ASTERACEAE	*Eriocephalus africanus L. var. paniculatus (Cass.) M.A.N.Müll.,P.P.J.Herman & Kolberg*	LC	No
ASTERACEAE	*Eriocephalus racemosus L. var. affinis (DC.) Harv.*	LC	No
ASTERACEAE	*Eriocephalus racemosus L. var. racemosus*	LC	No
ASTERACEAE	*Euryops linifolius (L.) DC.*	LC	No
ASTERACEAE	*Euryops multifidus (Thunb.) DC.*	LC	No
ASTERACEAE	*Felicia bergeriana (Spreng.) O.Hoffm.*	LC	No
ASTERACEAE	*Felicia dregei DC.*	LC	No
ASTERACEAE	*Felicia elongata (Thunb.) O.Hoffm.*	VU	No
ASTERACEAE	*Felicia elongata (Thunb.) O.Hoffm.*	VU	No
ASTERACEAE	*Felicia filifolia (Vent.) Burtt Davy subsp. schlechteri (Compton) Grau*	LC	No
ASTERACEAE	*Felicia heterophylla (Cass.) Grau*	LC	No
ASTERACEAE	*Felicia hyssopifolia (P.J.Bergius) Nees subsp. glabra (DC.) Grau*	LC	No
ASTERACEAE	*Felicia merxmuelleri Grau*	LC	No
ASTERACEAE	*Felicia merxmuelleri Grau*	LC	No
ASTERACEAE	*Felicia tenella (L.) Nees subsp. pusilla (Harv.) Grau*	LC	No
ASTERACEAE	*Foveolina tenella (DC.) Källersjö*	LC	No
ASTERACEAE	*Gymnodiscus capillaris (L.f.) DC.*	LC	No
ASTERACEAE	*Helichrysum bachmannii Klatt*	VU	No
ASTERACEAE	*Helichrysum cochleariforme DC.*	NT	No
ASTERACEAE	*Helichrysum indicum (L.) Grierson*	LC	No
ASTERACEAE	*Helichrysum litorale Bolus*	LC	No
ASTERACEAE	*Helichrysum niveum (L.) Less.*	LC	No
ASTERACEAE	*Helichrysum patulum (L.) D.Don*	LC	No
ASTERACEAE	*Helichrysum revolutum (Thunb.) Less.*	LC	No
ASTERACEAE	*Helichrysum tricostatum (Thunb.) Less.*	NT	No
ASTERACEAE	*Ifloga ambigua (L.) Druce*	LC	No
ASTERACEAE	*Ifloga verticillata (L.f.) Fenzl*	LC	No
ASTERACEAE	*Leucanthemum vulgare Lam.*	Not Evaluated	No
ASTERACEAE	*Leysera gnaphalodes (L.) L.*	LC	No
ASTERACEAE	*Metalasia densa (Lam.) P.O.Karis*	LC	No
ASTERACEAE	*Metalasia muricata (L.) D.Don*	LC	No
ASTERACEAE	*Nidorella foetida (L.) DC.*	LC	No
ASTERACEAE	*Oedera imbricata Lam.*	LC	No
ASTERACEAE	*Oedera uniflora (L.f.) Anderb. & K.Bremer*	LC	No

Family	*Species*	Threat status	SA Endemic
ASTERACEAE	*Oncosiphon sabulosum (Wolley-Dod) Källersjö*	LC	No
ASTERACEAE	*Oncosiphon suffruticosum (L.) Källersjö*	LC	No
ASTERACEAE	*Osteospermum grandiflorum DC.*	LC	No
ASTERACEAE	*Osteospermum pinnatum (Thunb.) Norl. var. pinnatum*	LC	No
ASTERACEAE	*Othonna arborescens L.*	LC	No
ASTERACEAE	*Othonna coronopifolia L.*	LC	No
ASTERACEAE	*Othonna cylindrica (Lam.) DC.*	LC	No
ASTERACEAE	*Othonna frutescens L.*	LC	No
ASTERACEAE	*Othonna mucronata Harv.*	LC	No
ASTERACEAE	*Othonna perfoliata (L.f.) Jacq.*	LC	No
ASTERACEAE	*Othonna quercifolia DC.*	LC	No
ASTERACEAE	*Poecilolepis ficoidea (DC.) Grau*	LC	No
ASTERACEAE	*Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt*		No
ASTERACEAE	*Pteronia divaricata (P.J.Bergius) Less.*	LC	No
ASTERACEAE	*Pteronia incana (Burm.) DC.*	LC	No
ASTERACEAE	*Pteronia onobromoides DC.*	LC	No
ASTERACEAE	*Pteronia onobromoides DC.*	LC	No
ASTERACEAE	*Pteronia uncinata DC.*	LC	No
ASTERACEAE	*Rhynchopsidium pumilum (L.f.) DC.*	LC	No
ASTERACEAE	*Senecio arenarius Thunb.*	LC	No
ASTERACEAE	*Senecio arniciflorus DC.*	LC	No
ASTERACEAE	*Senecio burchellii DC.*	LC	No
ASTERACEAE	*Senecio elegans L.*	LC	No
ASTERACEAE	*Senecio littoreus Thunb. var. hispidulus Harv.*	LC	No
ASTERACEAE	*Senecio littoreus Thunb. var. littoreus*	LC	No
ASTERACEAE	*Senecio maritimus L.*	LC	No
ASTERACEAE	*Senecio pterophorus DC.*	LC	No
ASTERACEAE	*Senecio sarcoides C.Jeffrey*	LC	No
ASTERACEAE	*Steirodiscus tagetes (L.) Schltr.*	VU	No
ASTERACEAE	*Tripteris calcicola J.C.Manning & Goldblatt*	VU	No
ASTERACEAE	*Tripteris sinuata DC. var. sinuata*	LC	No
ASTERACEAE	*Ursinia anethoides (DC.) N.E.Br.*	LC	No
ASTERACEAE	*Ursinia anthemoides (L.) Poir. subsp. anthemoides*	LC	No
BORAGINACEAE	*Amsinckia retrorsa Suksd.*	Not Evaluated	No
BORAGINACEAE	*Echiostachys spicatus (Burm.f.) Levyns*	EN	No
BORAGINACEAE	*Echiostachys spicatus (Burm.f.) Levyns*	EN	No
BORAGINACEAE	*Heliotropium supinum L.*	Not Evaluated	No
BORAGINACEAE	*Myosotis discolor Pers.*	Not Evaluated	No
BRASSICACEAE	*Barbarea verna (Mill.) Asch.*	Not Evaluated	No
BRASSICACEAE	*Heliophila acuminata (Eckl. & Zeyh.) Steud.*	LC	No

Family	*Species*	Threat status	SA Endemic
BRASSICACEAE	*Heliophila adpressa O.E.Schulz*	LC	No
BRASSICACEAE	*Heliophila africana (L.) Marais*	LC	No
BRASSICACEAE	*Heliophila elata Sond. var. elata*	Not Evaluated	No
BRASSICACEAE	*Heliophila linearis (Thunb.) DC. var. linearifolia (Burch. ex DC.) Marais*	LC	No
BRASSICACEAE	*Heliophila macowaniana Schltr.*	LC	No
BRASSICACEAE	*Raphanus raphanistrum L.*	Not Evaluated	No
BRYACEAE	*Bryum torquescens Bruch ex De Not.*		No
BUDDLEJACEAE	*Buddleja glomerata H.L.Wendl.*	LC	No
CAMPANULACEAE	*Microcodon glomeratum A.DC.*	LC	No
CAMPANULACEAE	*Prismatocarpus crispus L'Hér.*	LC	No
CAMPANULACEAE	*Roella prostrata E.Mey. ex A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia adpressa (Thunb.) Sond.*	LC	No
CAMPANULACEAE	*Wahlenbergia androsacea A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia capensis (L.) A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia exilis A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia hispidula (Thunb.) A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia obovata Brehmer*	LC	No
CAMPANULACEAE	*Wahlenbergia paniculata (Thunb.) A.DC.*	LC	No
CAMPANULACEAE	*Wahlenbergia suffruticosa C.N.Cupido*		No
CARYOPHYLLACEAE	*Silene burchellii Otth var. angustifolia Sond.*	Not Evaluated	No
CARYOPHYLLACEAE	*Silene ornata Aiton*	DDT	No
CARYOPHYLLACEAE	*Silene undulata Aiton*	LC	No
CARYOPHYLLACEAE	*Spergularia media (L.) C.Presl*	Not Evaluated	No
CELASTRACEAE	*Cassine peragua L. subsp. barbara (L.) R.H.Archer*	LC	No
CELASTRACEAE	*Gymnosporia buxifolia (L.) Szyszyl.*	LC	No
CELASTRACEAE	*Maytenus lucida (L.) Loes.*	LC	No
CELASTRACEAE	*Pterocelastrus tricuspidatus (Lam.) Walp.*	LC	No
CELASTRACEAE	*Putterlickia pyracantha (L.) Szyszyl.*	LC	No
CELASTRACEAE	*Putterlickia pyracantha (L.) Szyszyl.*	LC	No
CHENOPODIACEAE	*Atriplex cinerea Poir. subsp. bolusii (C.H.Wright) Aellen var. adamsonii Aellen*	LC	No
CHENOPODIACEAE	*Atriplex lindleyi Moq. subsp. inflata (F.Muell.) Paul G.Wilson*	Not Evaluated	No
CHENOPODIACEAE	*Atriplex semibaccata R.Br. var. appendiculata Aellen*	LC	No
CHENOPODIACEAE	*Bassia diffusa (Thunb.) Kuntze*	LC	No
CHENOPODIACEAE	*Chenopodium ambrosioides L.*	Not Evaluated	No
CHENOPODIACEAE	*Salicornia meyeriana Moss*	LC	No
CHENOPODIACEAE	*Sarcocornia capensis (Moss) A.J.Scott*	LC	No
CHENOPODIACEAE	*Sarcocornia littorea (Moss) A.J.Scott*	LC	No
CHENOPODIACEAE	*Sarcocornia mossiana (Toelken) A.J.Scott*	LC	No
CHENOPODIACEAE	*Sarcocornia natalensis (Bunge ex Ung.-Sternb.) A.J.Scott var. natalensis*	LC	No

Family	*Species*	Threat status	SA Endemic
CHENOPODIACEAE	*Sarcocornia perennis (Mill.) A.J.Scott var. perennis*	LC	No
CHENOPODIACEAE	*Sarcocornia pillansii (Moss) A.J.Scott var. pillansii*	LC	No
COMMELINACEAE	*Tradescantia fluminensis Vell.*	Not Evaluated	No
CONVOLVULACEAE	*Cuscuta nitida Choisy*	LC	No
CRASSULACEAE	*Crassula decumbens Thunb. var. brachyphylla (Adamson) Toelken*	NT	No
CRASSULACEAE	*Crassula dejecta Jacq.*	LC	No
CRASSULACEAE	*Crassula dichotoma L.*	LC	No
CRASSULACEAE	*Crassula expansa Dryand. subsp. expansa*	LC	No
CRASSULACEAE	*Crassula glomerata P.J.Bergius*	LC	No
CRASSULACEAE	*Crassula nudicaulis L. var. nudicaulis*	LC	No
CRASSULACEAE	*Crassula thunbergiana Schult. subsp. thunbergiana*	LC	No
CRASSULACEAE	*Crassula tomentosa Thunb. var. tomentosa*	LC	No
CUCURBITACEAE	*Kedrostis psammophylla Bruyns*	LC	No
CYPERACEAE	*Bolboschoenus maritimus (L.) Palla*	LC	No
CYPERACEAE	*Ficinia bulbosa (L.) Nees*	LC	No
CYPERACEAE	*Ficinia secunda (Vahl) Kunth*	LC	No
CYPERACEAE	*Isolepis levynsiana Muasya & D.A.Simpson*	LC	No
CYPERACEAE	*Isolepis marginata (Thunb.) A.Dietr.*	LC	No
CYPERACEAE	*Isolepis rubicunda (Nees) Kunth*	LC	No
CYPERACEAE	*Schoenoplectus corymbosus (Roth ex Roem. & Schult.) J.Raynal*	LC	No
CYPERACEAE	*Schoenoplectus triqueter (L.) Palla*	Not Evaluated	No
EBENACEAE	*Diospyros austro-africana De Winter var. austro-africana*	LC	No
EBENACEAE	*Euclea natalensis A.DC. subsp. capensis F.White*	LC	No
EBENACEAE	*Euclea racemosa Murray subsp. racemosa*	LC	No
ERICACEAE	*Erica flacca E.Mey. ex Benth.*	LC	No
ERICACEAE	*Erica inaequalis (N.E.Br.) E.G.H.Oliv.*	LC	No
ERICACEAE	*Erica mammosa L.*	LC	No
ERICACEAE	*Erica plumosa Thunb.*	LC	No
ERICACEAE	*Erica subdivaricata P.J.Bergius*	LC	No
ERICACEAE	*Erica trichostigma Salter*	VU	No
ERICACEAE	*Erica tristis Bartl.*	LC	No
EUPHORBIACEAE	*Adenocline violifolia (Kuntze) Prain*	LC	No
EUPHORBIACEAE	*Clutia affinis Sond.*	LC	No
EUPHORBIACEAE	*Clutia alaternoides L. var. alaternoides*	LC	No
EUPHORBIACEAE	*Clutia daphnoides Lam.*	LC	No
EUPHORBIACEAE	*Clutia ericoides Thunb. var. ericoides*	LC	No
EUPHORBIACEAE	*Euphorbia burmannii E.Mey. ex Boiss.*	LC	No
EUPHORBIACEAE	*Euphorbia mauritanica L. var. mauritanica*	LC	No
EUPHORBIACEAE	*Euphorbia peplus L.*	Not Evaluated	No
FABACEAE	*Acacia mearnsii De Wild.*	Not Evaluated	No

Family	*Species*	Threat status	SA Endemic
FABACEAE	*Amphithalea ericifolia (L.) Eckl. & Zeyh. subsp. erecta Granby*	CR	No
FABACEAE	*Argyrolobium velutinum Eckl. & Zeyh.*	EN	No
FABACEAE	*Calobota angustifolia (E.Mey.) Boatwr. & B.-E.van Wyk*	LC	No
FABACEAE	*Calobota cytisoides (Berg.) Eckl. & Zeyh.*	LC	No
FABACEAE	*Calobota lotononoides (Schltr.) Boatwr. & B.-E.van Wyk*	NT	No
FABACEAE	*Calobota spinescens (Harv.) Boatwr. & B.-E.van Wyk*	LC	No
FABACEAE	*Crotalaria excisa (Thunb.) Baker f. subsp. excisa*	LC	No
FABACEAE	*Dipogon lignosus (L.) Verdc.*	LC	No
FABACEAE	*Indigofera heterophylla Thunb.*	LC	No
FABACEAE	*Indigofera incana Thunb.*	LC	No
FABACEAE	*Indigofera meyeriana Eckl. & Zeyh.*	LC	No
FABACEAE	*Indigofera platypoda E.Mey.*	EN	No
FABACEAE	*Indigofera procumbens L.*	LC	No
FABACEAE	*Indigofera venusta Eckl. & Zeyh.*	LC	No
FABACEAE	*Lebeckia ambigua E.Mey.*	LC	No
FABACEAE	*Lebeckia plukenetiana E.Mey.*	EN	No
FABACEAE	*Lessertia herbacea (L.) Druce*	LC	No
FABACEAE	*Lessertia rigida E.Mey.*	LC	No
FABACEAE	*Liparia splendens (Burm.f.) Bos & de Wit subsp. splendens*	VU	No
FABACEAE	*Lotononis involucrata (P.J.Bergius) Benth. subsp. involucrata*	LC	No
FABACEAE	*Lotononis sabulosa T.M.Salter*	LC	No
FABACEAE	*Medicago polymorpha L.*	Not Evaluated	No
FABACEAE	*Melilotus indicus (L.) All.*	Not Evaluated	No
FABACEAE	*Melolobium aethiopicum (L.) Druce*	LC	No
FABACEAE	*Melolobium candicans (E.Mey.) Eckl. & Zeyh.*	LC	No
FABACEAE	*Melolobium exudans Harv.*	LC	No
FABACEAE	*Otholobium bolusii (H.M.L.Forbes) C.H.Stirt.*	NT	No
FABACEAE	*Otholobium bracteolatum (Eckl. & Zeyh.) C.H.Stirt.*	LC	No
FABACEAE	*Otholobium venustum (Eckl. & Zeyh.) C.H.Stirt.*	VU	No
FABACEAE	*Podalyria sericea (Andrews) R.Br. ex Aiton f.*	VU	No
FABACEAE	*Podalyria sericea (Andrews) R.Br. ex Aiton f.*	VU	No
FABACEAE	*Rafnia angulata Thunb. subsp. angulata*	LC	No
FABACEAE	*Rafnia capensis (L.) Schinz subsp. capensis*	LC	No
FABACEAE	*Sutherlandia frutescens (L.) R.Br.*	LC	No
FABACEAE	*Vicia benghalensis L.*	Not Evaluated	No
FABACEAE	*Vicia sativa L. subsp. sativa*	Not Evaluated	No
FABACEAE	*Wiborgia fusca Thunb. subsp. fusca*	LC	No
FABACEAE	*Wiborgia fusca Thunb. subsp. macrocarpa R.Dahlgren*	EN	No
FABACEAE	*Wiborgia leptoptera R.Dahlgren subsp. leptoptera*	LC	No
FABACEAE	*Wiborgia obcordata (P.J.Bergius) Thunb.*	LC	No

Family	*Species*	Threat status	SA Endemic
FABACEAE	*Wiborgia obcordata (P.J.Bergius) Thunb.*	LC	No
FABACEAE	*Xiphotheca reflexa (Thunb.) A.L.Schutte & B.-E.van Wyk*	EN	No
FABACEAE	*Xiphotheca reflexa (Thunb.) A.L.Schutte & B.-E.van Wyk*	EN	No
FUMARIACEAE	*Cysticapnos vesicaria (L.) Fedde subsp. vesicaria*	LC	No
GENTIANACEAE	*Chironia baccifera L.*	LC	No
GENTIANACEAE	*Chironia decumbens Levyns*	LC	No
GENTIANACEAE	*Chironia linoides L. subsp. linoides*	LC	No
GENTIANACEAE	*Orphium frutescens (L.) E.Mey.*	LC	No
GENTIANACEAE	*Sebaea aurea (L.f.) Roem. & Schult.*	LC	No
GERANIACEAE	*Pelargonium carnosum (L.) L'Hér. subsp. carnosum*	LC	No
GERANIACEAE	*Pelargonium chelidonium (Houtt.) DC.*	EN	No
GERANIACEAE	*Pelargonium hirtum (Burm.f.) Jacq.*	LC	No
HAEMODORACEAE	*Wachendorfia multiflora (Klatt) J.C.Manning & Goldblatt*	LC	No
HYACINTHACEAE	*Daubenya zeyheri (Kunth) J.C.Manning & A.M.van der Merwe*	VU	No
HYACINTHACEAE	*Eucomis regia (L.) L'Hér.*	LC	No
HYACINTHACEAE	*Lachenalia mathewsii W.F.Barker*	CR	No
HYACINTHACEAE	*Lachenalia mediana Jacq. var. mediana*	VU	No
HYACINTHACEAE	*Lachenalia pustulata Jacq.*	NT	No
HYACINTHACEAE	*Lachenalia viridiflora W.F.Barker*	CR	No
HYACINTHACEAE	*Ornithogalum juncifolium Jacq. var. juncifolium*	LC	No
HYACINTHACEAE	*Ornithogalum maculatum Jacq.*	LC	No
HYPOXIDACEAE	*Empodium veratrifolium (Willd.) M.F.Thomps.*	EN	No
HYPOXIDACEAE	*Pauridia longituba M.F.Thomps.*	EN	No
HYPOXIDACEAE	*Spiloxene serrata (Thunb.) Garside var. serrata*	LC	No
IRIDACEAE	*Babiana ambigua (Roem. & Schult.) G.J.Lewis*	LC	No
IRIDACEAE	*Babiana angustifolia Sweet*	NT	No
IRIDACEAE	*Babiana hirsuta (Lam.) Goldblatt & J.C.Manning*	NT	No
IRIDACEAE	*Babiana mucronata (Jacq.) Ker Gawl. subsp. mucronata*	LC	No
IRIDACEAE	*Babiana ringens (L.) Ker Gawl. subsp. ringens*	LC	No
IRIDACEAE	*Babiana tubiflora (L.f.) Ker Gawl.*	Declining	No
IRIDACEAE	*Ferraria densepunctulata M.P.de Vos*	VU	No
IRIDACEAE	*Ferraria foliosa G.J.Lewis*	NT	No
IRIDACEAE	*Geissorhiza lewisiae R.C.Foster*	VU	No
IRIDACEAE	*Geissorhiza monanthos Eckl.*	EN	No
IRIDACEAE	*Gladiolus alatus L.*	LC	No
IRIDACEAE	*Gladiolus floribundus Jacq.*	LC	No
IRIDACEAE	*Gladiolus gracilis Jacq.*	LC	No
IRIDACEAE	*Gladiolus orchidiflorus Andrews*	LC	No
IRIDACEAE	*Hesperantha erecta (Baker) Benth. ex Baker*	NT	No
IRIDACEAE	*Hesperantha radiata (Jacq.) Ker Gawl.*	LC	No
IRIDACEAE	*Lapeirousia anceps (L.f.) Ker Gawl.*	LC	No

Family	*Species*	Threat status	SA Endemic
IRIDACEAE	*Lapeirousia jacquinii N.E.Br.*	LC	No
IRIDACEAE	*Melasphaerula ramosa (L.) N.E.Br.*	LC	No
IRIDACEAE	*Moraea albiflora (G.J.Lewis) Goldblatt*	LC	No
IRIDACEAE	*Moraea caeca Barnard ex Goldblatt*	LC	No
IRIDACEAE	*Moraea macrocarpa Goldblatt*	LC	No
IRIDACEAE	*Romulea barkerae M.P.de Vos*	EN	No
IRIDACEAE	*Romulea saldanhensis M.P.de Vos*	EN	No
IRIDACEAE	*Romulea tabularis Eckl. ex Bég.*	LC	No
JUNCACEAE	*Juncus effusus L.*	LC	No
JUNCACEAE	*Juncus tenuis Willd.*	Not Evaluated	No
JUNCAGINACEAE	*Triglochin bulbosa L.*	LC	No
JUNCAGINACEAE	*Triglochin striata Ruíz & Pav.*	LC	No
LAMIACEAE	*Salvia africana-caerulea L.*	LC	No
LAMIACEAE	*Salvia lanceolata Lam.*	LC	No
LAMIACEAE	*Stachys arvensis L.*	Not Evaluated	No
LOBELIACEAE	*Cyphia crenata (Thunb.) C.Presl var. crenata*	LC	No
MALVACEAE	*Anisodontea biflora (Desr.) Bates*	LC	No
MALVACEAE	*Hermannia heterophylla (Cav.) Thunb.*	LC	No
MALVACEAE	*Hermannia pinnata L.*	LC	No
MALVACEAE	*Hermannia prismatocarpa E.Mey. ex Harv.*	LC	No
MALVACEAE	*Hermannia procumbens Cav. subsp. myrrhifolia (Thunb.) De Winter*	EN	No
MALVACEAE	*Hermannia scordifolia Jacq.*	LC	No
MALVACEAE	*Hermannia trifurca L.*	LC	No
MELIANTHACEAE	*Melianthus elongatus Wijnands*	LC	No
MESEMBRYANTHEMACEAE	*Amphibolia laevis (Aiton) H.E.K.Hartmann*	LC	No
MESEMBRYANTHEMACEAE	*Apatesia helianthoides (Aiton) N.E.Br.*	LC	No
MESEMBRYANTHEMACEAE	*Conicosia pugioniformis (L.) N.E.Br. subsp. pugioniformis*	LC	No

APPENDIX C. BIRD SPECIES LIST FOR QDS

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*

Common_name	Taxon_name
Crow, Cape	*Corvus capensis*
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*

Common_name	Taxon_name
Goose, Domestic	*Anser anser*
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*

Common_name	Taxon_name
Knot, Red	*Calidris canutus*
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*

Common_name	Taxon_name
Pipit, Long-billed	*Anthus similis*
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*

Common_name	Taxon_name
Sparrow, House	*Passer domesticus*
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*

Common_name	Taxon_name
Tern, Swift	*Sterna bergii*
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*

APPENDIX D MAMMAL SPECIES LIST

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Orycteropodidae	*Orycteropus*	*afer*	Aardvark	Least Concern	Yes
Mustelidae	*Aonyx*	*capensis*	African Clawless Otter	Least Concern	Yes
Felidae	*Felis*	*silvestris x catus (hybrid)*	African Wildcat hybrid	Not listed	
Canidae	*Otocyon*	*megalotis*	Bat-eared Fox	Least Concern	Yes
Bovidae	*Damaliscus*	*pygargus*	Bontebok	Vulnerable	
Muridae	*Parotomys*	*brantsii*	Brants's Whistling Rat	Least Concern	Yes
Muridae	*Gerbilliscus*	*vallinus*	Brush-tailed Hairy-footed Gerbil	Least Concern	Yes
Bovidae	*Sylvicapra*	*grimmia*	Bush Duiker	Least Concern	Yes
Bathyergidae	*Bathyergus*	*suillus*	Cape Dune Mole-rat	Least Concern	Yes
Canidae	*Vulpes*	*chama*	Cape Fox	Least Concern	Yes
Viverridae	*Genetta*	*tigrina*	Cape Genet	Least Concern	Yes
Muridae	*Gerbilliscus*	*afra*	Cape Gerbil	Least Concern	
Chrysochloridae	*Chrysochloris*	*asiatica*	Cape Golden Mole	Data Deficient	Yes
Herpestidae	*Herpestes*	*pulverulentus*	Cape Gray Mongoose	Least Concern	Yes
Bovidae	*Raphicerus*	*melanotis*	Cape Grysbok	Least Concern	Yes
Leporidae	*Lepus*	*capensis*	Cape Hare	Least Concern	Yes
Bathyergidae	*Georychus*	*capensis*	Cape Mole-rat	Least Concern	Yes
Hystricidae	*Hystrix*	*africaeaustralis*	Cape Porcupine	Least Concern	Yes
Vespertilionidae	*Neoromicia*	*capensis*	Cape Serotine	Least Concern	Yes
Muridae	*Desmodillus*	*auricularis*	Cape Short-tailed Gerbil	Least Concern	Yes
Viverridae	*Genetta*	*genetta*	Common Genet	Least Concern	Yes
Molossidae	*Tadarida*	*aegyptiaca*	Egyptian Free-tailed Bat	Least Concern	Yes
Herpestidae	*Herpestes*	*ichneumon*	Egyptian Mongoose	Least Concern	Yes
Nycteridae	*Nycteris*	*thebaica*	Egyptian Slit-faced Bat	Least Concern	Yes
Delphinidae	*Pseudorca*	*crassidens*	False Killer Whale	Least Concern	
Soricidae	*Myosorex*	*varius*	Forest Shrew	Data Deficient	Yes
Chrysochloridae	*Eremitalpa*	*granti*	Grant's Golden Mole	Vulnerable	Yes
Muridae	*Aethomys*	*granti*	Grant's Rock Mouse	Least Concern	
Soricidae	*Crocidura*	*flavescens*	Greater Red Musk Shrew	Data Deficient	Yes
Muridae	*Otomys*	*unisulcatus*	Karoo Bush Rat	Least Concern	
Soricidae	*Suncus*	*varilla*	Lesser Dwarf Shrew	Data Deficient	Yes
Vespertilionidae	*Eptesicus*	*hottentotus*	Long-tailed Serotine	Least Concern	Yes
Herpestidae	*Atilax*	*paludinosus*	Marsh Mongoose	Least Concern	Yes
Muridae	*Aethomys*	*namaquensis*	Namaqua Rock Mouse	Least Concern	
Vespertilionidae	*Miniopterus*	*natalensis*	Natal Long-fingered Bat	Not listed	Yes
Muridae	*Mus*		Old World Mice and Pygmy Mice	Not listed	
Muridae	*Gerbilliscus*	*paeba*	Paeba Hairy-footed Gerbil	Least Concern	Yes
Soricidae	*Crocidura*	*cyanea*	Reddish-gray Musk Shrew	Data Deficient	Yes
Procaviidae	*Procavia*	*capensis*	Rock Hyrax	Least Concern	Yes

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Muridae	*Rattus*	*rattus*	Roof Rat	Least Concern	
Felidae	*Felis*		Small Cats	Not listed	
Bathyergidae	*Cryptomys*	*hottentotus*	Southern African Mole-rat	Least Concern	Yes
Bovidae	*Antidorcas*	*marsupialis*	Springbok	Least Concern	Yes
Bovidae	*Raphicerus*	*campestris*	Steenbok	Least Concern	Yes
Mustelidae	*Ictonyx*	*striatus*	Striped Polecat	Least Concern	Yes
Muridae	*Myomyscus*	*verreauxi*	Verreaux's Mouse	Least Concern	
Muridae	*Otomys*		Vlei Rats	Not listed	
Muridae	*Rhabdomys*	*pumilio*	Xeric Four-striped Grass Rat	Least Concern	Yes
Herpestidae	*Cynictis*	*penicillata*	Yellow Mongoose	Least Concern	Yes

APPENDIX E HERPETOFAUNA LIST

Reptiles:

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Agamidae	*Agama*	*hispida*	Spiny Ground Agama	Least Concern (SARCA 2014)	
Chamaeleonidae	*Bradypodion*	*occidentale*	Western Dwarf Chameleon	Least Concern (SARCA 2014)	Yes
Chamaeleonidae	*Bradypodion*	*pumilum*	Cape Dwarf Chameleon	Vulnerable (SARCA 2014)	Yes
Colubridae	*Crotaphopeltis*	*hotamboeia*	Red-lipped Snake	Least Concern (SARCA 2014)	
Colubridae	*Dasypeltis*	*scabra*	Rhombic Egg-eater	Least Concern (SARCA 2014)	
Colubridae	*Dispholidus*	*typus*	Boomslang	Least Concern (SARCA 2014)	
Cordylidae	*Chamaesaura*	*anguina*	Cape Grass Lizard	Least Concern (SARCA 2014)	Yes
Cordylidae	*Cordylus*			Not listed	
Cordylidae	*Cordylus*	*cordylus*	Cape Girdled Lizard	Least Concern (SARCA 2014)	Yes
Cordylidae	*Cordylus*	*macropholis*	Large-scaled Girdled Lizard	Near Threatened (SARCA 2014)	Yes
Cordylidae	*Cordylus*	*niger*	Black Girdled Lizard	Near Threatened (SARCA 2014)	Yes
Cordylidae	*Karusasaurus*	*polyzonus*	Karoo Girdled Lizard	Least Concern (SARCA 2014)	
Elapidae	*Naja*	*nivea*	Cape Cobra	Least Concern (SARCA 2014)	
Gekkonidae	*Afrogecko*	*porphyreus*	Marbled Leaf-toed Gecko	Least Concern (SARCA 2014)	Yes
Gekkonidae	*Goggia*	*lineata*	Striped Pygmy Gecko	Least Concern (SARCA 2014)	
Gekkonidae	*Pachydactylus*	*austeni*	Austen's Gecko	Least Concern (SARCA 2014)	Yes
Gekkonidae	*Pachydactylus*	*geitje*	Ocellated Gecko	Least Concern (SARCA 2014)	Yes
Lacertidae	*Meroles*	*knoxii*	Knox's Desert Lizard	Least Concern (SARCA 2014)	
Lacertidae	*Pedioplanis*	*lineoocellata*	Common Sand Lizard	Least Concern (SARCA 2014)	
Lamprophiidae	*Duberria*	*lutrix*	South African Slug-eater	Least Concern (SARCA 2014)	Yes
Lamprophiidae	*Homoroselaps*	*lacteus*	Spotted Harlequin Snake	Least Concern (SARCA 2014)	Yes
Lamprophiidae	*Psammophis*	*crucifer*	Cross-marked Grass Snake	Least Concern (SARCA 2014)	
Lamprophiidae	*Psammophis*	*leightoni*	Cape Sand Snake	Vulnerable (SARCA 2014)	Yes
Lamprophiidae	*Psammophis*	*notostictus*	Karoo Sand Snake	Least Concern (SARCA 2014)	
Lamprophiidae	*Psammophylax*	*rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)	
Lamprophiidae	*Pseudaspis*	*cana*	Mole Snake	Least Concern (SARCA 2014)	
Leptotyphlopidae	*Leptotyphlops*	*nigricans*	Black Thread Snake	Least Concern (SARCA 2014)	Yes
Scincidae	*Acontias*	*grayi*	Gray's Dwarf Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Acontias*	*meleagris*	Cape Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Scelotes*	*bipes*	Silvery Dwarf Burrowing Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Scelotes*	*gronovii*	Gronovi's Dwarf Burrowing Skink	Near Threatened (SARCA 2014)	Yes
Scincidae	*Scelotes*	*kasneri*	Kasner's Dwarf Burrowing Skink	Near Threatened (SARCA 2014)	Yes
Scincidae	*Scelotes*	*montispectus*	Bloubergstrand Dwarf Burrowing Skink	Near Threatened (SARCA 2014)	Yes
Scincidae	*Trachylepis*	*capensis*	Cape Skink	Least Concern (SARCA 2014)	
Scincidae	*Trachylepis*	*homalocephala*	Red-sided Skink	Least Concern (SARCA 2014)	Yes

Scincidae	*Trachylepis*	*variegata*	Variegated Skink	Least Concern (SARCA 2014)	
Scincidae	*Typhlosaurus*	*caecus*	Southern Blind Legless Skink	Least Concern (SARCA 2014)	Yes
Testudinidae	*Chersina*	*angulata*	Angulate Tortoise	Least Concern (SARCA 2014)	
Typhlopidae	*Rhinotyphlops*	*lalandei*	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	
Viperidae	*Bitis*	*arietans*	Puff Adder	Least Concern (SARCA 2014)	

Amphibians

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Brevicepitidae	*Breviceps*	*namaquensis*	Namaqua Rain Frog	Least Concern	
Brevicepitidae	*Breviceps*	*rosei*	Sand Rain Frog	Least Concern	
Bufonidae	*Vandijkophrynus*	*angusticeps*	Sand Toad	Least Concern	
Pyxicephalidae	*Cacosternum*	*capense*	Cape Caco	Vulnerable	Yes
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog	Least Concern	
Pyxicephalidae	*Tomopterna*	*delalandii*	Cape Sand Frog	Least Concern	