HARTEBEEST LEEGTE WIND FARM NEAR LOERIESFONTEIN:

FAUNA & FLORA SPECIALIST SCOPING REPORT

PRODUCED FOR SiVEST

ON BEHALF OF MAINSTREAM RENEWABLE POWER SOUTH AFRICA

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NEMA 2014 CHECKLIST

Section		*NEMA 2014 Regulations for Specialist Studies*	Position in report (pg.)	check
1	1	A specialist report prepared in terms of these Regulations must contain—		
	(a)	details of-		
		(i) the specialist who prepared the report; and	4-5	✓
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;		
	(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 the purpose for which, the report was prepared;	6	✓
	(d)	a description of the methodology adopted in preparing the report or carrying out the specialised process;	8-10	✓
	(e)	a description of any assumptions made and any uncertainties or gaps in knowledge;	8	✓
	(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;	10-17	✓
	(g)	recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;	20-23	✓
	(h)	a description of any consultation process that was undertaken during the course of carrying out the specialist report;	See main EIA report	✓
	(i)	a summary and copies of any comments that were received during any consultation process; and	See main EIA report	✓
	(j)	any other information requested by the competent authority.		
	2	Where a proposed development and the geographical area within which it is located has been subjected to a pre-assessment using a spatial development tool, and the output of the pre-assessment in the form of a site specific development protocol has been adopted in the prescribed manner, the content of a specialist report may be determined by the adopted site specific development protocol applicable to the specific proposed development in the specific geographical area it is proposed in.	N/A	✓

PROFESSIONAL PROFILE OF CONSULTANT:

Simon Todd Consulting has extensive experience in the assessment of renewable energy developments, having provided ecological assessments for more than 80 different renewable energy developments. This includes a large number of developments in the immediate vicinity of the current site as well as in the broader Northern Cape Province. Simon Todd is a recognised ecological expert and is a past chairman of the Arid-Zone Ecology Forum and has 18 years' experience working throughout the country. Simon Todd is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Recent experience and relevant projects in the immediate vicinity of the current site include the following:

- Mainstream South Africa Dwarsrug Wind Energy Facility: Fauna & Flora Specialist Impact Assessment Report. Sivest 2014.
- Basic Assessment Process for the Proposed Construction of the Transnet 15km 50 kV Power Line from Eskom Helios Substation to the proposed new Transnet Helios Traction Feeder Substation. Nsovo Environmental Consulting. 2014.
- Loeriesfontein Wind Energy Facility – Substation & Grid Connection. Fauna & Flora Specialist Report for Basic Assessment. Specialist Report for Savannah Environmental. 2012.
- Proposed Re-Alignment of the Authorised Power Line for The Loeriesfontein 2 Wind Energy Facility.: Fauna & Flora Specialist Report for Basic Assessment. Savannah Environmental 2014.
- Mainstream Loeriesfontein 2 Wind Energy Facility: Fauna and Flora Preconstruction Walk-Through Report. Savannah Environmental 2014.
- Mainstream Khobab Wind Energy Facility: Fauna And Flora Preconstruction Walk-Through Report. Savannah Environmental 2014.

1 INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as Mainstream) are proposing to develop the Hartebeest Leegte Wind Farm located near to Loeriesfontein in the Northern Cape Province. The Hartebeest Leegte wind farm will form one of four wind energy developments known collectively as the Leeuwberg Wind Farm.

In addition to the wind energy development, a 132kV power line and a 33kV/132kV on-site substation with a 132kV Linking Substation, will be required to connect the proposed Hartebeest Leegte wind farm to the national grid at the Helios substation. Mainstream have appointed SiVEST as the independent Environmental Assessment Practitioner (EAP) to undertake the required environmental authorisation process for the proposed Leeuwberg Wind Farm. SiVEST has appointed Simon Todd Consulting to provide a specialist terrestrial biodiversity Scoping Study of the development site as part of the EIA process.

The purpose of the Terrestrial Biodiversity Scoping Report is to describe and detail the ecological features of the proposed site; provide a preliminary assessment of the ecological sensitivity of the site and identify the likely impacts that may be associated with the development of the site as a wind energy facility. A site visit and desktop review of the available ecological information for the area is conducted in order to identify and characterise the ecological features of the site. This information is used to derive a draft ecological sensitivity map that presents the likely ecological constraints and opportunities for development at the site, which can then be verified and refined during the EIA. The information and sensitivity map presented here provides an ecological baseline that can be used in the planning phase of the development to ensure that the potential negative ecological impacts associated with the development can be minimised. Furthermore, the study defines the terms of reference for the EIA phase of the project and outlines a plan of study for the EIA which will follow the Scoping Study.

The full scope of study is detailed below.

1.1 SCOPE OF STUDY

The scope of the study includes the following activities:

Conduct a desktop scoping study to broadly describe and characterise the study area in terms of:

- Vegetation types and/or habitats;
- National conservation status of major vegetation types;
- Red Data (threatened and endangered) flora and fauna species;
- The potential presence/absence of Red Data flora and fauna species;
    - The potential presence of trees protected according to the National Forests Act and

fauna and flora protected under the National Environmental Management: Biodiversity Act;
- The general status of vegetation on site; and
- Potential impacts on biodiversity, sensitive habitats and ecosystem functioning.

Compile a scoping level biodiversity report including (but not limited to) the following aspects:
- Introduction;
- High level description of the environmental baseline;
- Assumptions and limitations;
- Methodology;
- High level identification and mapping of biodiversity (fauna and flora) sensitive areas within the proposed application site;
- Potential anticipated impacts related to biodiversity (fauna and flora);
- Recommendations for further assessment; and
- Conclusion.

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

The Hartebeest Leegte Wind Farm is located approximately 62km north of Loeriesfontein, in the Khai-ma and Hantam Local Municipalities within the Northern Cape Province. As mentioned, the Hartebeest Leegte forms part of the larger Leeuwberg development, but due to the requirements of the REIPPPP process, four separate projects with independent EIA processes is required. The Leeuwberg project comprises four (4) wind farms consisting of the the following:

- Graskoppies Wind Farm
- !Xha Boom Wind Farm
- Hartebeest Leegte Wind Farm
- Ithemba Wind Farm

At this stage it is proposed that the wind farm, comprising wind turbines and associated infrastructure will have a total generation capacity of up to 235 MW. The generated electricity will be fed into the national grid at the Helios Substation via a 132kV power line. The key components of the project are detailed below.

- The Hartebeest Leegte WEF will be situated on the Remainder of Hartebeest Leegte No. 216 and have a total export capacity of up to 235 MW.
- Up to 70 wind turbines of 3-5MW will have a hub height of up to 160m and a rotor diameter of up to 160m.
- A 132kV on site Hartebeest Leegte IPP Substation will be built.

- The turbines will be connected via medium voltage cables to the proposed 132kV onsite Hartebeest Leegte IPP Substation.
- Internal access roads are proposed to be approximately 13.5m wide. This would however only be for the construction phase as the width of the internal access roads will be reduced to 6m during the operational phase.
- A temporary construction lay down area and a hard standing area / platform per turbine will be necessary.
- The construction of operations and maintenance buildings, including an on-site spares storage building, a workshop and an operations building.
- Fencing (if required) will be up to 5m where required and will be either mesh or palisade.

The current Scoping Study is restricted to consideration of the Hartebeest Leegte Wind Farm and associated infrastructure. The other wind farms are indicated on the maps and discussed as appropriate in order to place the Hartebeest Leegte Wind Farm in context as well as better predict cumulative impacts.

1.3 LIMITATIONS & ASSUMPTIONS

The current study is based on a site visit as well as an associated desktop study. Although it was not very wet at the time of the site visit, conditions were nevertheless suitable for the assessment and there no significant limitations associated with the timing of the field assessment. The presence of some fauna is difficult to verify in the field as these may be shy or rare and their potential presence at the site must be evaluated based on the literature and available databases. In many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many remote areas have not been well sampled with the result that the species lists derived for the area do not always adequately reflect the actual fauna and flora present at the site. This is acknowledged as a limitation of the study, however it is substantially reduced by the fact that the consultant has sampled the adjacent properties on multiple occasions across different seasons. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- 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.
- Information on plant and animal species recorded for Quarter Degree Squares (QDS) 3019AC, AB, AD and BC was extracted from the SABIF/SIBIS database hosted by SANBI. This 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.
- The IUCN conservation status (FIgure 1) 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 (2014).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- 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.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2014) (See Figure 1) 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 specialised habitat requirements occurring at the site were noted.

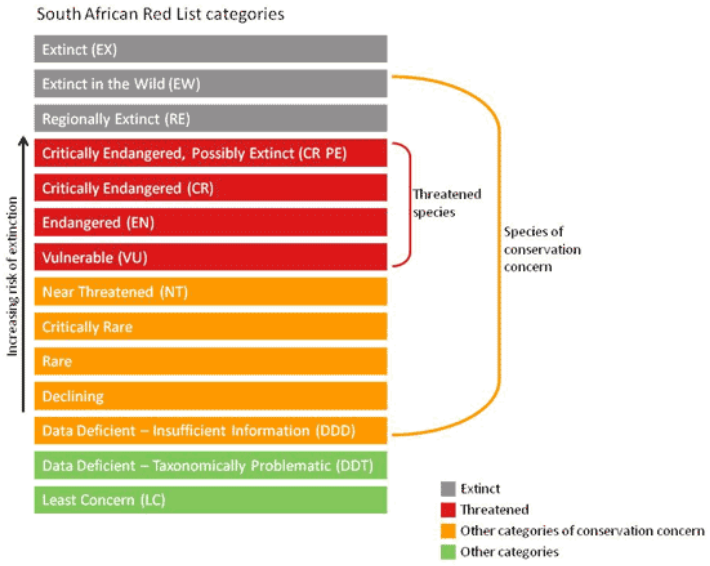

Figure 1. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

2.2 Site Visit

The site visit took place on the 11-13th of November 2016. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. A preliminary habitat map for the site had been produced prior to the site visit and this was validated in the field and modified where necessary. The habitat map also served to guide the site visit and ensure that all the different habitats visible on the satellite imagery of the site were sampled in the field and that representative samples of all the affected areas were included. Walk-through-surveys were conducted within representative areas across the different habitats units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. Within the context of the site, there was no perennial water present and no areas where amphibians were active at the time of the site visit. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site or included on the draft habitat map produced for the site.

2.3 Sensitivity Mapping & Assessment

A draft ecological sensitivity map of the site was produced by integrating the results of the site visit with the available ecological and biodiversity information available in the literature and various spatial databases as described above. As a starting point, mapped sensitive features such as wetlands, drainage lines, rocky hills and pans were collated and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas where then identified from the satellite imagery of the site and delineated. All the different layers

created were then merged to create a single coverage. Features that were specifically captured in the sensitivity map include drainage features, wetlands and pans, as well as rocky outcrops and steep slopes. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a low impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures.
- **Medium** - Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.
- In some situations, areas where also categorised between the above categories, such as Medium-High, where an area appeared to be of intermediate sensitivity with respect to the two defining categories.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

The national vegetation map (Mucina & Rutherford 2006) for the study area is depicted below in Figure 2. The majority of the Hartebeest Leegte site is mapped as falling within the Bushmanland Basin Shrubland vegetation type, with a small proportion of Western Bushmanland Klipveld in the south. However, the site visit revealed that the majority of the site consists of Bushmanland Arid Grassland rather than Bushmanland Basin Shrubland. Although the dominant and characterisitic species associated with each of these vegetation types is described in Mucina & Rutherford, these lists are not repeated here as the actual vegetation as observed at the site is described in the next section.

Bushmanland Arid Grassland is an extensive vegetation type and is the second most extensive vegetation type in South Africa and occupies an area of 45 478 km^2. It extends from around Aggeneys in the east to Prieska in the west. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is a relatively low number given the extensive nature of the vegetation type.

The south western margin of the site consists of Western Bushmanland Klipveld, which forms part of the Succulent Karoo Biome and occurs on the northwestern plains of Bushmanland east of the Namaqualand Klipkoppe, north and south of Kliprand and west of Stofvlei. It consists of sparse plains of desertic character supporting dwarf succulent shrubs and drought-tolerant grasses. This vegetation type has an extent of 2297km2, of which 99% is still intact, with no major transformation, although erosion is extensive with as much as 70% considered to be suffering from significant erosion. Eight endemic species are reported for this vegetation type by Mucina & Rutherford, which is significant given the low extent of this vegetation type.

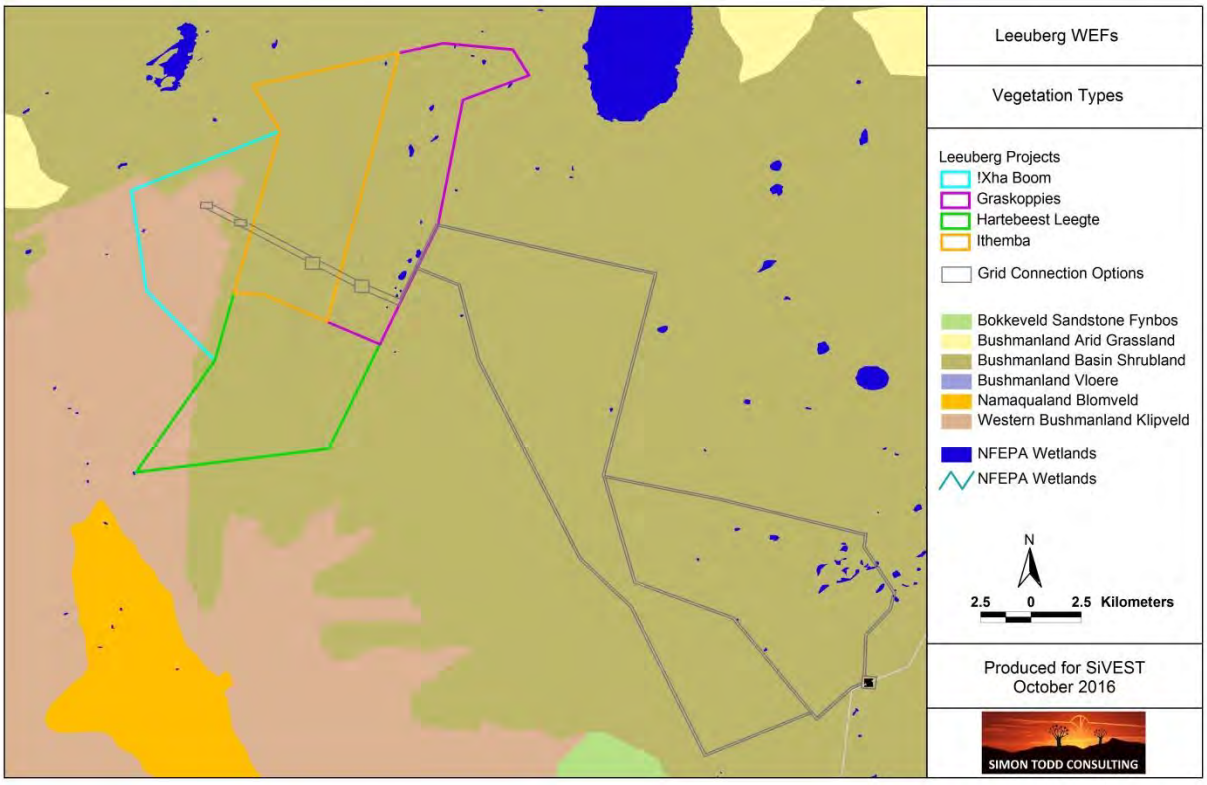

Figure 2. The national vegetation map (Mucina & Rutherford 2006) for the study area. Rivers and wetlands (pans) delineated by the National Freshwater Ecosystem Priority Areas Assessment (Nel et al. 2011) are also depicted.

3.2 FINE-SCALE VEGETATION PATTERNS

The site visit revealed that the majority of the site is dominated almost entirely by so called "white grasses" and is clearly representative of the Bushmanland Arid Grassland vegetation type. This discrepancy with the vegetation map can be ascribed to the coarse nature of the national vegetation map and associated uncertainty along the boundaries of the vegetation units. In addition, boundaries between units have been mapped largely from aerial or satellite imagery and these boundaries are not always clearly visible. The main driver of vegetation pattern in the area is substrate. On gravels and stony soils, the vegetation consists of open shrub-dominated vegetation typical of Bushmanland Basin Shrubland, while on sandy soils the vegetation is typically dominated by various *Stipagrostis* species and is typical of Bushmanland Arid Grassland. There are also many areas on shallow soils, which consist of grassy shrublands and are clearly transitional areas between the two typical forms.

Typical vegetation of the Hartebeest Leegte site, which is homogenous with few features and dominated by *Stipagrostis* grasslands typical of the Bushmanland Arid Grasslands vegetation Type.

The areas of Bushmanland Arid Grassland tend to be very homogenous with little species turnover and are usually dominated by *Stipagrostis ciliata*, *S.brevifolia* and *s.obtusa* with low shrubs such as *Lebeckia spinescens*, *Monechma incanum*, *Asparagus capensis*, *Asparagus retrofractus*, *Eriocephalus microphyllus var. pubescens*, *Zygophyllum retrofactum* with occasional larger *Lycium pumilum* shrubs or small *Parkinsonia africana* trees. Protected or listed species are rare in this habitat and only an occasional *Hoodia gordonii* was observed within this vegetation type.

The areas of Western Bushmanland Klipveld are dominated by species such as *Pentzia incana*, *Zygophyllum lichtensteinianum*, *Zygophyllum retrofractum*, *Eriocephalus spinescens*, *Aptosimum spinescens*, *Tripteris sinuata*, *Hermannia spinosa*, *Felicia clavipilosa*, *Osteospermum armatum*, *Pegolettia retrofracta*, *Pteronia glomerata*, *Pteronia sordida*, *Thesium hystrix, Euphorbia decussata* and *Salsola tuberculata*; succulent shrubs including *Aridaria noctiflora*, *Ruschia intricata* and *Sarcocaulon patersonii*; taller shrubs are usually restricted to run-on environments and consist of species such as *Lycium pilifolium* and *Rhigozum trichotomum*.

The majority of the Hartebeest Leegte site consists of extensive open plains of Bushmandland Arid Grassland. These areas are not considered sensitive as the diversity is low and there are few species of concern present.

The south western boundary of the site consists of gravelly hills mapped as Western Bushmanland Klipveld. There are few species of concern in these areas and they are not considered sensitive.

3.3 LISTED PLANT SPECIES

The study area has been very poorly sampled in the past and many of the quarter degree squares in the area have no data available. Listed and protected species observed in the area include the provincially protected species *Aloe falcata, A.claviflora* and *Hoodia gordonii* and *Aloinopsis luckhoffii* and *Euphorbia multiceps*. *Hoodia gordonii* is protected under NEMA and is listed as DDD (Data Deficient – insufficient information) while *Aloinopsis luckhoffii* is provincially protected is listed as taxonomically uncertain (DDT).

3.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The site lies within the planning domain of the Namakwa Biodiversity Sector Plan (Desmet & Marsh 2007). This biodiversity assessment identifies Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. There are no CBAs within the wind farm site or along the power line corridors, with the nearest CBA being northeast of the site on one of the large pans of the area. The southwestern corner of the site projects a little way into an Ecological Support Area but if there is any development in this area it would not significantly impact the ecological functioning of the CBA. Although it is not yet published, the Northern Cape Conservation Plan (Oosthuysen & Holness, 2016) defines CBAs

for the whole Northern Cape and will shortly be published. The site does not fall within any CBAs defined within this map either (Figure 3), suggesting that no significant biodiversity features have been identified in this area. Although there are some CBAs along the grid connection route, the presence of a power line will generate a low terrestrial impact and this would not compromise the functioning of the these CBAs which are corridors associated with larger drainage lines. In addition, the site does not lie within a National Protected Area Expansion Strategy (NPAES) focus area and has therefore not been identified as an important area for future conservation area expansion.

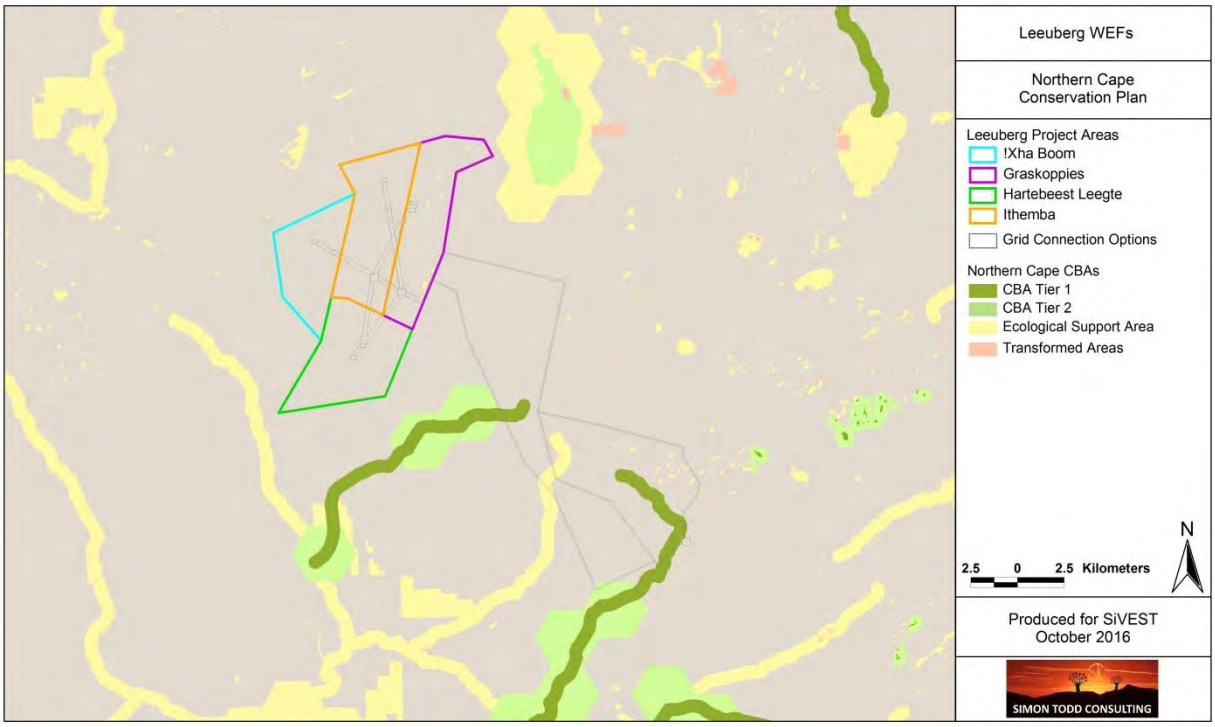

Figure 3. Extract of the Northern Cape Conservation Plan for the study area, showing that there are no CBAs within the Hartebeest Leegte site, but some CBA corridors along the power line options.

3.5 CUMULATIVE IMPACTS

In terms of existing impacts in the area and the potential for the Leeuberg Wind Farm to contribute to cumulative impacts, other renewable energy developments are detailed below in Table 1. Although the DEA also maintains a map of approved and in-process renewable energy facilities that are part of the RE IPPP, this is currently not up to date and is not illustrated here as a result. All of the other wind energy developments in the area are to the east of the current site, between the site and the Helios substation, with only the Dwarsrug facility further east.

A node of renewable energy development is developing around the Helios Substation which would potentially generate significant local impact. However, as the intensity of development in the wider area is very low and there are no specific features of the development area which would

indicate that it is more important than the surrounding area for faunal movement or landscape connectivity, the contribution of the development to cumulative impact would be relatively low and would operate at a local scale only. In addition, the existing and proposed wind energy developments are not very extensive and even with the development of up to four wind farms under the Leeuberg development, the overall intensity of development within a 20-30km radius would remain low. Taking a worst-case estimate of 100ha of direct habitat loss per development, even if all existing developments in the area were to go ahead, there would be about 400ha of development from wind farm developments and an additional 400-500ha from solar energy (based on 3 approved projects), which is not significant given the overwhelmingly intact nature of the surrounding landscape.

Table 1. Renewable energy developments in the vicinity of the Leeuwberg Wind Farm site. So far only the Loeriesfontein 2 and Khobab wind farms and the Hantam PV Solar Energy Facility are under construction or have preferred bidder status.

Development	Current status of EIA/development	Proponent	Capacity	Farm details
Khobab Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Pt 2 of Farm Sous 226
Loeriesfontein 2 Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Pt 1 & 2 of Farm Aan de Karree Doorn Pan 213
Wind farm	Environmental Authorisation issued	Mainstream Renewable Power	50MW	Pt 1 of Farm Aan de Karree Doorn Pan 213
PV Solar Energy Facility	Environmental Authorisation issued	Mainstream Renewable Power	100MW	Portion 2 of Farm Aan de Karree Doorn Pan 213
Hantam PV Solar Energy Facility	Environmental Authorisation issued / Approved under RE IPPPP	Solar Capital (Pty) Ltd	525MW	RE of Farm Narosies 228
PV Solar Power Plant	Environmental Authorisation issued	BioTherm Energy	70MW	Pt 5 of Farm Kleine Rooiberg 227
Dwarsrug Wind Farm	Environmental Authorisation issued	Mainstream Renewable Power	140MW	Remainder of Brak Pan 212 Stinkputs 229
Kokerboom 1 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	Remainder of the Farm Leeuwbergrivier No. 1163 Remainder of the Farm Kleine Rooiberg No. 227
Kokerboom 2 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	Remainder of the Farm Springbok Pan No. 1164 Remainder of the Farm Springbok Tand No. 215

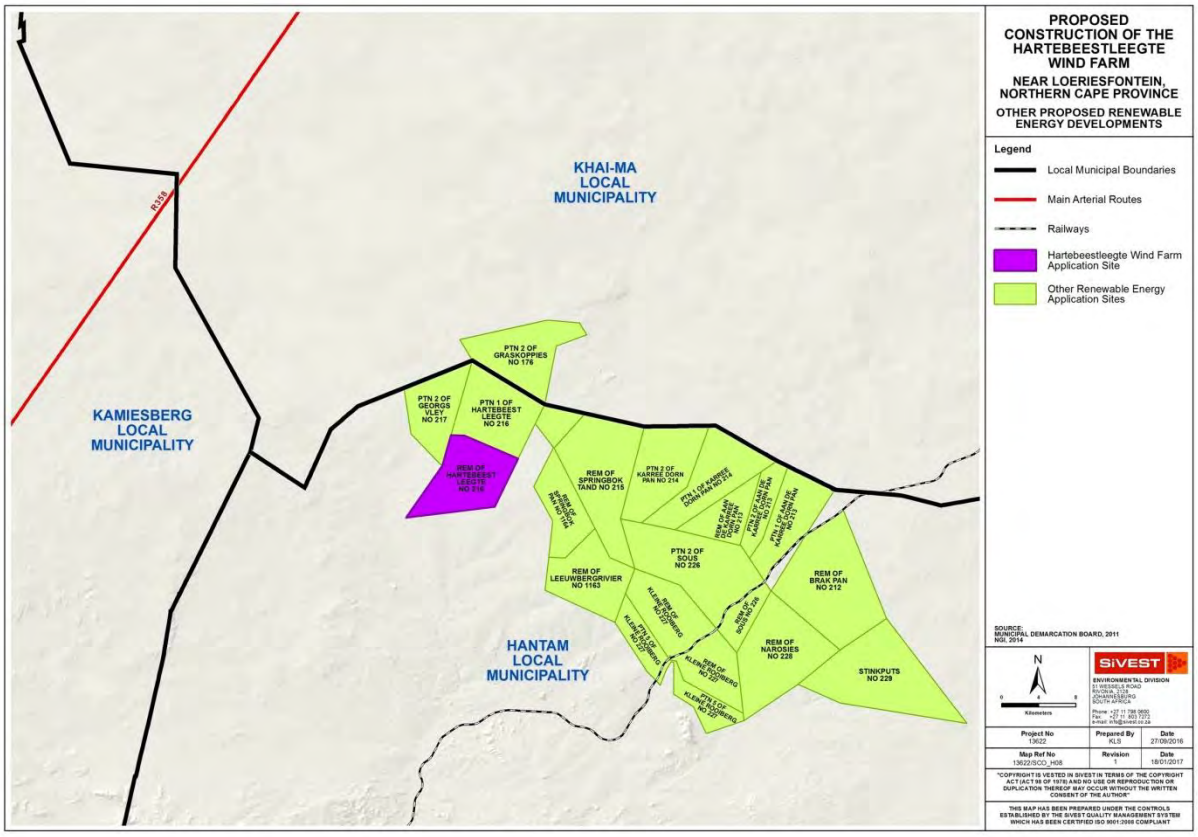

Figure 4. DEA-registered renewable energy projects known from the vicinity of the Hartebeest Leegte Wind Energy Facility (purple) and showing the other Leeuwberg WEFs.

3.6 FAUNAL COMMUNITIES

Mammals

The site falls within the distribution range of 40 terrestrial mammals suggesting that potential mammalian diversity at the site is quite low. Species observed in the area include Steenbok *Raphicerus campestris*, Cape Porcupine *Hystrix africaeaustralis*, Aardvark *Orycteropus afer*, Yellow Mongoose *Cynictis penicillata*, Cape Hare *Lepus capensis,* Cape Fox *Vulpes chama*, Bat-eared Fox *Otocyon megalotis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. In terms of specific habitats which are likely to be of above average significance, the low ridges and drainage lines are likely to contain the highest fauna abundance and diversity.

Listed mammal species which may occur at the site includes the Black-footed cat *Felis nigripes* (Vulnerable) and Honey Badger *Mellivora capensis* which is listed as Endangered in the South African Red Data Book of Mammals, but is listed as Least Concern by the IUCN. As these species have a broad distribution across South Africa, the relatively limited footprint of the development

is not likely to compromise the local or regional populations of these species, especially given the aridity of the area and the associated very low density of such species in the area.

Reptiles

The site lies in or near the distribution range of at least 40 reptile species (Appendix 3), comprising 5 tortoises, 12 snakes, 15 lizards and skinks, 8 geckos and 1 chameleon. This is a comparatively low total, suggesting that reptile diversity at the site is likely to be low. There are no listed species which are likely to occur at the site. Species which were observed in the area include the Karoo Girdled Lizaed *Karusasaurus polyzonus*, Namaqua Sand Lizard *Pedioplanis namaquensis*, Spotted Desert Lizard *Meroles suborbitalis*, Western Sandveld Lizard *Nucras tessellata*, Southern Rock Agama *Agama atra*, Ground Agama *Agama aculeata* subsp. *aculeata* and Bushmanland Tent Tortoise *Psammobates tentorius verroxii*. In terms of the likely impacts of the development on reptiles, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. In some situations, the loss of vegetation cover associated with roads and other cleared areas can generate significant impact on reptiles as they may be vulnerable to predation while crossing such cleared areas, but as the site is arid, plant cover is already low and the reptile species present are mostly well-adapted to low-cover environments.

Amphibians

Given the aridity of the site and lack of surface water in the area, it is not surprising that only six frog species may occur in the area. Of these only those which are relatively independent of water such as the Karoo Toad *Vandijkophrynus gariepensis* are likely to occur within the site itself. Impacts on amphibians are likely to be low given the limited extent of the development as well as low likely density of amphibians in the area. Although there are some pans present in the area, these are not necessarily available to amphibians as many of the pans are saline and not suitable for amphibians.

4 HARTEBEEST LEEGTE SENSITIVITY ASSESSMENT

The draft sensitivity map for the study area is depicted below in Figure 5. The vast majority of the site consists of arid grasslands or low open shrublands on open plains that are not considered highly sensitive. There are few significant features on the site and the only sensitive feature observed within the site are the minor drainage lines in the west of the site. These can easily be avoided and would not pose a significant obstacle for the development. Due to the low habitat and species diversity of the Hartebeest Leegte site, the impact of the development would be local in nature and there are no highly significant impacts that cannot be reduced to a low level.

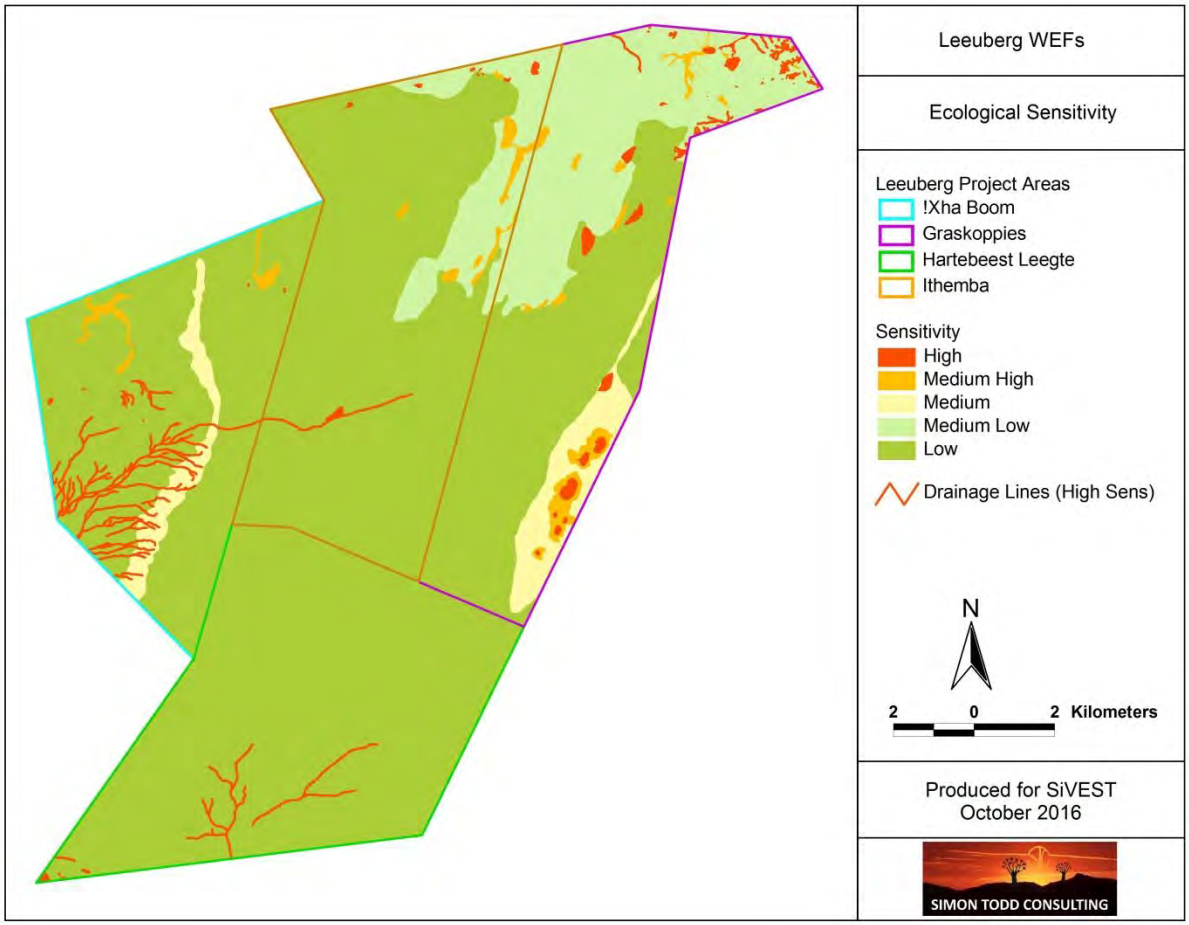

Figure 5. Draft sensitivity map for the Hartebeest Leegte study area and the larger Leeuwberg site. The majority of the site is arid grassland or low open shrublands of low sensitivity.

5 *IMPACTS AND ISSUES IDENTIFICATION*

The development of the Hartebeest Leegte Wind Farm, is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as turbine foundations and service areas, roads, operations buildings etc. The following impacts are identified as the major impacts that are likely to be associated with the development and which will be assessed during the EIA phase of the Hartebeest Leegte wind farm, for the preconstruction, construction and operational phases of the development.

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Hartebeest Leegte Wind Farm are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities

associated with the development are identified and briefly outlined and summarised below before the impacts are assessed

Impact 1. Impacts on vegetation and listed or protected plant species

The development would require vegetation clearing for turbines, roads and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species would potentially be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be relatively low. This impact will therefore be assessed for the facility as well as grid connection, for the construction phase only.

Impact 2. Direct Faunal Impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. During the operational phase, noise generated by the operation of the turbines is likely to negatively affect at least some fauna. Faunal impacts will therefore be assessed during the construction and operational phase of the facility and for the construction phase only of the power line.

Impact 3. Increased Erosion Risk

The large amount of disturbance created during construction would leave the site vulnerable to wind and water erosion. Soil disturbance associated with the development will render the impacted areas vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operational phase and should therefore be assessed for both phases.

Impact 4. Alien Plant Invasion

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant

invasion for years. This impact would manifest during the operational phase, although some of the required measures to reduce this impact are required during construction.

Impact 5. *Cumulative Impact 1. Impacts on broad-scale ecological processes and cumulative habitat loss*

The development will contribute to cumulative impacts in the area and potentially the ability to meet future conservation targets. In addition, the presence of the wind turbines and daily operational activities at the site may deter certain species from the area, resulting in a loss in broad-scale landscape connectivity. In this regard it is important to note that while the development footprint is low in comparison with the total extent of the site, some fauna may be affected across a much wider area than the footprint due to noise and other effects which extend beyond the direct footprint of the development.

6 SCOPING ASSESSMENT OF IMPACTS

A preliminary assessment of the likely extent and significance of each impact identified above is made below. It is however important to note that this a scoping assessment and represents the potential significance of impacts which may change substantially in the EIA depending on the mitigation and avoidance measures that are implemented by the proponent in response to the sensitivity maps and site attributes reported here.

Impact 1. Impacts on vegetation and protected plant species	
Environmental Parameter	Vegetation and protected plant species
Issue/Impact/Environmental Effect/Nature	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.
Extent	The extent of the impact will be restricted the wind farm site and as such would be local in nature.
Probability	This impact will definitely occur as vegetation clearing will be required for the construction and establishement of the project.
Reversibility	This impact is not highly reversible as it would take a long time for any cleared to return to their former state.
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources.
Duration	The construction phase itself will be of short duration, but the resulting impact would persist for a long time.
Cumulative effect	The clearing would contribute to vegetation impacts in the area, the contribution of a single facility would be low, but as

Impact 1. Impacts on vegetation and protected plant species		
	there are several facilities in the area, the cumulative impact would be moderate.	
Intensity/magnitude	The intensity of the impact would be moderate to high, depending on where and how much vegetation was cleared.	
Significance Rating	Without mitigation, this impact would be of moderate significance, but with avoidance this impact can be reduced to a low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-48 (medium negative)	-28 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise development footprint within sensitive areas and ensure that final development layout takes account of areas identified as sensitive. . 2) Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. Particular attention will be paid to the presence of listed species within the affected areas and the possibilities for avoidance and mitigation.	

Impact 2. Impacts on fauna during construction and operation	
Environmental Parameter	Faunal impacts due to construction and operation activities
Issue/Impact/Environmental Effect/Nature	Vegetation clearing, the use of heavy machinery and human presence during construction is likely to negatively affect resident fauna during construction. During operation, noise and human activity will generate some disturbance for fauna.
Extent	The extent of the impact will be restricted the site and as such would be local in nature.

Impact 2. Impacts on fauna during construction and operation		
Probability	This impact is likely to occur and cannot be easily mitigated or avoided.	
Reversibility	This impact is largely reversible and it is only habitat loss that is not considered easily reversible.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.	
Duration	The construction phase itself will be of relatively short duration, but some impact will persist into operation on account of the noise generated by the turbines.	
Cumulative effect	The clearing would contribute to cumulative habitat loss for fauna in the area, but this would be largely local in nature.	
Intensity/magnitude	The intensity of the impact would be moderate.	
Significance Rating	As construction would be relatively short duration but of moderate to high intensity. During operation, impacts will be reduced but of long-duration. Overall significance is likely to be moderate before mitigation and moderate to low thereafter.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-45 (medium negative)	-26 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Avoid sensitive faunal habitats such as drainage lines. 2) A variety of avoidance and mitigation measures to reduce impact on fauna will need to be implemented during construction, including limiting impacts from construction staff and the operation of construction vehicles.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes, the fauna present at the site will be better characterised in the field and sensitive habitats identified and delineated where necessary.	

Impact 3. Increased Soil Erosion Risk		
Environmental Parameter	Ecosystem integrity	
Issue/Impact/Environmental Effect/Nature	Following construction, the site will be highly vulnerable to soil erosion due to disturbance	
Extent	The extent of the impact will be restricted the wind farm site and as such would be local in nature.	
Probability	This impact would be likely to occur due to the large amount of disturbance generated during construction.	
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	This impact is likely to persist for several years after construction.	
Cumulative effect	Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be moderate as the site is not considered highly vulnerable to erosion.	
Significance Rating	Without mitigation, this impact would be of moderate to low significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	3	1
Significance rating	-39 (medium negative)	-12 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Soil erosion plan to be part of the EMP. 2) Rehabilitation of eroded areas on a regular basis.	

Impact 4. Alien Plant Invasion		
Environmental Parameter	Ecosystem integrity	
Issue/Impact/Environmental Effect/Nature	Following construction, the site will be highly vulnerable to alien plant invasion due to disturbance	
Extent	The extent of the impact will be restricted the wind farm site and as such would be local in nature.	
Probability	This impact would be likely to occur as there are already some alien species at the site and these would be likely to increase in response to disturbance.	
Reversibility	Reversibility would be high for mild infestation, but would become increasingly low with extensive invasion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	This impact is likely to persist for several years after construction.	
Cumulative effect	Alien invasion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be moderate as the site is not considered highly vulnerable to invasion.	
Significance Rating	Without mitigation, this impact would be of moderate significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	3	1
Significance rating	-42 (medium negative)	-12 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Alien management plan to be part of the EMP. 2) Regular alien clearing where invasion occurs.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. As this a highly likely potential impact, it will be assessed in the EIA phase for the operation and decommissioning phase.	

Impact 4. Cumulative impacts and loss of broad-scale connectivity		
Environmental Parameter	Broad-scale ecological processes	
Issue/Impact/Environmental Effect/Nature	Transformation and presence of the facility will contribute to cumulative impacts on broad-scale ecological processes.	
Extent	The extent of the impact will be restricted the wind farm site and immediate environment as such would be largely local in nature.	
Probability	This impact is highly likely to occur due to the presence of the facility.	
Reversibility	This impact is not highly reversible as it would perisist for the lifetime of the facility, but could be largely reduced thereafter.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources.	
Duration	This impact would persist for the lifespan of the facility.	
Cumulative effect	The development would contribute to cumulative impacts n the area, and while the contribution of a single facility would be low, there are several facilities in the area and so overall cumulative impacts are likely to be moderate.	
Intensity/magnitude	The intensity of the impact would be moderate to high, depending on where and how much vegetation was cleared.	
Significance Rating	Due to the relatively low contribution of the development and the low overall current level of impact in the area, the significance of this impact is likely to be moderate to low.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-48 (medium negative)	-28 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise the development footprint within the high sensitivity areas.	

Impact 4. Cumulative impacts and loss of broad-scale connectivity	
	2) There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. 3) Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes, cumulative impacts are highly likely and will be assessed for the development.

7 IDENTIFICATION OF PREFERRED ALTERNATIVES

There are currently no layout alternatives for the wind farm itself and it is only the on-site substation location where there alternatives to be considered at this stage. The comparative assessment is provided below, but ultimately there are no significant differences between the two alternatives.

Hartebeest Leegte Wind Farm Substation

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION ALTERNATIVES		
On-site Substation Option 1	Preferred	The site is located on the typical open plains of the site, dominated by *Stipagrostis*. There are no sensitive features within the footprint area. No significant issues associated with the site. Only preferred because the site is slightly flatter than Option 2.
On-site Substation Option 2	Favourable	The site is located on the typical open plains of the site, dominated by *Stipagrostis*. There are no sensitive features within the footprint area. No significant issues associated with the site. Also considered acceptable and only less referred because the site is slightly steeper than Option 1.

8 PROPOSED ACTIVITIES FOR THE EIA PHASE

The current study is based on a desktop study as well as a site visit, which reduces the uncertainty associated with the scoping-level assessment. In addition, since a field assessment has been conducted for the current assessment, the characteristics of the affected environment have been well defined and there is little uncertainty as to the sensitivity of the site and the presence of sensitive features has been verified in the field. No layout has been provided for the current assessment and an important activity for the EIA will be assessing the layout in relation to the sensitive features of the site. Additional activities and outputs for the EIA will include the following studies and activities:

- Evaluate the impact of the final layout of the development in relation to the sensitive features and attributes of the site.
- Evaluate, based on the site attributes, what the most applicable mitigation measures to reduce the impact of the development on the site would be and if there are any areas where specific precautions or mitigation measures should be implemented.
- Assess cumulative impacts in the area based on the current as well as the other proposed and existing developments in the area.
- Assess the impacts identified above in light of the site-specific findings and the final layout for assessment to be provided by the developer.

9 CONCLUSION & RECOMMENDATIONS

The Hartebeest Leegte Wind Farm consists largely of arid grassland or low open shrubland on flat plains and gently sloping hills that are low sensitivity, with few species of conservation concern. Development in these areas would generate low impacts of local significance only. The only sensitive feature present at the site are some minor drainage lines in the south. These however occupy a small proportion of the site and these can easily be avoided by the final layout of the development.

Cumulative impacts as a result of the development are likely to be relatively low as the footprint of the development is quite low and the intensity of development in the wider area is still low despite the fact that a node of renewable energy is developing around the Helios substation. In addition, there are no specific features of the Hartebeest Leegte development area which would indicate that it is more important than the surrounding area for faunal movement or landscape

connectivity. The contribution of the Hartebeest Leegte development to cumulative impact is thus likely to be relatively low and would operate at a local scale only.

With the application of relatively simple mitigation and avoidance measures, the impact of the Hartebeest Leegte Wind Farm can be reduced to a low overall level. There are no specific long-term impacts likely to be associated with the wind farm that cannot be reduced to an acceptable level through mitigation and avoidance. As such, there are no fatal flaws associated withn the development and no apparent reasons that it should not proceed to the EIA phase.

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11 ANNEX 1. LIST OF PLANTS

List of plant species known from the vicinity of the Hartebeest Leegte study site, based on the SANBI SIBIS database. Conservation status is from the South African Red Data List of Plants 2016.

Family	Species	IUCN Status	Family	Species	IUCN Status
ACANTHACEAE	*Acanthopsis disperma*	LC	ACANTHACEAE	*Blepharis furcata*	LC
AIZOACEAE	*Aizoon canariense*	LC	AIZOACEAE	*Galenia africana*	LC
AIZOACEAE	*Galenia fruticosa*	LC	AIZOACEAE	*Galenia sarcophylla*	LC
AIZOACEAE	*Galenia squamulosa*	LC	AIZOACEAE	*Plinthus karooicus*	LC
AIZOACEAE	*Tetragonia arbuscula*	LC	AIZOACEAE	*Tetragonia fruticosa*	LC
AIZOACEAE	*Tetragonia microptera*	LC	AMARYLLIDACEAE	*Brunsvigia comptonii*	LC
APOCYNACEAE	*Gomphocarpus filiformis*	LC	APOCYNACEAE	*Fockea sinuata*	LC
APOCYNACEAE	*Hoodia gordonii*	DDD	APOCYNACEAE	*Quaqua incarnata*	LC
ASPARAGACEAE	*Asparagus africanus*	LC	ASPARAGACEAE	*Asparagus capensis var. capensis*	LC
ASPHODELACEAE	*Aloe claviflora*	LC	ASPHODELACEAE	*Aloe falcata*	LC
ASTERACEAE	*Amellus microglossus*	LC	ASTERACEAE	*Amellus strigosus subsp. pseudoscabridus*	LC
ASTERACEAE	*Arctotis fastuosa*	LC	ASTERACEAE	*Dicoma capensis*	LC
ASTERACEAE	*Didelta carnosa var. carnosa*	LC	ASTERACEAE	*Didelta spinosa*	LC
ASTERACEAE	*Dimorphotheca polyptera*	LC	ASTERACEAE	*Eriocephalus ericoides subsp. ericoides*	LC
ASTERACEAE	*Eriocephalus microphyllus var. pubescens*	LC	ASTERACEAE	*Eriocephalus spinescens*	LC
ASTERACEAE	*Felicia clavipilosa subsp. clavipilosa*	LC	ASTERACEAE	*Foveolina dichotoma*	LC
ASTERACEAE	*Gazania lichtensteinii*	LC	ASTERACEAE	*Gazania jurineifolia*	LC
ASTERACEAE	*Helichrysum herniarioides*	LC	ASTERACEAE	*Lasiopogon glomerulatus*	LC
ASTERACEAE	*Osteospermum pinnatum var. pinnatum*	LC	ASTERACEAE	*Osteospermum spinescens*	LC
ASTERACEAE	*Pegolettia retrofracta*	LC	ASTERACEAE	*Pentzia spinescens*	LC
ASTERACEAE	*Pteronia adenocarpa*	LC	ASTERACEAE	*Pteronia glauca*	LC
ASTERACEAE	*Pteronia glomerata*	LC	ASTERACEAE	*Pteronia leucoclada*	LC
ASTERACEAE	*Pteronia mucronata*	LC	ASTERACEAE	*Pteronia oblanceolata*	LC
ASTERACEAE	*Rosenia humilis*	LC	ASTERACEAE	*Senecio niveus*	LC
ASTERACEAE	*Senecio abbreviatus*	LC	ASTERACEAE	*Tripteris sinuata var. linearis*	LC
ASTERACEAE	*Tripteris sinuata var. sinuata*	LC	ASTERACEAE	*Ursinia nana subsp. nana*	LC
BIGNONIACEAE	*Rhigozum trichotomum*	LC	BRASSICACEAE	*Heliophila arenosa*	LC
BRASSICACEAE	*Lepidium desertorum*	LC	CARYOPHYLLACEAE	*Dianthus namaensis var. dinteri*	LC

CHENOPODIACEAE	*Atriplex vestita var. appendiculata*	LC	CHENOPODIACEAE	*Bassia salsoloides*	LC
CHENOPODIACEAE	*Exomis microphylla var. axyrioides*	LC	CHENOPODIACEAE	*Salsola aellenii*	LC
CHENOPODIACEAE	*Salsola aphylla*	LC	CHENOPODIACEAE	*Salsola henriciae*	LC
CHENOPODIACEAE	*Salsola procera*	LC	CHENOPODIACEAE	*Salsola tuberculata*	LC
CHENOPODIACEAE	*Suaeda fruticosa*	LC	CHENOPODIACEAE	*Suaeda merxmuelleri*	LC
CHENOPODIACEAE	*Sasola kali*	Alien	CHENOPODIACEAE	*Atriplex semibaccata*	Alien
CHENOPODIACEAE	*Atriplex lindleyi subsp inflata*	Alien	EUPHORBIACEAE	*Euphorbia aequoris*	LC
EUPHORBIACEAE	*Euphorbia multiceps*	LC	FABACEAE	*Lebeckia spinescens*	LC
FABACEAE	*Lessertia macrostachya var. macrostachya*	LC	FABACEAE	*Lotononis leptoloba*	LC
FABACEAE	*Melolobium candicans*	LC	FABACEAE	*Parkinsonia africana*	LC
FABACEAE	*Sutherlandia frutescens*	LC	FABACEAE	*Prosopis glandulosa*	Alien
FRANKENIACEAE	*Frankenia pulverulenta*	LC	GERANIACEAE	*Pelargonium minimum*	LC
GERANIACEAE	*Sarcocaulon patersonii*	LC	HYACINTHACEAE	*Drimia intricata*	LC
IRIDACEAE	*Moraea pallida*	LC	IRIDACEAE	*Tritonia karooica*	LC
LAMIACEAE	*Salvia disermas*	LC	LORANTHACEAE	*Septulina glauca*	LC
MALVACEAE	*Hermannia paucifolia*	LC	MALVACEAE	*Hermannia spinosa*	LC
MALVACEAE	*Radyera urens*	LC	MELIANTHACEAE	*Melianthus comosus*	LC
MESEMBRYANTHEMACEAE	*Aloinopsis luckhoffii*	DDT	MESEMBRYANTHEMACEAE	*Antimima evoluta*	LC
MESEMBRYANTHEMACEAE	*Aridaria noctiflora subsp. straminea*	LC	MESEMBRYANTHEMACEAE	*Cephalophyllum fulleri*	Rare
MESEMBRYANTHEMACEAE	*Conophytum uviforme subsp. uviforme*	LC	MESEMBRYANTHEMACEAE	*Drosanthemum lique*	LC
MESEMBRYANTHEMACEAE	*Lampranthus haworthii*	LC	MESEMBRYANTHEMACEAE	*Lampranthus uniflorus*	LC
MESEMBRYANTHEMACEAE	*Lithops otzeniana*	VU	MESEMBRYANTHEMACEAE	*Mesembryanthemum crystallinum*	LC
MESEMBRYANTHEMACEAE	*Mesembryanthemum stenandrum*	LC	MESEMBRYANTHEMACEAE	*Psilocaulon coriarium*	LC
MESEMBRYANTHEMACEAE	*Psilocaulon junceum*	LC	MESEMBRYANTHEMACEAE	*Ruschia abbreviata*	LC
MESEMBRYANTHEMACEAE	*Ruschia robusta*	LC	MESEMBRYANTHEMACEAE	*Stoeberia frutescens*	LC
MESEMBRYANTHEMACEAE	*Stomatium mustellinum*	LC	MOLLUGINACEAE	*Hypertelis salsoloides var. salsoloides*	LC
MOLLUGINACEAE	*Limeum aethiopicum*	LC	NEURADACEAE	*Grielum humifusum var. parviflorum*	LC
OXALIDACEAE	*Oxalis beneprotecta*	LC	PEDALIACEAE	*Sesamum capense*	LC
PLUMBAGINACEAE	*Dyerophytum africanum*	LC	POACEAE	*Aristida adscensionis*	LC
POACEAE	*Ehrharta calycina*	LC	POACEAE	*Enneapogon desvauxii*	LC
POACEAE	*Enneapogon scaber*	LC	POACEAE	*Fingerhuthia africana*	LC
POACEAE	*Schismus barbatus*	LC	POACEAE	*Stipagrostis anomala*	LC
POACEAE	*Stipagrostis brevifolia*	LC	POACEAE	*Stipagrostis ciliata var. capensis*	LC

POACEAE	*Stipagrostis namaquensis*	LC	POACEAE	*Stipagrostis obtusa*	LC
POLYGALACEAE	*Polygala seminuda*	LC	RUTACEAE	*Agathosma virgata*	LC
SANTALACEAE	*Thesium hystricoides*	LC	SANTALACEAE	*Thesium hystrix*	LC
SANTALACEAE	*Thesium lineatum*	LC	SCROPHULARIACEAE	*Aptosimum indivisum*	LC
SCROPHULARIACEAE	*Aptosimum procumbens*	LC	SCROPHULARIACEAE	*Aptosimum spinescens*	LC
SCROPHULARIACEAE	*Jamesbrittenia atropurpurea subsp. atropurpurea*	LC	SCROPHULARIACEAE	*Nemesia calcarata*	LC
SCROPHULARIACEAE	*Peliostomum leucorrhizum*	LC	SCROPHULARIACEAE	*Selago albida*	LC
SCROPHULARIACEAE	*Selago pinguicula*	LC	SOLANACEAE	*Lycium cinereum*	LC
SOLANACEAE	*Lycium pilifolium*	LC	SOLANACEAE	*Lycium oxycarpum*	LC
SOLANACEAE	*Solanum burchellii*	LC	SOLANACEAE	*Solanum capense*	LC
URTICACEAE	*Forsskaolea candida*	LC	ZYGOPHYLLACEAE	*Tribulus terrestris*	LC
ZYGOPHYLLACEAE	*Tribulus zeyheri*	LC	ZYGOPHYLLACEAE	*Zygophyllum flexuosum*	LC
ZYGOPHYLLACEAE	*Zygophyllum lichtensteinianum*	LC	ZYGOPHYLLACEAE	*Zygophyllum retrofractum*	LC
ZYGOPHYLLACEAE	*Zygophyllum simplex*	LC			

12 ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur in the broad vicinity of the Hartebeest Leegte study area. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2016.

Scientific Name	Common Name	Status	Habitat	Likelihood
Afrosoricida (Golden Moles):				
Chrysochloris asiatica	Cape Golden Mole	LC	Coastal parts of the Northern and Western Cape	High
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	Confirmed
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Low
Lagomorpha (Hares and Rabbits):				
Pronolagus rupestris	Smith's Red Rock Rabbit	LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	Low
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	High
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Confirmed
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	High
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	Confirmed
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	High

Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	Confirmed
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Petromyscus collinus	Pygmy Rock Mouse	LC	Arid areas on rocky outcrops or koppies with a high rock cover	Low
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	High
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Herpestes pulverulentus	Cape Grey Mongoose	LC	Wide habitat tolerance	High
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	Confirmed

Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	Confirmed
Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	High
Mellivora capensis	Ratel/Honey Badger	IUCN LC/SA RDB EN	Catholic habitat requirements	Low
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	Moderate
Pelea capreolus	Grey Rhebok	LC	Associated with rocky hills, rocky mountainsides, mountain plateaux with good grass cover.	Low
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Low
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed
Oreotragus oreotragus	Klipspringer	LC	Closely confined to rocky habitat.	Low
Chiroptera (Bats)				
Sauromys petrophilus	Flat-headed free-tailed bat	LC	Rocky areas and the availability of narrow rock fissures essential requirements	Low
Neoromicia capensis	Cape Serotine Bat	LC	Wide habitat tolerances, but often found near open water	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	In arid areas. often associated with water sources	High
Nycteris thebaica	Egyptian Slit-faced Bat	LC	Wide habitat tolerance	High
Rhinolophus clivosus	Geoffroy's horsehoe bat	LC	Wide habitat tolerance but Roost in caves	Low
Rhinolophus capensis	Cape horseshoe bat	LC	Many records from coastal caves	Low

13 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur in the broad vicinity of the Hartebeest Leegte site, based on records from the SARCA database, conservation status is from Bates et al. 2013.

Type	Family	Genus	Species	Subspecies	Common name	Red list category
Chameleon	*Chamaeleonidae*	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern
Geckos	*Gekkonidae*	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern
Geckos	*Gekkonidae*	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern
Geckos	*Gekkonidae*	*Goggia*	*lineata*		Striped Pygmy Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*labialis*		Western Cape Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*latirostris*		Quartz Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern
Geckos	*Gekkonidae*	*Ptenopus*	*garrulus*	*maculatus*	Spotted Barking Gecko	Least Concern
Lizards	*Agamidae*	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern
Lizards	*Agamidae*	*Agama*	*atra*		Southern Rock Agama	Least Concern
Lizards	*Cordylidae*	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern
Lizards	*Cordylidae*	*Namazonurus*	*peersi*		Peers' Girdled Lizard	Least Concern
Lizards	*Gerrhosauridae*	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern
Lizards	*Lacertidae*	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern
Lizards	*Lacertidae*	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*laticeps*		Karoo Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*namaquensis*		Namaqua Sand Lizard	Least Concern
Lizards	*Scincidae*	*Acontias*	*lineatus*		Striped Dwarf Legless Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*occidentalis*		Western Three-striped Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*variegata*		Variegated Skink	Least Concern
Snakes	*Colubridae*	*Boaedon*	*capensis*		Brown House Snake	Least Concern
Snakes	*Colubridae*	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern
Snakes	*Colubridae*	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern
Snakes	*Colubridae*	*Lamprophis*	*guttatus*		Spotted House Snake	Least Concern

Snakes	*Colubridae*	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern
Snakes	*Colubridae*	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern
Snakes	*Colubridae*	*Pseudaspis*	*cana*		Mole Snake	Least Concern
Snakes	*Colubridae*	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern
Snakes	*Elapidae*	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed
Snakes	*Elapidae*	*Naja*	*nivea*		Cape Cobra	Least Concern
Snakes	*Typhlopidae*	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern
Snakes	*Viperidae*	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern
Tortoises	*Testudinidae*	*Chersina*	*angulata*		Angulate Tortoise	Least Concern
Tortoises	*Testudinidae*	*Homopus*	*signatus*	*signatus*	Namaqua Speckled Padloper	Not listed
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*subsp. ?*	Tent Tortoise (subsp. ?)	Least Concern
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*tentorius*	Karoo Tent Tortoise	Not listed
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed

14 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in in the broad vicinity of the Hartebeest Leegte site. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the Minter et al. 2004.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Vandijkophrynus gariepensis	Karoo Toad	Least Concern	Karoo Scrub	Widespread	High
Xenopus laevis	Common Platanna	Least Concern	Any more or less permanent water	Widespread	Very Low
Amietia fuscigula	Cape River Frog	Least Concern	Large still bodies of water or permanent streams and rivers.	Widespread	Very Low
Cacosternum namaquense	Namaqua Caco	Least Concern	Marshy areas, vleis and shallow pans	Widespread	Moderate
Cacosternum boettgeri	Common Caco	Least Concern	Marshy areas, vleis and shallow pans	Widespread	Moderate
Tomopterna tandyi	Tandy's Sand Frog	Least Concern	Nama karoo grassland and savanna	Widespread	High