PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Specialist Assessment Reports

A.1 – Bats Scoping Assessment Report

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Appendix A.1

Bats Scoping Assessment Report

Bats Scoping Assessment Report

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ABBREVIATIONS & ACRONYMS

AoO	Area of Occupancy
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
EW	Extinct in the Wild
EoO	Extent of Occurrence
EWT	Endangered Wildlife Trust
EX	Extinct
FA	Focus Area
IUCN	The World Conservation Union
IWS	Inkululeko Wildlife Services
km	Kilometres
LC	Least Concern
m	Meters
MW	Mega Watts
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management Biodiversity Act
NEM:PA	National Environmental Management Protected Areas Act
NEPAD	New Partnership for Africa's Development
NT	Near Threatened
PS	Protected Species
PV	Photo Voltaic
REDZ	Renewable Energy Development Zone
SA	South Africa / South African
SABAA	South African Bat Assessment Association
SABAAP	South African Bat Assessment Association Panel
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SPVF	Solar Photo Voltaic Facility
TOPS	Threatened and Protected Species
UCT	University of Cape Town

UK	United Kingdom
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
USA	United States of America
VU	Vulnerable
WEF	Wind Energy Facility
WWF	World Wildlife Fund

1. SUMMARY

Phase 2 of the wind and solar PV Strategic Environmental Assessment (SEA) was commissioned by the Department of Environmental Affairs (DEA) in order to identify additional Renewable Energy Developments Zones (REDZs). Eight focus areas (FA) have been selected for the current assessment – some for the development of solar photo voltaic (PV) facilities only, one for the development of wind energy facilities (WEF) only and others for the potential development of both solar PV and wind energy facilities.

Through a process of desktop review of spatial features, literature and author knowledge, key bat important features were identified and mapped and each of these were assigned sensitivity classes depending on the development technology (solar PV or wind). Sensitivity buffers were also added to some of the features. Terrestrial ecoregions, geology, known bat roosts, vegetation, irrigated agricultural areas, urban areas, eroded areas, wetlands, rivers, dams and extent of occurrence of conservation important bat species were selected as features relevant to bats. The key areas of bat importance for each FA are summarized below:

Site	Brief description
FA1 Solar PV only	Whilst FA1 is largely disturbed by human activity, there is roosting potential in defunct mine tunnels, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and extensive wetland systems. This FA has the highest potential of bat species of conservation importance occurrence. Any Environmental Impact Assessments (EIA), which could be a Basic Assessment or Scoping and EIA process, within this FA should confirm whether *Cloeotis percivali, Epomophorus wahlbergi, Otomops martiensseni, Rhinolophus blasii, Rhinolophus cohenea, Rhinolophus swinnyi* and/ or *Rousettus aegyptiacus* will be impacted on by any proposed solar PV developments.
FA2 Solar PV only	The most significant bat important feature of this FA is the cave-forming Dolomite geology in the central and eastern parts. Roosting potential exists in possible caves, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and smaller wetlands. Defunct underground mines can harbour large colonies of bats. Species of conservation importance to look out for in more detailed EIAs include *Epomophorus wahlbergi* and *Rhinolophus denti*.
FA3 Solar PV only	The most significant bat important feature of this FA are the cave-forming Dolomite patches throughout the FA. Known bat roosts are found in this FA, with many more potential roosts in the Dolomite and tunnels/ adits in defunct mines. Defunct underground mines can harbour large colonies of bats. Additional roosting potential exists in rock outcrops and buildings. Foraging potential is low, except where there is water. The species of conservation importance to look out for in more detailed EIAs is *Rhinolophus denti*.
FA4 Solar PV only	Roosting potential exists in old mine tunnels, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and extensive wetlands. Defunct underground mines can harbour large colonies of bats. Species of conservation importance to look out for in more detailed EIAs include *Epomophorus wahlbergi* and *Rhinolophus denti.*
FA5 Wind only	There are no major habitat features of concern for bats in this FA, however, species at the high risk of wind turbine fatality, Wahlberg's Epauletted Fruit Bat *Epomophorus wahlbergi,* Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca,* do occur throughout the FA. There is roosting potential in rock outcrops, trees and buildings.
FA6 Solar PV and Wind	Bat activity will be highest near rock outcrops, irrigated agricultural areas, rivers and wetlands. The species of conservation importance to look out for in more detailed EIAs is *Laephotis namibensis.* Least concern species at the highest risk of wind turbine fatality are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.
FA7 Solar PV and Wind	Roosting potential exists in possible caves, rock outcrops, trees and buildings and foraging potential exists over rivers and wetlands. Zinc mining surrounds the town of Copperton. Defunct underground mines can harbour large colonies of bats. The species of conservation importance to look out for in more detailed EIAs is *Rhinolophus denti.* Least concern species at the highest risk of wind turbine fatality are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.

Site	Brief description
FA8 Solar PV and Wind	Besides sedimentary rock outcrops and scattered ephemeral wetlands, there are no major habitat features of concern for bats in this FA. Species of conservation importance to look out for in more detailed EIAs include *Laephotis namibensis* and *Cistugo seabrae.* Least concern species at the highest risk of wind turbine fatality are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.

Whilst these won't be the only impacts that site specific projects may face, key impacts on bats at a strategic level were identified as follows:

1. Roost disturbance and/or destruction due to construction activities
2. Fragmentation to and displacement from foraging habitat due to solar PV panel or wind turbine construction and operation.
3. Bat fatalities due to collision with or barotrauma caused by wind turbines while foraging or migrating.

Key mitigation measures to reduce disturbance and displacement impacts on bats (points 1 and 2 above) include:

- Pre-construction surveys or monitoring should attempt to identify all roosts and potential roosts on and around the site of development.
- Minimise the construction footprint, for example, by minimising clearing of natural vegetation and agricultural areas.
- It is recommended that NO development (including the full rotor swept zone of wind turbines) takes place in BOTH Very High and High bat sensitivity areas. Strict operational mitigation measures will be recommended in such instances if there is no alternative.
- It is recommended that areas of Low bat sensitivity are the first-choice selection for all turbine development (including the full rotor swept zone of wind turbines). Operational mitigation measures will also be recommended for turbines placed in Medium bat sensitive areas.
- Minimise impacts to natural and artificial wetlands and water bodies.

Additional mitigation measures to reduce bat fatalities due wind turbine rotation (Point 3) are:

- Constructing a facility with the least rotor swept area is preferable.
- Once the site-specific sensitivity mapping is refined in the Basic Assessment or Scoping and EIA process, all turbines (including their full rotor swept zone) to be kept out of all Very High and High bat sensitive areas. Constructing a facility in areas of low sensitivity for bats is preferable.
- It is recommended that there should be at least a 500 m no turbine development zone around any existing or newly built or to be constructed sub-stations or office/ operations and maintenance buildings due to the attraction of bats to nocturnal lighting around buildings and the potential to find roosting space in walls and roofs. Should all of the below additional measures be implemented, the no turbine development buffer around buildings can be reduced to 200 m:
    - With the exception of compulsory civil aviation lighting, minimise artificial lighting at night, especially high-intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights at sub-station, offices and turbines.

All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination.

- o All non-aviation internal turbine nacelle and tower lighting should be extinguished when unoccupied.
- o Bat-proof constructions for all new buildings.

- Bat fatality minimization measures such as curtailment (increasing the turbine rotation cut-in speed or stopping turbine movement) or ultrasonic deterrents should be recommended where appropriate, based on site specific preconstruction monitoring conducted according to Sowler *et al.* (2017) or subsequent versions and knowledge from already operational facilities.
- Operational monitoring according to Aronson *et al.* (2014) or subsequent versions to be conducted from the commencement of turbines spinning.
- Based on site specific results, the thresholds recommended in MacEwan *et al.* (2018) or subsequent versions and taking into consideration which turbines had the highest fatalities and which weather parameters bats were most active in, turbine specific mitigation measures should be implemented.
- During operational monitoring, annual monitoring reports to be submitted to SABAAP, EWT, the DEA, Provincial Conservation Authorities and to the South African National Biodiversity Institute (SANBI) Bird and Bat Database.

Whilst it is very important to consider the local impacts that may be caused by individual developments, it is equally important to consider the cumulative impacts of multiple developments in proximity to each other.

Bats are particularly susceptible to many anthropogenic changes, particularly wind energy, cave disturbances, habitat alteration, poisoning etc. because of their low reproductive rate and high metabolic rates. The consequences of bat population declines are decreased pest-insect control by insectivorous bats, decreased pollination and seed dispersal by frugivorous bats and other ecosystem services provided by bats.

South Africa should at all costs avoid the situation in the USA and Canada where hundreds to thousands of bats, both local and migratory bats, die annually (Arnett and Baerwald, 2013). Hoary bats (*Lasiurus cinereus*), once a widespread and common migratory species in the USA, are under serious threat due to wind energy and are facing population declines (Frick *et al.* 2017). This is because preventative and/or corrective action was not taken early enough.

The South African Bat Fatality Threshold Guidelines Edition 2 (MacEwan *et al.* 2018) has introduced a way to calculate a bat fatality threshold for development projects or greater cumulative areas based on the development area and the Ecoregion in which the development is located. This method could help reduce the possibility of population level declines. Should adjusted bat fatalities (adjusted for biases such as searcher efficiency and carcass persistence) equal or exceed the annual fatality threshold per species, then operational mitigation (examples of the types of measures that can be applied are found in Aronson *et al.* (2018)) must be implemented according to this Guideline or subsequent versions thereof.

2. INTRODUCTION

Phase 2 of the wind and solar PV Strategic Environmental Assessment (SEA) was commissioned by the Department of Environmental Affairs (DEA) in order to identify additional Renewable Energy Developments Zones (REDZs). The new REDZs will be selected using new wind and solar PV resource data available at a national scale as well as a review and update of the environmental four tiers sensitivity data/maps prepared during Phase 1 based on most recent and publicly available datasets for the strategic issues considered for the existing focus areas at a national scale. In the Phase 2 SEA, eight focus areas (FAs) have been selected for the current assessment (Figure 1) – FA1 to FA4 for the development of solar PV facilities (SPVFs) only, FA5 for the development of wind energy facilities (WEFs) only and FA6, FA7 and FA8 for the potential development of both SPVFs and WEFs.

The Council for Scientific and Industrial Research (CSIR) was appointed by the DEA to undertake the Phase 2 wind and solar PV SEA. The CSIR in turn appointed Inkululeko Wildlife Services (IWS) as an independent, suitably qualified bat specialist consultancy to provide authorative input on the impacts of the development of wind and solar PV REDZs on bats.

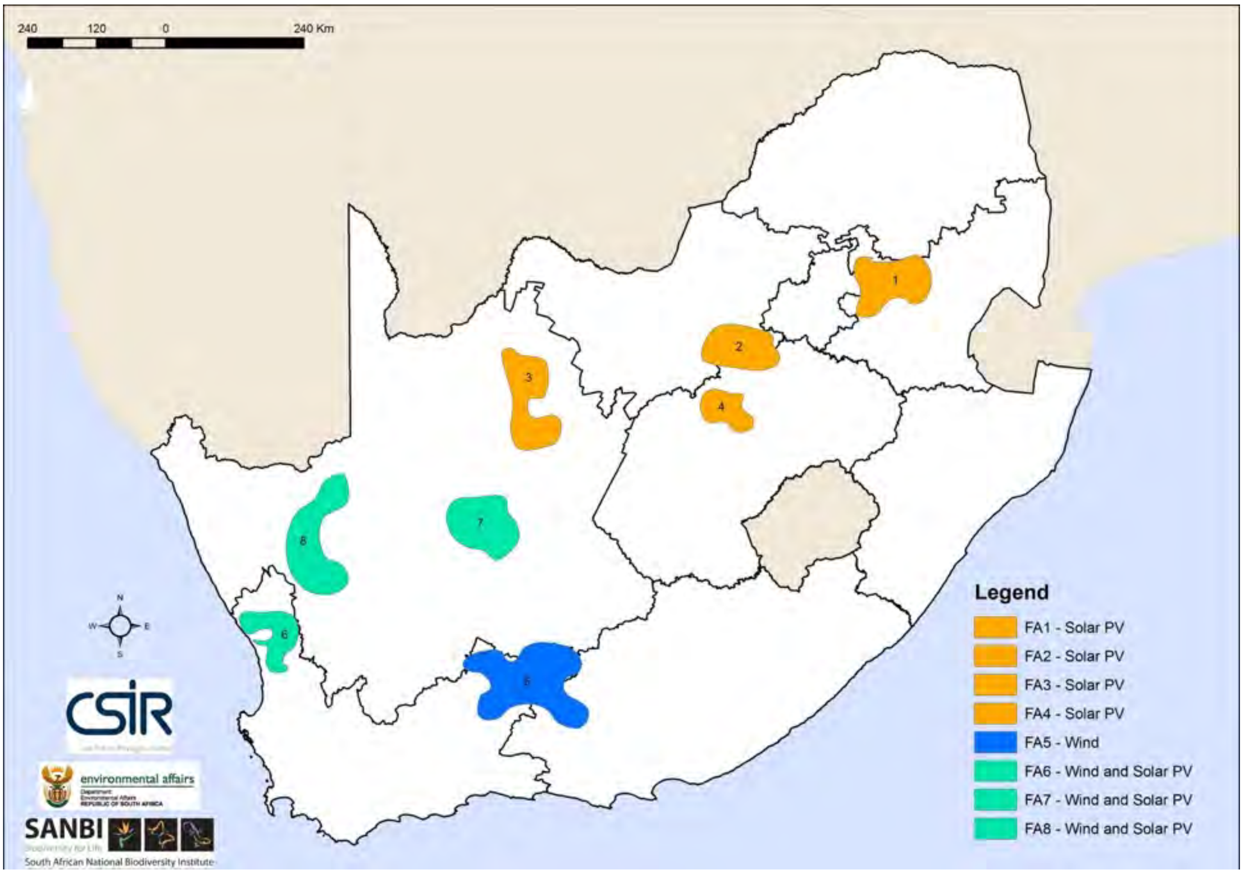


Figure 1 Phase 2 FAs selected for the SEA

Bats (Order: Chiroptera), the second most diverse mammalian group on the planet, provide vital ecosystem services that support our agricultural industry, tourism and health sectors, both directly and indirectly. They therefore warrant consideration and protection, at the very least, for their economic value. Insectivorous bats are known to eat up to their body weight in insects daily; many of their prey considered pests. They thus act as vital pest-control agents, and their value has been estimated at $1bn in global savings in the agricultural industry (Kalka *et al*., 2008; Kunz *et al*., 2011; Maine & Boyles, 2015). In the health sector bats provide effective organic control of mosquitoes which carry the malaria parasite (Gonsalves *et al*. 2013).

Fruit and nectar-eating bats are known to act as vectors for seed dispersal and pollination of 528 plant species which include important agricultural crops and naturally occurring species (Fleming, Geiselman & Kress, 2009). Cave-dwelling bats play important roles in nutrient cycling via the production of guano, a vital input of energy in most cave systems (IUCN SSC, 2014). Bats are thus important keystone species for most ecosystems and act as good indicators of ecosystem health (Jones *et al*., 2009).

Evidence from SA WEFs (MacEwan, 2016; Perold & MacEwan 2017; nine IWS operational monitoring reports issued to clients) and studies in the United States of America (USA), Canada and Europe show that wind turbines do kill bats (Kunz *et al*., 2007; Arnett *et al*., 2008; Rydell *et al*., 2012; Baerwald & Barclay, 2011; Voigt *et al*., 2012). Arnett and Baerwald (2013) conducted a synthesis of bat fatality data from 122 post-construction fatality studies between the years 2000 to 2011 from 73 regional wind energy facilities in the USA and Canada. The findings estimated that cumulative bat fatalities for these 12 years amounted to between 650 104 to 1 308 378. The figures would have increased substantially since 2011, but there is no new synthesis study that IWS is aware of.

Compared to other similar-sized mammals, bats have low reproductive rates (O'Shea *et al*., 2010). Females usually give birth to only one or two pups at a time, and females of some species only give birth every second year. Regardless of causal mechanisms, bat fatalities raise serious concerns because of the population-level impacts that mass fatalities may cause. Although long-lived, bats have exceptionally low reproductive rates, and their population growth is therefore relatively slow. This limits their ability to recover from declines and maintain sustainable populations (Barclay & Harder, 2003; Voigt & Kingston, 2016). Cave-dwelling and/or migratory bats are especially vulnerable to disturbance because large numbers (hundreds or thousands) of individuals may be concentrated in a few restricted localities (Hester & Grenier, 2005). Consequently, disturbance of only a few populations can have a devastating impact on a species. However, regular killings of several individuals from smaller local populations could also be unsustainable for those populations and needs to be assessed in the site-specific EIA specialist study.

There are four main groups of bats that are at risk of collision or barotrauma[1] fatality by wind turbines in SA. These are:

- Open-air foragers. These insectivorous bats fly across a range of elevations but mostly feed in the open-air, high above tree canopy height, possibly reaching heights of > 2km above the ground (Williams *et al*. 1973; McCraken *et al*., 2008). This group is made up of the families Molossidae and Emballonuridae. They are adapted for speed and agility – having long narrow wings that provide high wing-loading and aspect ratios. All species within these families are at high risk of fatality and several Molossidae bats have been found dead beneath turbines in SA (Doty & Martin, 2012; MacEwan, 2016; IWS several assessments unpublished).
- Clutter-edge foragers. These insectivorous bats forage amongst and above the tree canopy. They consist mainly of bat species of the Vespertilionidae family. Certain species are at particular risk and have been found dead below turbines, e.g. Cape Serotine Bat *Neoromicia capensis* (Doty & Martin, 2012; MacEwan, 2016; IWS several assessments unpublished).
- Migrating bats. Whilst the three bats most well-known for seasonal movement or migration events in SA are Natal Long-fingered Bats *Miniopterus natalensis* (van der Merwe, 1975), Temminck's Myotis Bat *Myotis tricolor* (Monadjem *et al*., 2010) and Egyptian Rousette Bat *Rousettus aegyptiaca* (Herselman & Norton, 1985; Monadjem *et al*., 2010), evidence from pre-construction monitoring studies in SA suggests that other high-risk species may also undertake seasonal movements (IWS – over 30 unpublished assessments). In the USA and Canada, migrating bats are tree-roosting species, but in SA, migrating bats are generally cavity roosting species. They cover large distances during their seasonal movements (up to 240 km (van der Merwe, 1975)) and are thought to travel well above the tree canopy height during migration events. The fact that they occur in large numbers in caves suggests that they possibly also migrate in large numbers, which could result in large-scale fatalities by WEFs. However, an Honours in Science project completed by Mark Hodgeson at the University of

[1] Barotrauma involves tissue damage to air- containing structures caused by rapid or excessive pressure change. Pulmonary barotrauma is lung damage due to expansion of air in the lungs that is not accommodated by exhalation (Baerwald *et al*. 2008)

Cape Town (UCT) (Hodgeson, 2016) showed that the Western Cape *Miniopterus natalensis* population suggests that they in fact may not migrate en mass and that maternity colonies may fragment, with small groups of bats going to different hibernacula. Further research on the dispersion patterns of bats from large roosts is required.

What isotope studies do tell us though, is that migrating bats disperse large distances - 1 000 km in Europe (Voigt *et al*., 2012) and possibly up to 240km in South Africa (Hodgeson, 2016). Therefore, fatalities of migrating bats from potentially large geographic areas could have a devastating, long-term impact on species.

Migrating bats are considered to be at Medium to High risk of fatality. A few *Miniopterus natalensis* carcasses have been found so far at a facility in the Eastern Cape, SA (MacEwan, 2016).

- <u>Fruit bats</u>. Two fruit bat species, *Rousettus aegyptiacus* and *Epomophorus wahlbergi*, have wide distributions in South Africa and are likely to occur in regions where wind energy development occurs. This group are at a Medium to High risk of fatality, and carcasses of both species have already been found at WEFs in the Eastern Cape, SA (MacEwan, 2016).

Given the ecological and economic importance of bats, and their susceptibility and low resilience to severe population crashes, the potential impacts of WEFs on all bat species, not just conservation important species, deserve thorough evaluation and effective mitigation.

3. SCOPE OF THIS STRATEGIC ISSUE

3.1 Terms of Reference

- Attend Multi-Author Workshop #1 scheduled at the beginning of the specialist assessment process, as well as Multi-Author Workshop #2 to discuss the first draft report (V1). These meetings will take place at the CSIR offices in Stellenbosch.
- Review existing literature (including the latest research undertaken both locally and internationally); maps and aerial photographs; and habitat data (if available) to compile a baseline description applicable to each focus area; including a list of bat species that are sensitive to renewable energy developments that have been observed and/or are likely to occur in each focus area; a shortlist of priority bat species that should be the focus of further assessment (if applicable) and a description of any likely movement corridors or flyways used by collision-prone priority species.
- Verify and update (where required and related to the bats only) the focus areas of the environmental four-tier sensitivity map that the CSIR and SANBI will provide. Verify the approach for classing each sensitivity feature according to a four-tiered sensitivity rating system, i.e. Very High, High, Medium or Low. Identification of any additional features of interest (such as caves and roosts) or any gaps in information within the focus areas not identified in the existing sensitivity analysis, making use of datasets made available through the draft environmental constraints map and additional information sourced by the specialist.
- Identification and discussion on the key potential impacts (positive and negative) associated with the development of wind and solar PV projects and associated activities (e.g. construction of power lines and substations and construction of roads) relating to the strategic issue.
- Evaluate the potential cumulative impacts associated with the development of wind and solar PV projects and associated activities (e.g. construction of power lines and substations and construction of roads) relating to the strategic issue in the second draft focus areas, considering existing renewable energy projects across SA and the existing REDZs.

- Review and provide input to the environmental assessment protocol, checklist and norms or standards. For example, in the protocol, what additional information and level of assessment is required in each sensitivity category (and where appropriate for habitats within each sensitivity class) before an authorisation with respect to bats should be considered.
- Assist in addressing reviewer comments writing the revised first draft (V2).
- Assist in addressing the stakeholder and expert comments on the revised first draft (V2) and second draft.
- Provide input to the pre-construction site-specific environmental assessment protocol.

3.2 Assumptions and Limitations

- The current study is a very high-level desk-top impact assessment for input into the SEA. The protocols developed and the recommendations may require that further on-site work be done in certain areas at specific sites. Should the desktop analysis reveal that field verification work is required, such work will be recommended for input into the site-specific EIA protocol.
- The assessment can only be as good as the data that are available to input into the assessment. Gaps in knowledge are listed in Section 8.

3.3 Relevant Regulations and Legislation

3.3.1 International Legislation, Guidelines and Treaties

There are various conventions, unions and treaties in place for the protection of biodiversity. Below are just a few:

3.3.1.1 Convention on Biological Diversity

The Convention on Biological Diversity (CBD), also referred to as the Biodiversity Convention, was established during the 1992 UN Conference on Environment and Development (UNCED), also known as the 1992 Earth Summit, held in Rio de Janeiro, Brazil. It represented the first global, comprehensive, legally-binding agreement to address all aspects of biological diversity ranging from genetic resources to species and ecosystems. It is regarded as the key document regarding sustainable development. The CBD has three main goals: conservation, sustainable use of biodiversity and equitable sharing of benefits arising from genetic resources. SA signed the treaty in 1998 showing further commitment to the conservation of biodiversity, including inter- and intra-specific bat diversity and bat habitat.

3.3.1.2 The Bonn Convention (on the Conservation of Migratory Species of Wild Animals)

The Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their range and ensure the sustainable use of these species. The treaty was signed in 1979 in Bonn, France, and was legislated (or implemented) in 1983. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme (UNEP), which is concerned with the conservation of wildlife and habitats on a global scale. SA is a party to this Convention, and several bat species in SA are known or suspected to be migratory, e.g. the Natal Long-fingered Bat *Miniopterus natalensis*.

3.3.1.3 CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)

CITES is an international agreement aimed at ensuring sustainable international trade in wild animal and plant specimens to ensure they are not threatened by trading. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union) and came into effect in 1975. There are currently 183 parties to this convention.

3.3.1.4 Agenda 21 and Rio Declaration

Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organisations of the United Nations System, governments, and major groups in every area in which human impacts on the environment.

3.3.1.5 The IUCN (World Conservation Union)

The Union's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

The IUCN have assigned (through research and assessments) various red list conservation categories, based on levels of threat to animal and plant species (IUCN, 2012), ranging requiring little conservation effort to those threatened by extinction and deserving of special conservation:

- Least Concern (LC)
- Near Threatened (NT)
- Vulnerable (VU)
- Endangered (EN)
- Critically Endangered (CR)
- Extinct in the Wild (EW)

Often the ranking of biodiversity into these categories at the global level do not accurately reflect the status of biodiversity at a national and regional level. In such cases national lists are compiled.

Of particular relevance to bats and wind energy is the World Bank Group's Environmental Health, and Safety Guidelines for Wind Energy. These guidelines among other aspects, highlight the environmental responsibility of onshore and offshore WEF developers. There is recognition that there is a potential adverse impact on bats due to direct collision and barotrauma. It highlights that site selection should consider:

- The proximity of proposed WEFs to areas of high biodiversity value
- Consultation with relevant organisations to inform site selection
- Site-specific issues informed by specialists
- Species-specific issues informed by specialists
- Season-specific issues informed by specialists
- Siting of turbines relative to various environmental impacts.

The guidelines further state that pre- and post-construction monitoring should occur and be informed by the most relevant monitoring guidelines, and that the results of such should be made available to stakeholders and mitigation measures should be adhered to. Such mitigation measures should be revised where necessary and the revised measures should then be implemented.

3.3.2 Regional Agreements

3.3.2.1 Action Plan of the Environmental Initiative of NEPAD

This New Partnership for Africa's Development (NEPAD) Action Plan was established during the 2003 African Convention on Conservation of Nature and Natural Resources held in Maputo. As a contracting state, South Africa has undertaken to adopt measures to ensure the conservation, utilisation and development of soil, water, floral and faunal resources in accordance with scientific principles and with due regard to the best interests of the people and the environment. The Action Plan encourages sustainable development and associated conservation and wise use of biodiversity in Africa. It has been recognised that a healthy and productive environment is a prerequisite for the success of NEPAD, together with the need to systematically address and sustain ecosystems, biodiversity and wildlife.

3.3.3 National Legislation and Guidelines

Unlike in the UK and the USA, bats are not directly legally protected in South Africa. However, there are various Acts and Regulations relevant to the protection of fauna, including bats:

3.3.3.1 National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA)

NEMA is an umbrella Act covering broad principles of environmental management. This Act can be regarded as the most important piece of general environmental legislation covering three main areas namely: land, planning and development; natural and cultural resource use and conservation; pollution control and waste management. According to NEMA sustainable development requires the consideration of all relevant factors including:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or, where such loss cannot be avoided, be minimised and remedied;
- That the development, use and exploitation of renewable resources and the ecosystems of which they are a part, do not exceed the level beyond which their integrity is jeopardised.
- Sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

3.3.3.2 NEM: Biodiversity Act, 2004 (Act 10 of 2004) (NEM:BA)

NEM:BA makes provisions to provide for the management and conservation of South Africa's biodiversity within the framework of NEMA and to ensure the sustainable use of indigenous biological resources.

3.3.3.3 NEM: Biodiversity Act, 2004: Threatened and Protected Species (TOPS) Regulations

According to Section 56(1) of NEM:BA, in February 2007 the Minister of Environmental Affairs and Tourism published a list of Threatened (Critically Endangered, Endangered and Vulnerable) or Protected Species (referred to as TOPS). According to the NEM:BA TOPS Regulations a person may not carry out a restricted activity involving a specimen of TOPS without a permit. The Regulations fail to recognise most bat species of conservation concern - only one bat species, the Large-eared Free-tailed Bat (*Otomops martiensseni*) is listed on the TOPS list and other species are not protected at a national level. Fortunately, certain bat species are protected under various provincial environmental legislation which are primarily used to guide environmental decisions for any development (nature conservation is a parallel function of national and provincial government in terms of the Constitution (Act 108 or 1996).

3.3.4 Provincial Legislation and Guidelines

Each province of SA has its own conservation legislation, guidelines or policies. Most provinces list all or some bats as Protected Species (PS). Such legislation, guidance or policy should be seriously taken into consideration in site specific EIAs. In addition, most provinces require that permits are required for work that involves catching and handling of wild animals and hunting of wild animals, including bats.

3.3.5 Bat Monitoring Guidelines

In addition to the above, the following national monitoring guidelines for bats and WEFs have been released and have been adopted as the best-practise guidelines by DEA, Environmental Assessment Practitioners (EAPs) and specialists:

- South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. 1st Edition (Aronson *et al*., 2014).
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Development – Pre-construction. Edition 4.1 (Sowler *et al*., 2017)
- The South African Bat Fatality Threshold Guidelines Edition 2 (MacEwan *et al*., 2018) (under revision).
- Mitigation Guidance for Bats at Wind Energy Facilities in South Africa. 2nd Edition (Aronson *et al*., 2018).

3.3.6 Buffer Zones

Directly from Sowler *et al.* (2017), the South African Bat Assessment Advisory Panel (SABAAP) recommends that for wind turbine developments, including all parts of the blades and towers, SABAAP recommends, as an absolute minimum, a buffer of 200m around all potentially bat important features, e.g. delineated watercourses, i.e. from the edge of the riparian zone or from the edge of the outer wetland zone (DWAF definition), woodland vegetation (any trees or bush clumps considered important on site, including alien vegetation), outbuildings (all structures considered as potentially important for bats – water towers, farm buildings, bridges, artificial roosts, etc.), rocky outcrops, topographical ridges and Protected Areas (as described in NEMA: Protected Areas Act 57 of 2003). The exception to the above distance is for confirmed or suspected roosts (permanent or seasonal roosts), where the following buffers should apply:

- A buffer of 500 m for a colony of 1 – 50 Least Concern bats and/or Low Fatality Risk bats.
- A buffer of 1 km for a colony of 50 – 500 Least Concern bats and/or Low Fatality Risk bats.
- A buffer of 2.5 km for a colony of 500-2000 Least Concern bats and/or Low Fatality Risk bats.
- A buffer of 1 km for a colony of 1 - 50 Medium, Medium-High and High Fatality Risk and/or Conservation Important bats
- A buffer of 2.5 km for a colony of 50 - 500 Medium, Medium-High and High Fatality Risk and/or Conservation Important bats
- A buffer of 10 km for a colony of 500 - 2000 Medium, Medium-High and High Fatality Risk and/or Conservation Important bats
- A buffer of 20 km for a colony of >2000 Bats of any status and/or risk level

Important Notes:

- These are minimum values and they do not exempt the developer from implementing additional mitigation measures outside of the buffer zones where bat activity levels dictate.

- Where radial buffers are not appropriate, the specialist must map appropriate polygons within those buffers distances that are suitable for foraging and safe movement.
- The buffer distances must also ensure protection of the roost from disturbance
- Increased linear buffers may be required where migration or movement corridors are known.

For other associated wind energy facility development, such as buildings, sub-stations, roads and powerlines, SABAAP recommends:

- For roads: The 200m minimum buffer applies to bat roosts, but roads can cross bat important foraging areas, as long as all the other water use license mitigation measures are in place in the case of wetlands and rivers.
- For power lines: No powerline infrastructure should be constructed within 2km of any large known confirmed roosts and 500m from smaller confirmed roosts. However, power lines can cross bat important foraging areas area, as long as all the other water use license mitigation measures are in place in the case of wetlands and rivers.
- For buildings and sub-station infrastructure: the 200m minimum buffer applies.

Appropriate site-specific buffers need to be selected by a qualified specialist for bat conservation important habitat (whether it is for foraging or roosting) that will meet the requirements of the particular species or populations occurring in the area.

4. KEY BAT IMPORTANT ATTRIBUTES AND SENSITIVITIES OF THE STUDY AREAS

Terrestrial ecoregions, geology (especially where linked to caves and crevices formed in dolomite and limestone and extrusive rocky outcrops), known bat roosts, vegetation, irrigated agricultural areas, buildings, eroded areas, wetlands, rivers, dams and extent of occurrence of conservation important bat species were selected as features relevant to bats. These features were mapped per FA and then each feature or feature sub-class was assigned a sensitivity class and where appropriate, a buffer. The feature maps and sensitivity maps for each FA are provided in this report.

Very High sensitivity areas were considered to have very high roosting and/ or foraging potential and/ or due to very high bat activity levels and/ or potential occurrence of Vulnerable, Data Deficient or Endangered species. These areas are likely to be unsuited to development from a bat perspective owing to the very high bat importance or very high risk to bats. High sensitivity areas were considered to have high roosting and/ or foraging potential and/ or due to high bat activity levels. These areas are potentially unsuited to development from a bat perspective owing to the high bat importance or high risk to bats. Medium sensitivity areas were considered to have moderate roosting and/ or foraging potential and/ or due to moderate bat activity levels and/ or due to unknown bat activity levels and/ or potential occurrence of Near-threatened or Rare species. These areas are potentially suitable for development, but as with Very High and High bat sensitivity areas, the site-specific sensitivity map will be refined in the EIA and potential on-site impacts must be fully investigated and effective mitigation options clearly identified. Low sensitivity areas were considered to have low roosting and/ or foraging potential and/ or due to low bat activity levels and no known occurrence of conservation important species. These areas would be more suitable for development than the Medium to Very High sensitivity areas, but the site-specific sensitivity map will be refined in the EIA.

For more detail on each of the features and their bat related sensitivities, please refer to Section 4.2.1.

The current habitat and potential occurrence of conservation important and high fatality risk bat species for each Focus Area is presented in Section 4.1.

4.1 Focus Area Description

Site	Brief description
FA1 **Solar PV only**	FA1 is made up mostly of the Highveld Grassland Ecoregion, with smaller patches of Southern African Bushveld and Drakensberg Montane Grasslands, Woodlands and Forests. As far as there is data available, Grassland ecoregions have moderate bat activity levels compared with other ecoregions. Two large towns – Witbank and Middleburg take up the central area of the FA, with smaller Belfast to the east. Coal mining is extensive in this region and irrigated agriculture makes up a large part of the landscape, with scattered stands of alien trees. Defunct underground mines can harbour large colonies of bats. The FA is mainly underlain by Arenite geology. Whilst FA1 is largely disturbed by human activity, there is roosting potential in defunct mine tunnels, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and extensive wetland systems. This FA has the highest potential of bat species of conservation importance occurrence (according to Child *et al*. (2016) and MacEwan *et al*. (2018)) Any EIAs within this FA should confirm whether *Cloeotis percivali* (EN (Balona *et al*. (2016)), *Epomophorus wahlbergi* (LC (Schoeman *et al*. (2016b)), *Otomops martiensseni* (NT (Richards *et al*. (2016)), *Rhinolophus blasii* (NT (Jacobs *et al*. (2016c)), *Rhinolophus cohenea* (VU (Cohen *et al*. (2016)), *Rhinolophus swinnyi* (VU (Jacobs *et al*. (2016d)) and/ or *Rousettus aegyptiacus* (LC (Markotter *et al*. (2016)) will be impacted on by any proposed solar PV developments.
FA2 **Solar PV only**	FA2 is made up entirely of the Highveld Grassland Ecoregion. As far as there is data available, Grassland ecoregions have moderate bat activity levels compared with other ecoregions. Two large towns – Klerksdorp and Potchefstroom take up the central area of the FA, with smaller Vredefort to the east. Irrigated agriculture makes up a large part of the landscape, with scattered mining and other industry. The most significant bat important feature of this FA is the cave-forming Dolomite geology in the central and eastern parts. Roosting potential exists in possible caves, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and smaller wetlands. Defunct underground mines can harbour large colonies of bats. Species of conservation importance (according to Child *et al*. (2016) and MacEwan *et al*. (2018)) to look out for in more detailed EIAs include *Epomophorus wahlbergi* (LC (Schoeman *et al*. (2016b)) and *Rhinolophus denti* (NT (Schoeman *et al*. (2016a)).
FA3 **Solar PV only**	FA3 is made up entirely of the Kalahari Xeric Savanna Ecoregion. There is no bat activity data available for this ecoregion, however, IWS predicts that it would be similar to the Nama Karoo, which has low to moderate activity levels depending on site specific habitat features. Towns in this region of the North-West Province and Northern Cape are built mainly around mineral mining, e.g. iron-ore, manganese, asbestos, diamonds etc. The most significant bat important feature of this FA are the cave-forming Dolomite patches throughout the FA. Known bat roosts are found in this FA, with many more potential roosts in the Dolomite and tunnels/ adits in defunct mines. Additional roosting potential exists in rock outcrops and buildings. Foraging potential is low, except where there is water. The species of conservation importance (according to Child *et al*. (2016) and MacEwan *et al*. (2018)) to look out for in more detailed EIAs is *Rhinolophus denti* (NT (Schoeman *et al*. (2016a)).
FA4 **Solar PV only**	FA4 is made up entirely of the Highveld Grassland Ecoregion. As far as there is data available, Grassland ecoregions have moderate bat activity levels compared with other ecoregions. Two large towns – Welkom and Virginia take up the south eastern area of the FA, with smaller towns scattered around the FA. Irrigated agriculture makes up a large part of the landscape, with gold mining and other industry also occurring. Roosting potential exists in rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and extensive wetlands. Defunct underground mines can harbour large colonies of bats. Species of conservation importance (according to Child *et al*. (2016) and MacEwan *et al*. (2018)) to look out for in more detailed EIAs include *Epomophorus wahlbergi* (LC (Schoeman *et al*. (2016b)) and *Rhinolophus denti* (NT (Schoeman *et al*. (2016a)).
FA5 **Wind only**	FA5 is made up mostly of the Nama Karoo Ecoregion, with smaller patches of Albany Thicket in the south east and Drakensberg Montane Grasslands, Woodlands and Forests in the north east. From bat activity data collected by IWS over six years, the Nama Karoo Ecoregion has low to moderate bat activity levels compared with other ecoregions. There are no major habitat features of concern for bats in this FA, however, species at the high risk of wind turbine fatality (according to Sowler *et al*. (2017), Perold and MacEwan (2017) and MacEwan (2016)), Wahlberg's Epauletted Fruit Bat *Epomophorus wahlbergi*, Natal Long-fingered Bat *Miniopterus natalensis*, Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*, do occur throughout the FA. There is roosting potential in rock outcrops, trees and buildings.

Site	Brief description
FA6 Solar PV and Wind	On the west coast, FA6 consists of three ecoregions – mainly the Succulent Karoo, with patches of Lowland and Montane Fynbos and Renosterveld in the south and east respectively. From IWS's database, the Succulent Karoo is a low bat activity ecoregion. Bat activity will be highest near rock outcrops, irrigated agricultural areas, rivers and wetlands. The species of conservation importance, according to Child *et al*. (2016), to look out for in more detailed EIAs is *Laephotis namibensis* (VU (Avenant *et al*. (2016)). Least concern species at the highest risk of wind turbine fatality (according to Sowler *et al*. (2017) and Perold and MacEwan (2017)) are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.
FA7 Solar PV and Wind	FA7 in the Northern Cape consists entirely of Nama Karoo Ecoregion. From bat activity data collected by IWS over six years, the Nama Karoo Ecoregion has low to moderate bat activity levels compared with other ecoregions. The most significant bat important features of this FA are the cave-forming Dolomite geology in the eastern parts, the sedimentary rock, the river and the scattered wetlands. Roosting potential exists in possible caves, rock outcrops, trees and buildings and foraging potential over the river courses and wetlands/seasonal pans. Zinc mining surrounds the town of Copperton. Defunct underground mines can harbour large colonies of bats. The species of conservation importance, according to Child *et al*. (2016), to look out for in more detailed EIAs is *Rhinolophus denti* (NT (Schoeman *et al.* (2016a)). Least concern species at the highest risk of wind turbine fatality (according to Sowler *et al*., (2017) and Perold and MacEwan (2017)) are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.
FA8 Solar PV and Wind	FA8 in the Northern Cape consists mostly of Nama Karoo Ecoregion, with a patch of Succulent Karoo in the south. The Nama Karoo has low to moderate bat activity levels and the Succulent Karoo has low bat activity levels compared with other ecoregions. Besides sedimentary rock outcrops and scattered ephemeral wetlands, there are no major habitat features of concern for bats in this FA. Species of conservation importance, according to Child *et al*. (2016), to look out for in more detailed EIAs include *Laephotis namibensis* (VU (Avenant *et al*. (2016)) and *Cistugo seabrae* (NT Jacobs *et al*. (2016a)). Least concern species at the highest risk of wind turbine fatality (according to Sowler *et al*. (2017) and Perold and MacEwan (2017)) are Natal Long-fingered Bat *Miniopterus natalensis,* Cape Serotine Bat *Neoromicia capensis* and Egyptian Free-tailed Bat *Tadarida aegyptiaca*.

4.2 Feature Sensitivity Mapping

4.2.1 Identification of feature sensitivity criteria

Only features relevant to bats and relevant to the specific technologies and FAs are listed below.

4.2.1.1 Solar PV

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Ecoregions	Terrestrial Ecoregions (Olson *et al*., 2001). The Nature Conservancy, Arlington, VA. Available at http://maps.tnc.org/files/shp/terr-ecoregions-TNC.zip	Terrestrial Ecoregions are large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions (Olson *et al*., 2001). The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level (Miller-Butterworth *et al*., 2003). From numerous monitoring assessments (MacEwan *et al.* 2016), the average bat passes per hour was calculated for eight of the 17 ecoregions to gain an understanding of the bat activity levels. For the KwaZulu-Cape Coastal Forest Mosaic, activity levels were verified with Taylor *et al*. (2007). Only relevant Ecoregions to this SEA are listed here.	KwaZulu-Cape Coastal Forest Mosaic	Very High	None	1
			Lowland Fynbos and Renosterveld	Low	None	6
			Nama Karoo	Low	None	7, 8
			Drakensberg Montane Grasslands, Woodlands and Forest	Medium	None	1
			Highveld Grassland	Low	None	2, 4
			Kalahari Xeric Savannah	Low	None	3
			Southern African Bushveld	Medium	None	1
			Montane Fynbos and Renosterveld	Low	None	6
			Succulent Karoo	Low	None	6
			Zambesian and Mopane Woodlands	Medium	None	1

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Geology	Council for Geosciences SA. Geology wr90 shapefile and Geology Geoscience shapefile. Limited metadata are available but date of creation is 1997.	Geology is a significant environmental parameter for bats (Kunz *et al*., 2012), and many South African bats are crevice or hollow-roosting species (Monadjem *et al*., 2010). Crevice roosting bats utilizing rock cracks, bridge expansion joints, under tree bar, etc. usually roost individually or in small groups, although they can congregate in larger numbers, especially in the eastern parts of the country. Hollow-roosting bats utilize larger hollows, such as caves, tunnels and roofs of houses. Solution caves are the most frequently occurring caves and such caves form in rock that is soluble, such as limestone, dolomite and salt. In South Africa, caves or karst formations are mostly associated with rocks such carbonate rocks like limestone and dolomite. Four main lithologies were selected as relevant to bats in terms of roosting potential: Limestone, Dolomite, Arenite and Sedimentary and Extrusive rock.	Dolomite	Very High	200 m	2, 3, 7
			Arenite	Medium	200 m	1, 2, 4 6
			Sedimentary and Extrusive Rock	Medium	200 m	1, 2, 3, 6, 7, 8
Bat Roosts	Sources included databases from a collection of scientists, collated by the CSIR in 2017 and desktop refined by IWS in 2018. Main sources were: Bats KZN database, IWS database, Herselman and Norton (1985), Wingate (1983), Rautenbach (1982), David Jacobs database, Animalia database.	A few of the points were removed due to high levels of uncertainty and some points were moved, as the projection had put them in the ocean. All roosts were considered to be of a Very High sensitivity. Due to mainly construction phase impacts being the concern for bats, a minimum 500 m radial buffer was placed on each roost, irrespective of size or species.	Bat Roost Points	Very High	500m	3, 6
Land Cover: Vegetation	2013 – 2014 South African National Land-Cover Dataset. Created by GeoterraImage for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44 The following land cover classes were used: thicket/dense bush, plantations and indigenous forest (LC classes 4, 5, 32 and 33). For detailed descriptions of these classes please see Appendix A in http://www.geoterraimage.com/uploads/GTI%202013-14%20SA%20LANDCOVER%20REPORT%20-	Trees and heterogenic landscapes are important for bats (Heim *et al*., 2015) especially in dry regions (Hacket *et al*., 2013)	Plantations / Woodlands:	Medium	200 m	1, 2, 4, 6, 7

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
	%20CONTENTS%20vs%2005%20DEA%20OPEN%20ACCESS%20vs2b.pdf Forests, plantations and thick bush provide refuge for several species of bats.					
Irrigated Agricultural Areas	2013 – 2014 South African National Land-Cover Dataset. Created by GeoterraImage for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44. The following land cover classes were used: Vines, Subsistence cultivation, Pineapple agriculture, sugarcane plantations, commercial fields, and commercial pivots (LC classes 16-31). For detailed descriptions of these classes please see Appendix A in http://www.geoterraimage.com/uploads/GTI%202013-14%20SA%20LANDCOVER%20REPORT%20-%20CONTENTS%20vs%2005%20DEA%20OPEN%20ACCESS%20vs2b.pdf	Human induced land-use changes can be beneficial for certain species of bats, with irrigated and fertile crop lands being hotspots for insectivorous bat foraging (Boyles *et al.*, 2011, Sirami *et al.*, 2013, Heim *et al.*, 2015)	All irrigated crops	Medium	None	1, 2, 4, 6
Land Cover: Urban Built-up Areas	2013 – 2014 South African National Land-Cover Dataset. Created by Geoterra Image for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44	Land use change in the form of buildings can represent roosting habitat for specific crevice and hollow-roosting bat species Such human induced land-use changes can be beneficial for certain species of bats (Taylor *et al.*, 2013, Sirami *et al.*, 2013). As this is only beneficial to certain species and not all buildings or human developments provide such habitat, urban areas were assigned a Medium sensitivity.	Urban Areas	Medium	None	1, 2, 3, 4, 6, 7, 8
		Disturbed or eroded lands with no vegetation cover, no water and no buildings were assigned a Low sensitivity due to the low roosting and foraging potential.	Disturbed Land (Eroded)	Low	None	1, 2, 3, 4, 6
Wetlands & Dams	Wetlands = National Freshwater Ecosystem Priority Areas (NFEPA). CSIR. July 2011. Dams = dams500g_wgs84 shapefile. Dept. Water and Sanitation.	Wetlands provide drinking and foraging opportunities for bats. Dams provide drinking and foraging opportunities for bats.	NFEPA Wetlands, Farm Dams and Natural Dams	Very High	200m	1, 2, 3, 4, 6, 7, 8

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Rivers	Rivers = wriall500_primary shapefile. Dept. Water and Sanitation	There is strong support for the importance of rivers and riparian areas for bats (Serra-Cobo *et al*., 2000; Akasaka *et al*., 2009; Hagen & Sabo, 2012).	Major Perennial Rivers	Very High	200m	1, 2, 3, 4, 6, 7, 8
Coastline	Surveyor General (2006) 1:50 000 topographical maps	Numerous known and unknown cave roosts occur along the South African coast. There is also anecdotal evidence that some species of bats migrate along the coast.	SA Coastline	Very High	5 km	6
				High	10 km	
				Medium	20 km	
Extent of Occurrence of Bat Species of Conservation Importance	Database from a collection of scientists and organisations. Collated by SANBI and the EWT in 2016 for use in the National Bat Red Data listings.	Extent of Occurrence (EoO)[2] is defined as the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy (IUCN, 2012). Only species, where their EoO overlaps with the FAs and they are relevant to Solar PV development, are mentioned here.	*Cistugo seabrae*	Medium	None	8
			Cloeotis percivali	Medium	None	1
			Laephotis namibensis	Medium	None	6, 8
			Otomops martiensseni	Medium	None	1
			Rhinolophus blasii	Medium	None	1
			Rhinolophus cohenae	Medium	None	1
			Rhinolophus denti	Medium	None	2, 3, 4, 7
			Rhinolophus swinnyi	Medium	None	1

[2] Extent of Occurences (EoOs) were compiled for conservation important and certain high-risk bat species using the Child *et al*. (2016) species point data. These are simply points where one or more individuals from a particular species were confirmed from museum and scientific records. Because bats travel extensive distances nightly and some seasonally, these points are an under-estimation of the area each individual will occupy in their lifetime. Therefore, an arbitrary 50 km radius was placed around each confirmed point record to buffer for some or all of the potential movement or habitat spread. Then, a best fit polygon (the tightest possible polygon) was drawn around these radii to create an EoO for each relevant species. This is deemed as the maximum known extent that each species occurs in. However, the process did not exclude areas within the polygon where the bats are unlikely to occur due to disturbance or unfavourable habitat, i.e. the polygons did not represent the true area of occupancy (AoO). AoO is defined as the area within its EoO which is occupied by a taxon, excluding cases of vagrancy. In other words, the AoO is a more refined EoO that takes the detailed life history of each species into account. An AoO reflects the fact that a taxon will not usually occur throughout its entire EoO because the entire area may contain unsuitable or unoccupied habitats. To compile more AoOs per species is a huge task, way beyond the scope of this SEA.

4.2.1.2 Wind

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Ecoregions	Terrestrial Ecoregions (Olson *et al*., 2001). The Nature Conservancy, Arlington, VA. Available at http://maps.tnc.org/files/shp/terr-ecoregions-TNC.zip	Terrestrial Ecoregions are large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions (WWF, 2014). The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level (Miller-Butterworth *et al*., 2003). From numerous monitoring assessments (MacEwan *et al.* 2016), the average bat passes per hour was calculated for eight of the 17 ecoregions to gain an understanding of the bat activity levels in each and in the case of wind energy, the potential turbine fatality risk in each (Sowler *et al.* 2017). For the KwaZulu-Cape Coastal Forest Mosaic, activity levels were verified with Taylor *et al*. (2007).	Lowland Fynbos and Renosterveld	High	None	6
			Albany thickets	Medium	None	5
			Nama Karoo	Medium	None	7, 8
			Drakensberg Montane Grasslands, Woodlands and Forest	Medium	None	5
			Montane Fynbos and Renosterveld	Low	None	6
			Succulent Karoo	Low	None	6
Geology	Council for Geosciences SA. Geology wr90 shapefile and Geology_Geoscience shapefile. Limited metadata are available but date of creation is 1997.	Geology is a significant environmental parameter for bats (Kunz *et al*., 2012), and many South African bats are crevice or hollow-roosting species (Monadjem *et al*., 2010). Crevice roosting bats utilizing rock cracks, bridge expansion joints, under tree bar, etc. usually roost individually or in small groups, although they can congregate in larger numbers, especially in the eastern parts of the country. Hollow-roosting bats utilize larger hollows, such as caves, tunnels and roofs of houses. Solution caves are the most frequently occurring caves and such caves form in rock that is soluble, such as limestone, dolomite and salt. In South Africa, caves or karst formations are mostly associated with rocks such carbonate rocks like limestone and dolomite Four main lithologies were selected as relevant to bats in terms of roosting potential: Limestone, Dolomite, Arenite and Sedimentary and Extrusive rock.	Dolomite	Very High	200 m	7
			Arenite	High	200 m	5, 6
			Sedimentary and Extrusive Rock	Medium	200 m	5, 6, 7, 8
Bat Roosts	Sources included databases from a collection of scientists, collated by the CSIR in 2017 and desktop	A few of the points were removed due to high levels of uncertainty and some points were moved, as the	Bat Roost Points	Very High	Depends on size of roost	6

Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
	refined by IWS in 2018. Main sources were: Bats KZN database, IWS database, Herselman and Norton (1985), Wingate (1983), Rautenbach (1982), David Jacobs database, Animalia database.	projection had put them in the ocean. All roosts were considered to be of a Very High sensitivity. Due to mainly construction phase impacts being the concern for bats, a minimum 500 m radial buffer was placed on each roost, irrespective of size or species.			and type of bats – 500 m to 20 km. Refer to Section 6.3.6	
Land Cover: Vegetation	2013 – 2014 South African National Land-Cover Dataset. Created by GeoterraImage for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44 The following land cover classes were used: thicket/dense bush, plantations and indigenous forest (LC classes 4, 5, 32 and 33). For detailed descriptions of these classes please see Appendix A in http://www.geoterraimage.com/uploads/GTI%202013-14%20SA%20LANDCOVER%20REPORT%20-%20CONTENTS%20vs%2005%20DEA%20OPEN%20ACCESS%20vs2b.pdf Forests, plantations and thick bush provide refuge for several species of bats.	Trees and heterogenic landscapes are important for bats (Heim *et al*., 2015) especially in dry regions (Hacket *et al*., 2013)	Plantations / Woodlands:	Medium	200 m	5, 6, 7
			Thicket/ Dense Bush	Medium	200 m	5
Irrigated Agricultural Areas	2013 – 2014 South African National Land-Cover Dataset. Created by GeoterraImage for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44. The following land cover classes were used: Vines, Subsistence cultivation, Pineapple agriculture, sugarcane plantations, commercial fields, and commercial pivots (LC classes 16-31). For detailed descriptions of these classes please see Appendix A in http://www.geoterraimage.com/uploads/GTI%202013-14%20SA%20LANDCOVER%20REPORT%20-%20CONTENTS%20vs%2005%20DEA%20OPEN%20ACCESS%20vs2b.pdf	Human induced land-use changes can be beneficial for certain species of bats, with irrigated and fertile crop lands being hotspots for insectivorous bat foraging (Boyles *et al*., 2011, Sirami *et al*., 2013, Heim *et al*., 2015)	All irrigated crops	Medium	None	5, 6

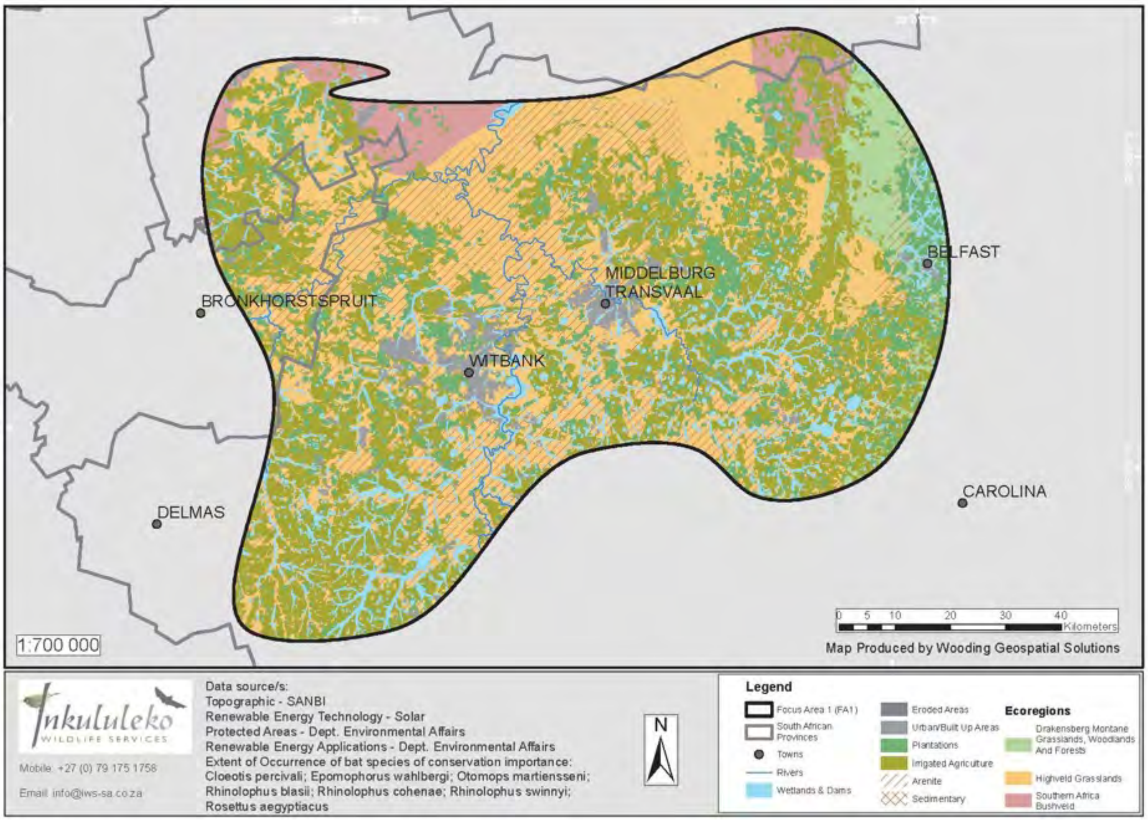
Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Land Cover: Urban Built-up Areas	2013 – 2014 South African National Land-Cover Dataset. Created by Geoterra Image for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44	Land use change in the form of buildings can represent roosting habitat for specific crevice and hollow-roosting bat species Such human induced land-use changes can be beneficial for certain species of bats (Taylor *et al*., 2013, Sirami *et al*., 2013). As this is only beneficial to certain species and not all buildings or human developments provide such habitat, urban areas were assigned a Medium sensitivity. Disturbed or eroded lands with no vegetation cover, no water and no buildings were assigned a Low sensitivity due to the low roosting and foraging potential.	Urban Areas	Medium	None	5, 6, 7, 8
			Disturbed Land (Eroded)	Low	None	5, 6
Wetlands & Dams	Wetlands = National Freshwater Ecosystem Priority Areas (NFEPA). CSIR. July 2011. Dams = dams500g_wgs84 shapefile. Dept. Water and Sanitation.	Wetlands provide drinking and foraging opportunities for bats. Dams provide drinking and foraging opportunities for bats.	NFEPA Wetlands, Farm Dams and Natural Dams	Very High	200m	5, 6, 7, 8
Rivers	Rivers = wriall500_primary shapefile. Dept. Water and Sanitation	There is strong support for the importance of rivers and riparian areas for bats (Serra-Cobo *et al*., 2000; Akasaka *et al*., 2009; Hagen & Sabo, 2012).	Major Perennial Rivers	Very High	200m	5, 6, 7, 8
Coastline	Surveyor General (2006) 1:50 000 topographical maps	Numerous known and unknown cave roosts occur along the South African coast. There is also anecdotal evidence that some species of bats migrate along the coast.	SA Coastline	Very High	5 km	6
				High	10 km	
				Medium	20 km	
Extent of Occurrence of Bat	Conservation Important species are those with a near-threatened and threatened status according to Child *et al*. (2016).	Extent of Occurrence (EoO)[3] is defined as the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the	*Cistugo seabrae* (NT)	Medium	No additional buffer on the EoO but there	8

[3] Extent of Occurences (EoOs) were compiled for conservation important and certain high-risk bat species using the Child *et al*. (2016) species point data. These are simply points where one or more individuals from a particular species were confirmed from museum and scientific records. Because bats travel extensive distances nightly and some seasonally, these points are an under-estimation of the area each individual will occupy in their lifetime. Therefore, an arbitrary 50 km radius was placed around each confirmed point record to buffer for some or all of the potential movement or habitat spread. Then, a best fit polygon (the tightest possible polygon) was drawn around these radii to create an EoO for each relevant species. This is deemed as the maximum known extent that each species occurs in. However, the process did not exclude areas within the polygon where the bats are unlikely to occur due to disturbance or unfavourable habitat, i.e. the polygons did not represent the true area of occupancy (AoO). AoO is defined as the area within its EoO which is occupied by a taxon, excluding cases of vagrancy. In other words, the AoO is a more refined EoO that takes the detailed life history of each species into account. An AoO reflects the fact that a taxon will not usually occur throughout its entire EoO because the entire area may contain unsuitable or unoccupied habitats. To compile more AoOs per species is a huge task, way beyond the scope of this SEA.

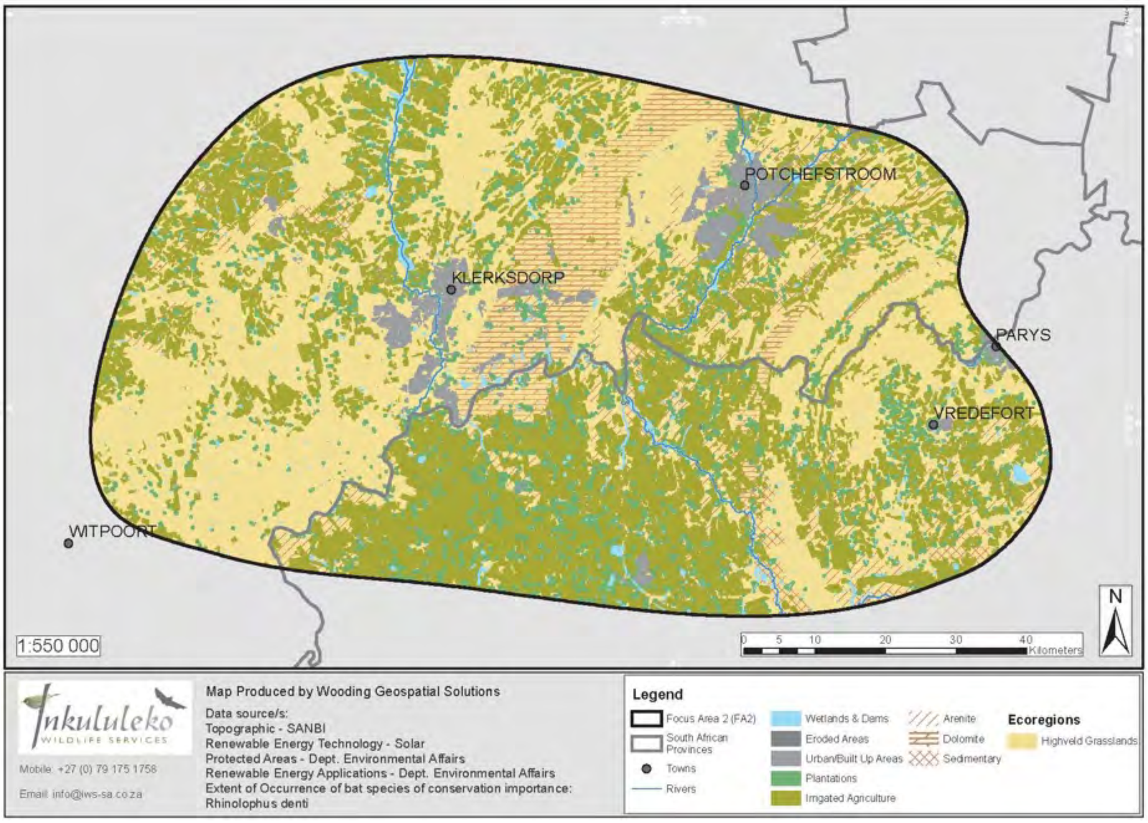
Sensitivity Feature Class	Data Source and Date of Publications	Sensitivity Explanation	Feature Sub-class	Feature Sub-class Sensitivity	Buffer Distance	Relevant Focus Areas
Species of Conservation Importance	In addition, two LC fruit bat species (*Epomophorus wahlbergi* and *Rousettus aegyptiacus*) were added to the list for wind energy, due to their high fatality risk and not enough understanding of their natural fecundity and death rates and hence sustainable losses. The conservation status of each species is indicated in brackets next to each species name.	known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy (IUCN, 2012). Only species, where their EoO overlaps with the FAs and they are relevant to Solar PV development, are mentioned here.			is a 50 km buffer on the individual record points.	
			Epomophorus wahlbergi (LC)	High	No additional buffer on the EoO but there is a 50 km buffer on the individual record points.	5
			Laephotis namibensis (VU)	Medium	No additional buffer on the EoO but there is a 50 km buffer on the individual record points.	6, 8
			Rhinolophus denti (NT)	Medium	No additional buffer on the EoO but there is a 50 km buffer on the individual record points.	7

4.2.2 Absolute Feature maps

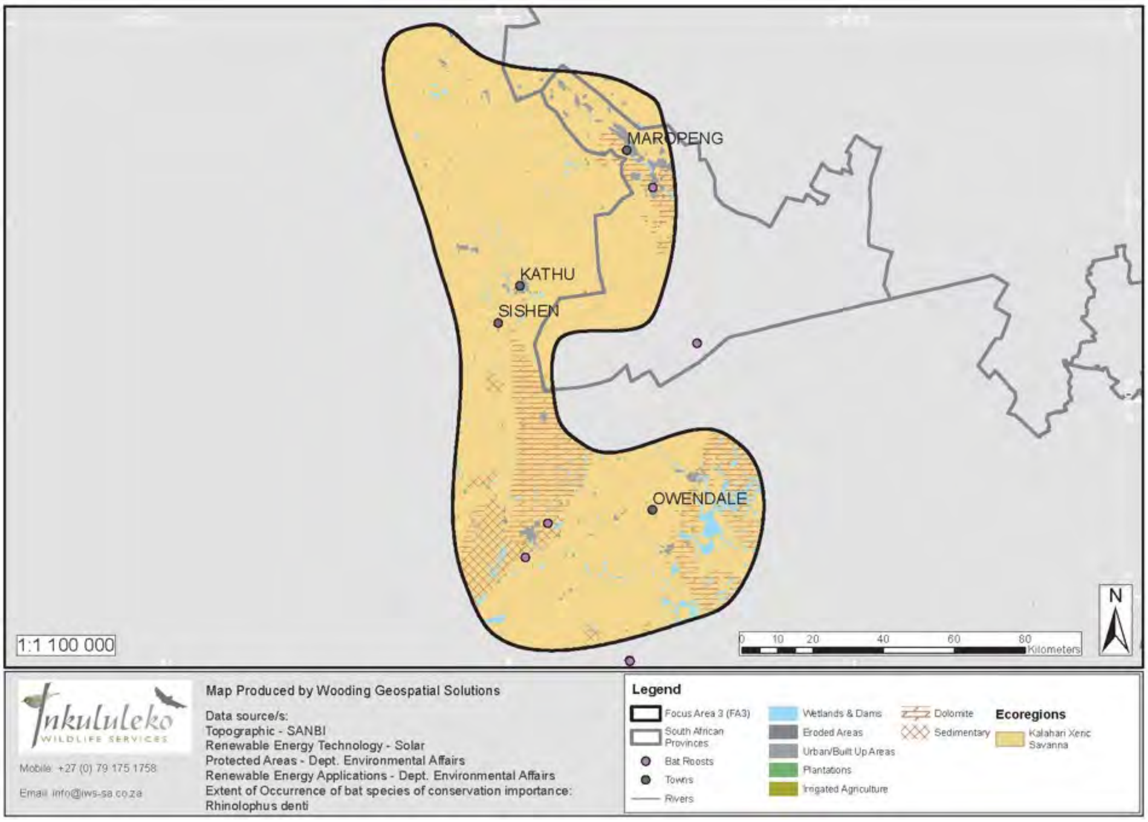
4.2.2.1 FA1



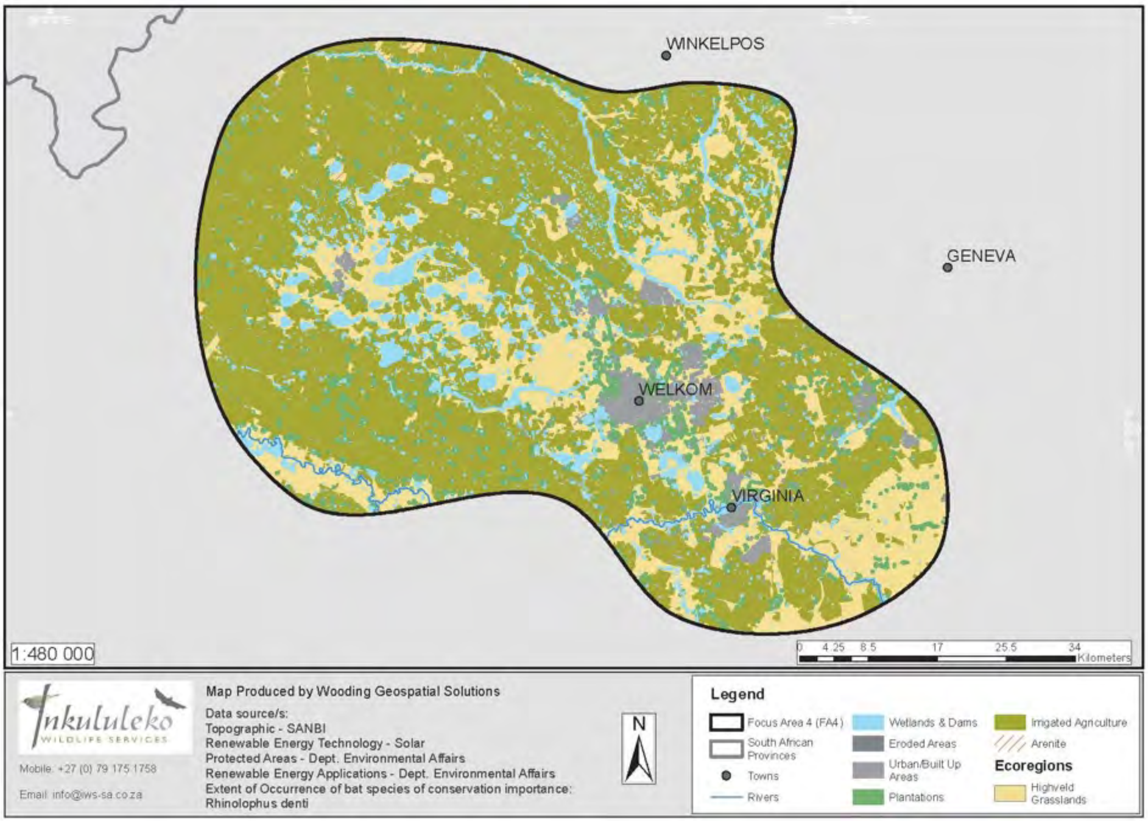
4.2.2.2 FA2



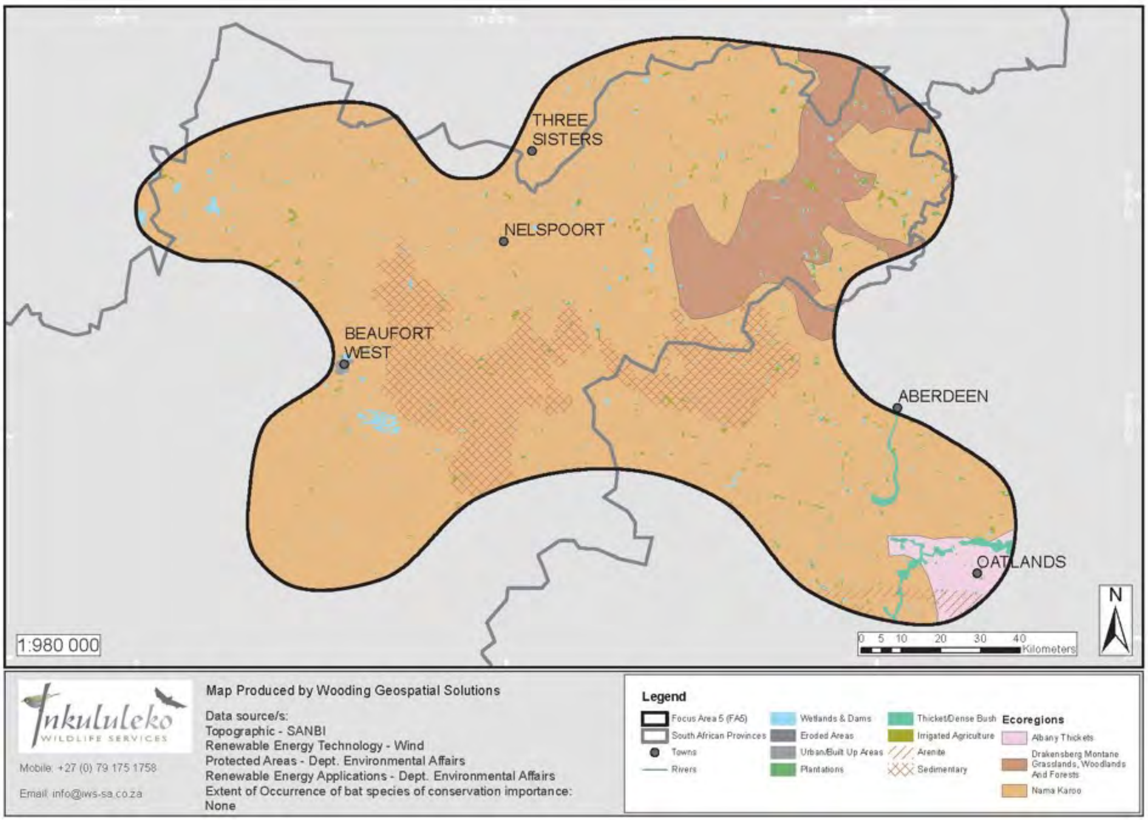
4.2.2.3 FA3



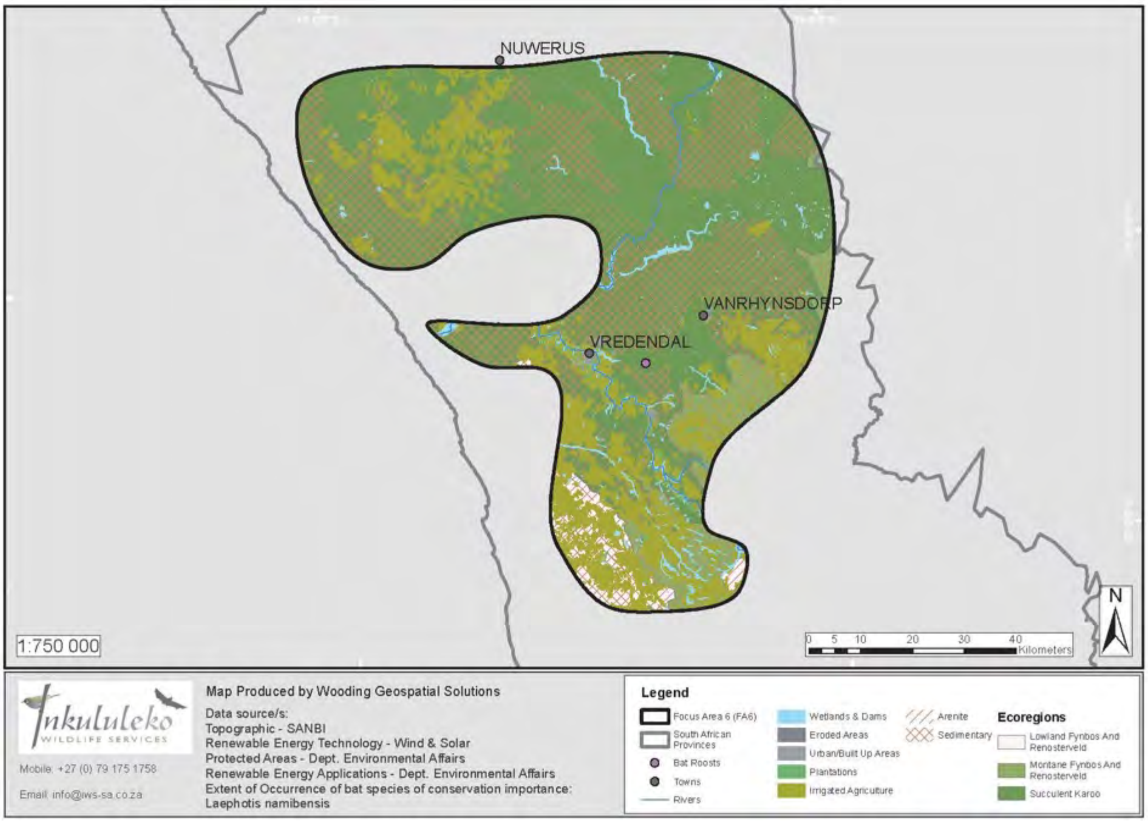
4.2.2.4 FA4



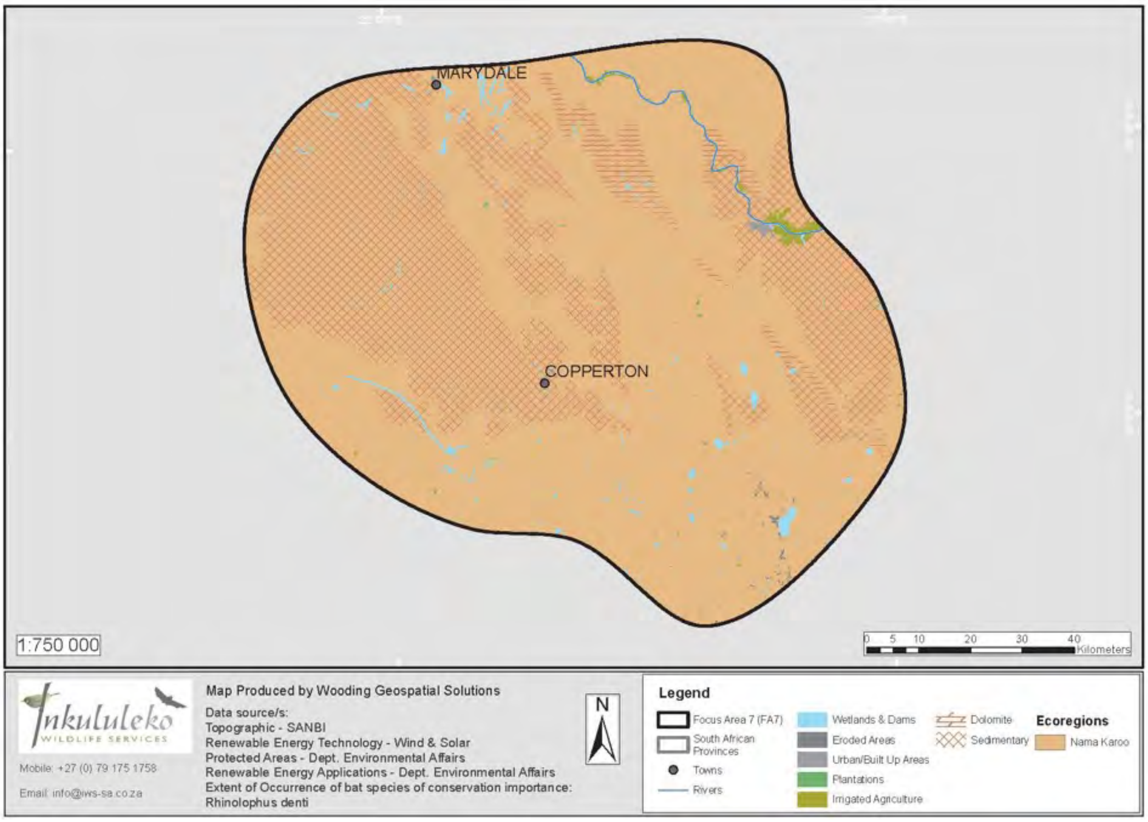
4.2.2.5 FA5



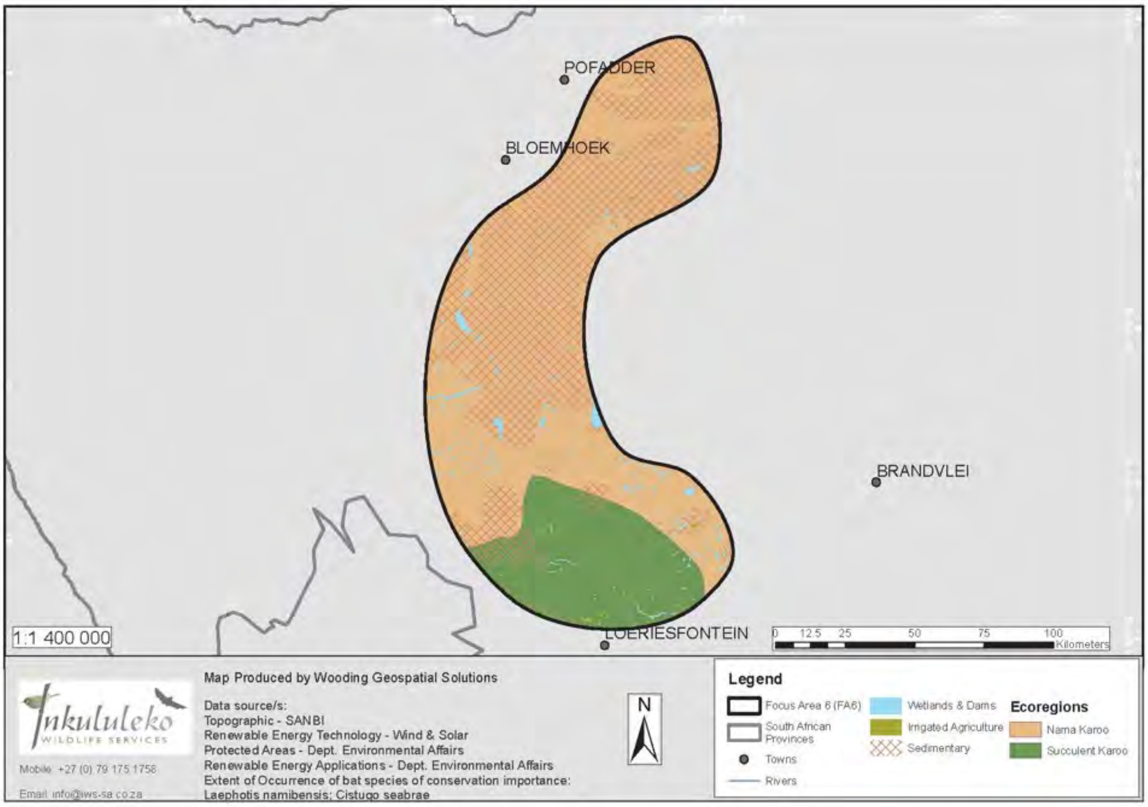
4.2.2.6 FA6



4.2.2.7 FA7



4.2.2.8 FA8

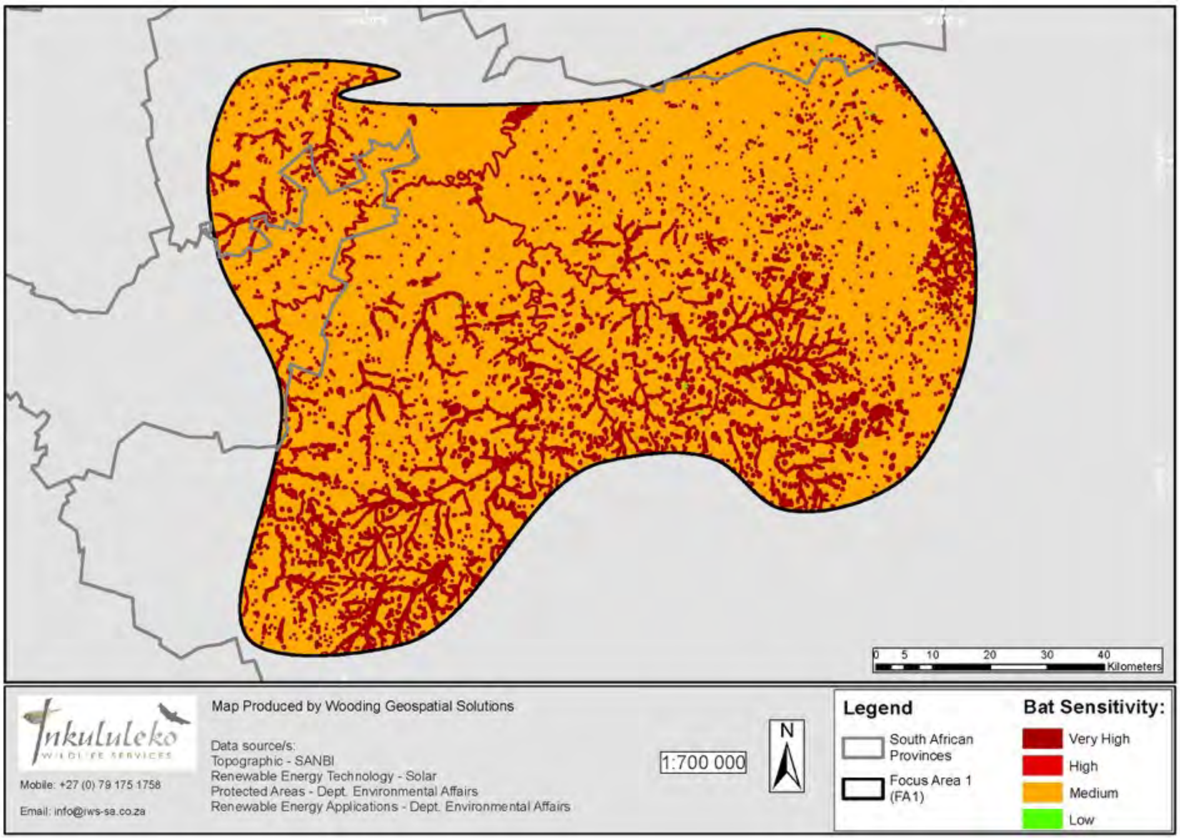


4.3 Four- Tier Sensitivity Mapping

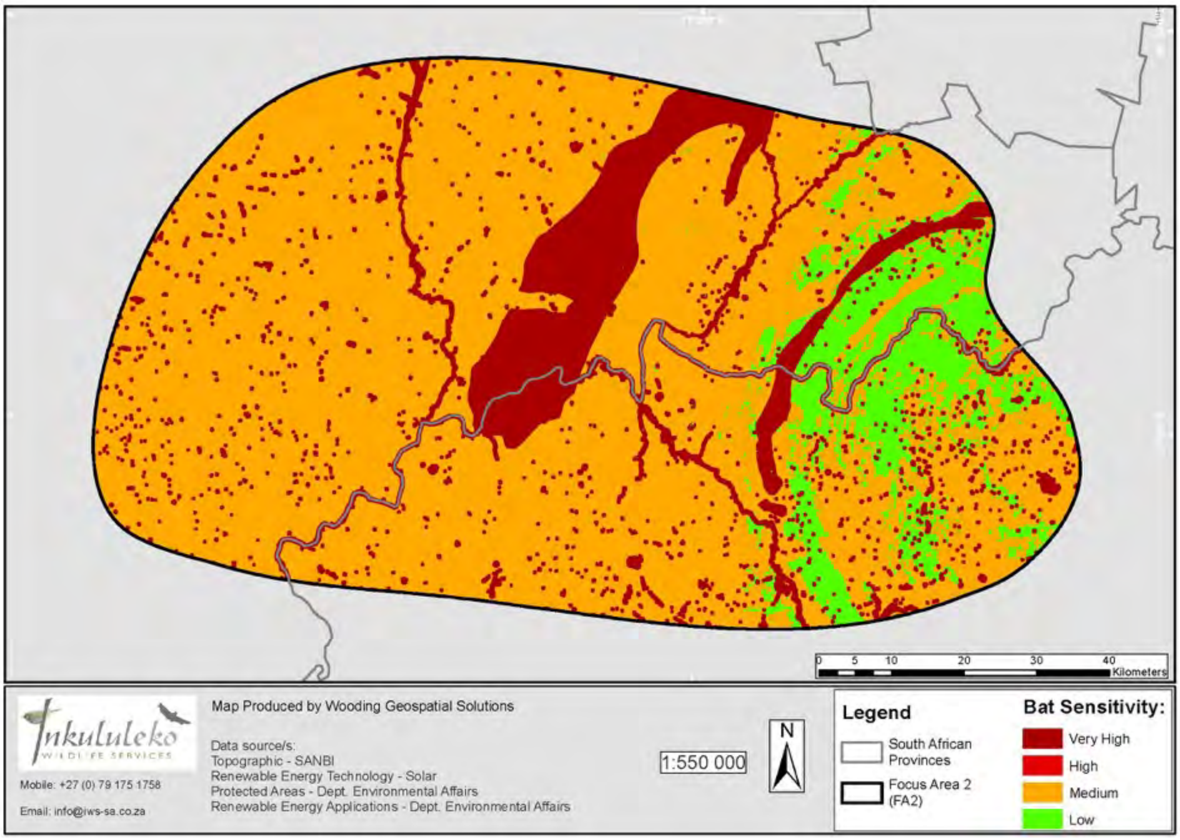
4.3.1 Solar

The sensitivity of bats to solar PV development is provided for Focus Areas 1, 2, 3, 4, 6, 7 and 8, that are proposed to include Solar PV.

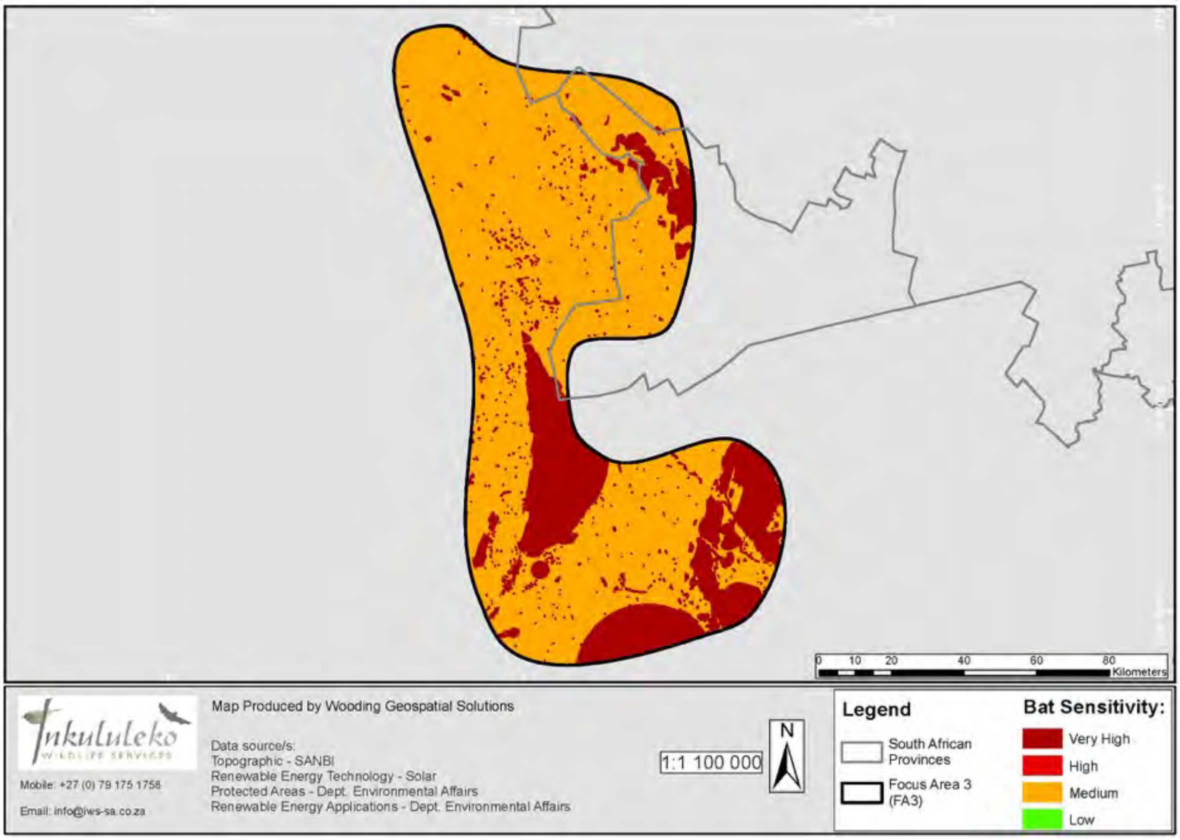
4.3.1.1 FA1 solar PV sensitivity



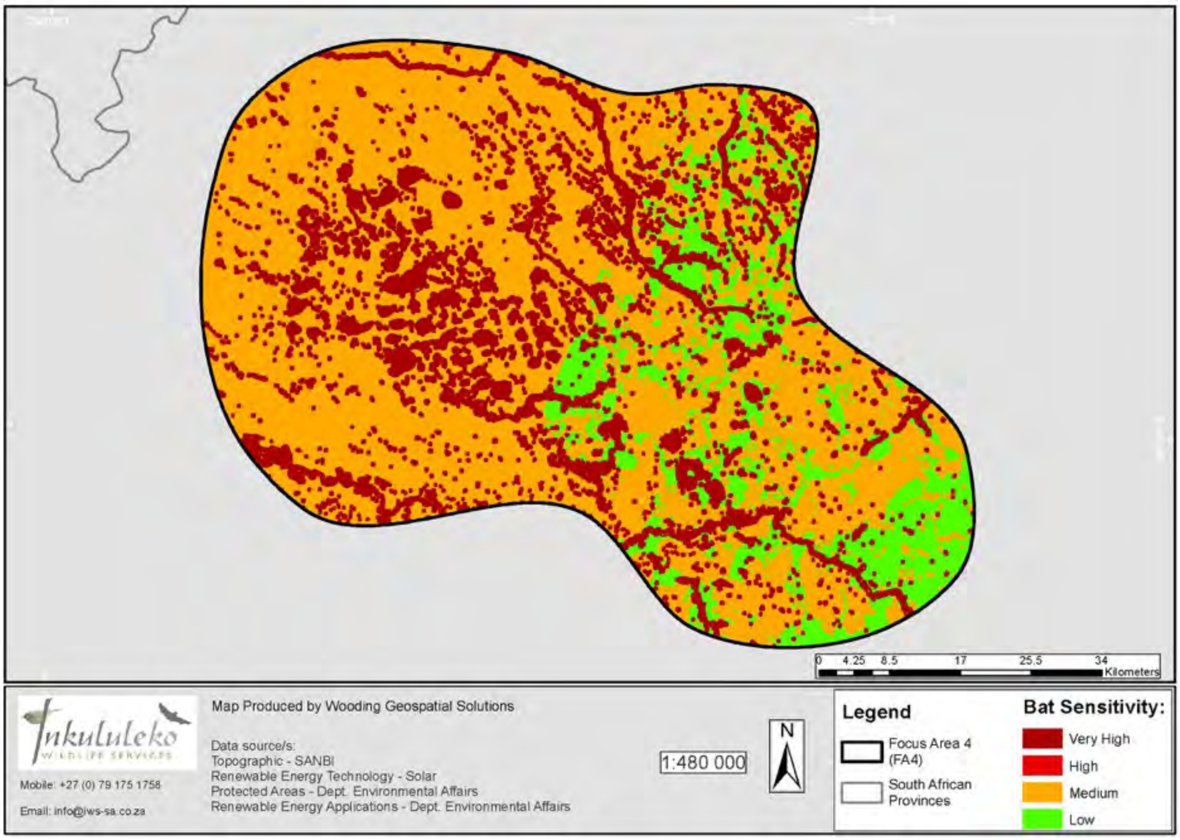
4.3.1.2 FA2 solar PV sensitivity



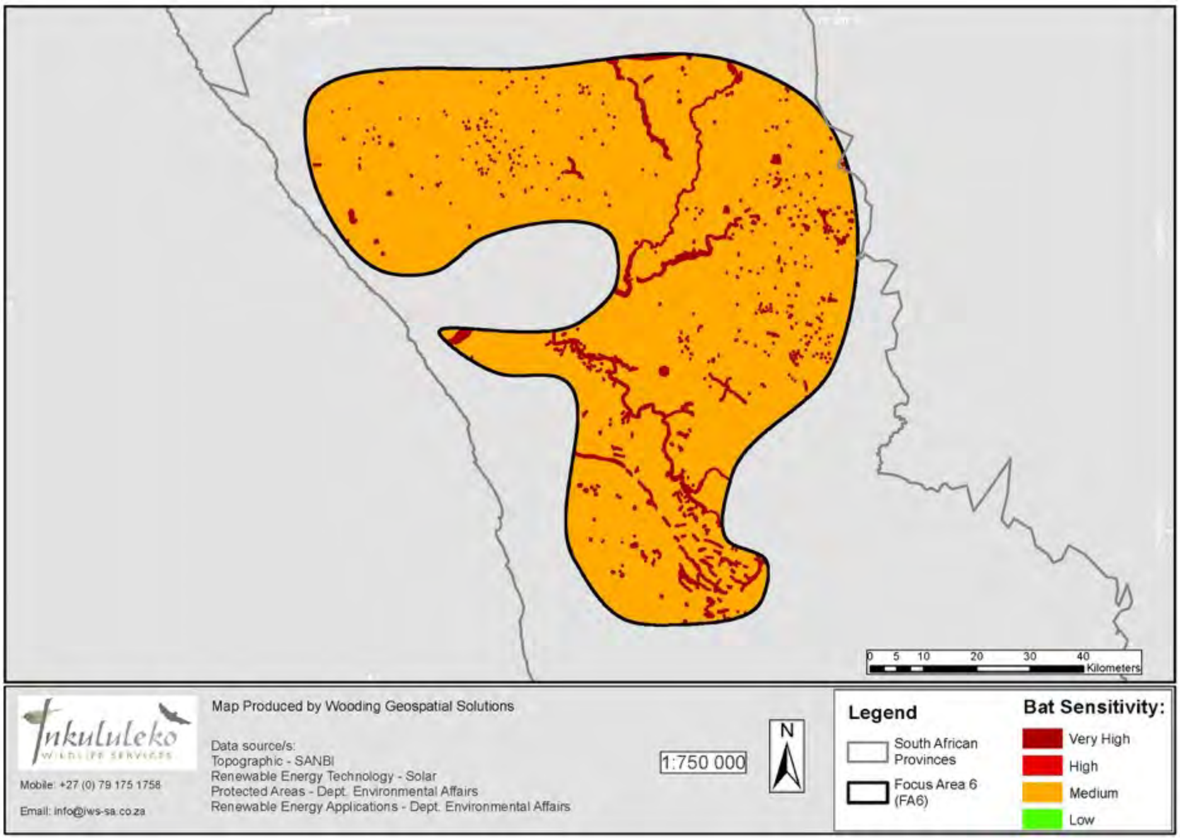
4.3.1.3 FA3 solar PV sensitivity



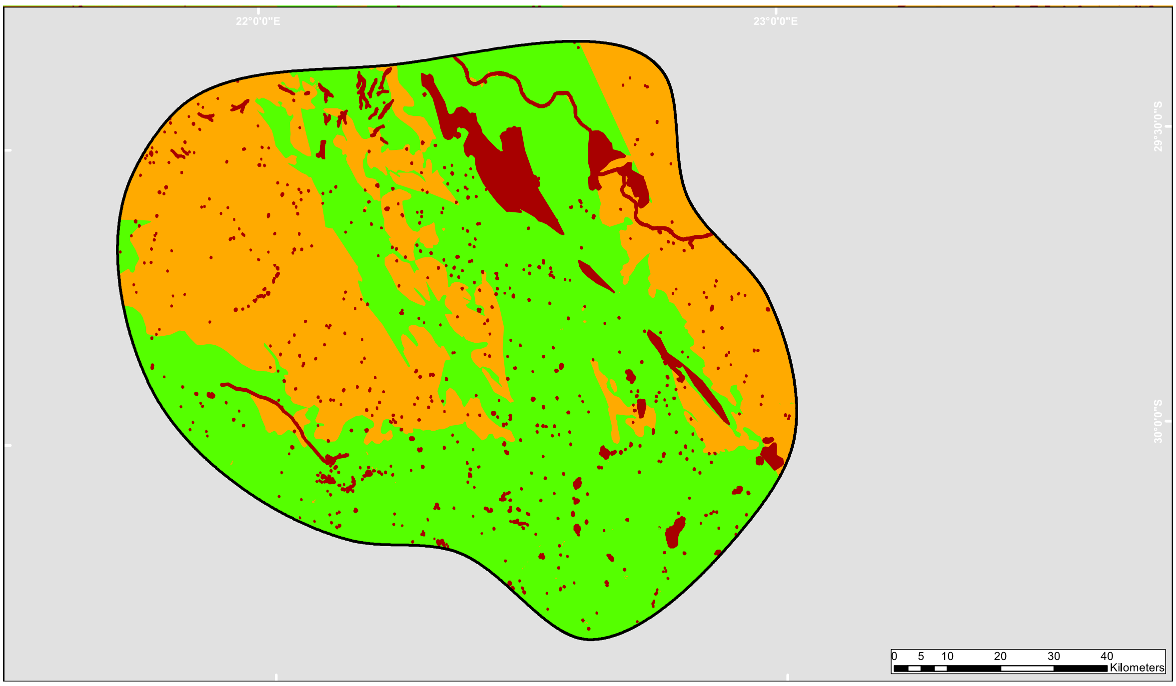
4.3.1.4 FA4 solar PV sensitivity



4.3.1.5 FA6 solar PV sensitivity

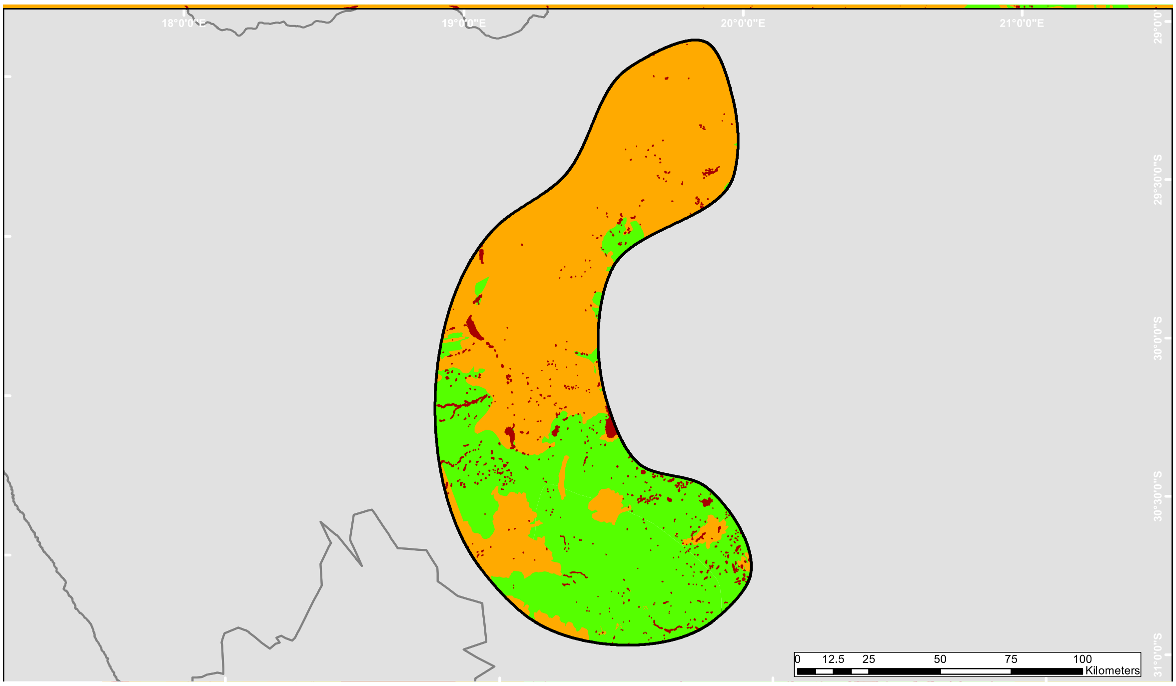


4.3.1.6 FA 7 solar PV sensitivity



rea 7
(FA7)
South African
Provinces

4.3.1.7 FA8 solar PV sensitivity

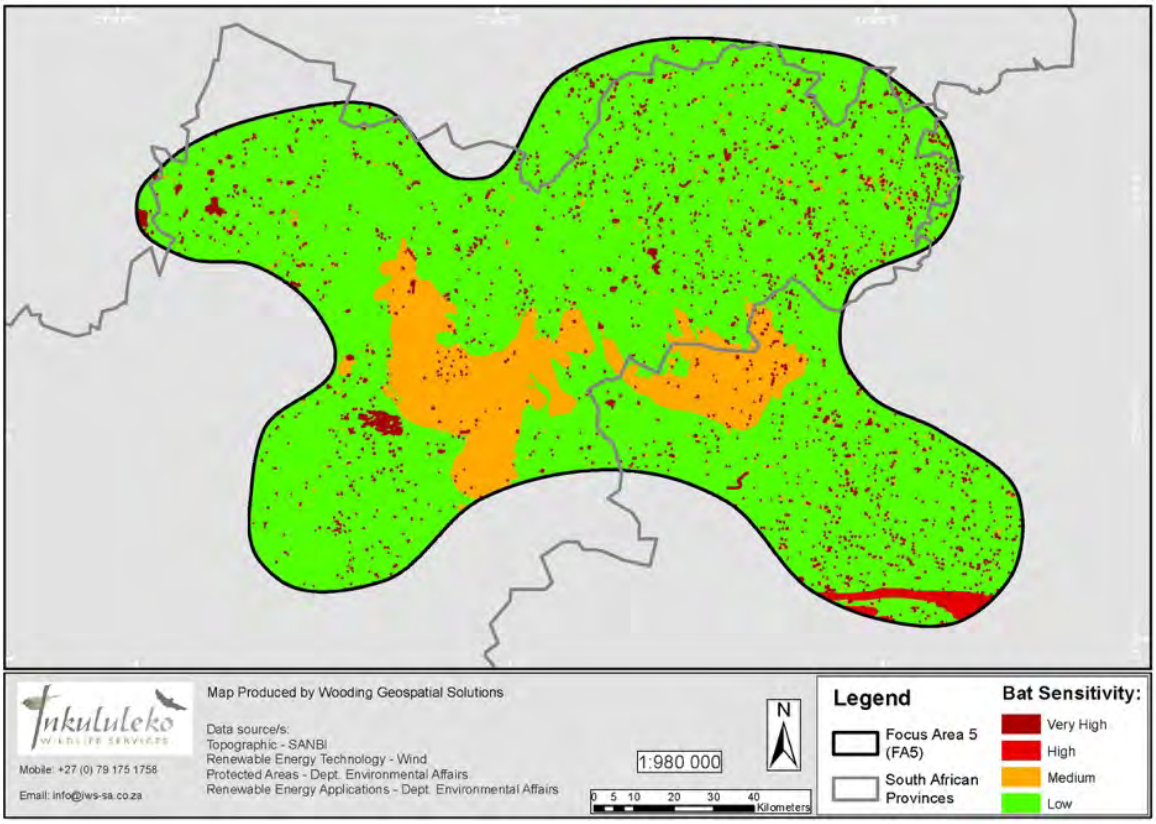


A8)

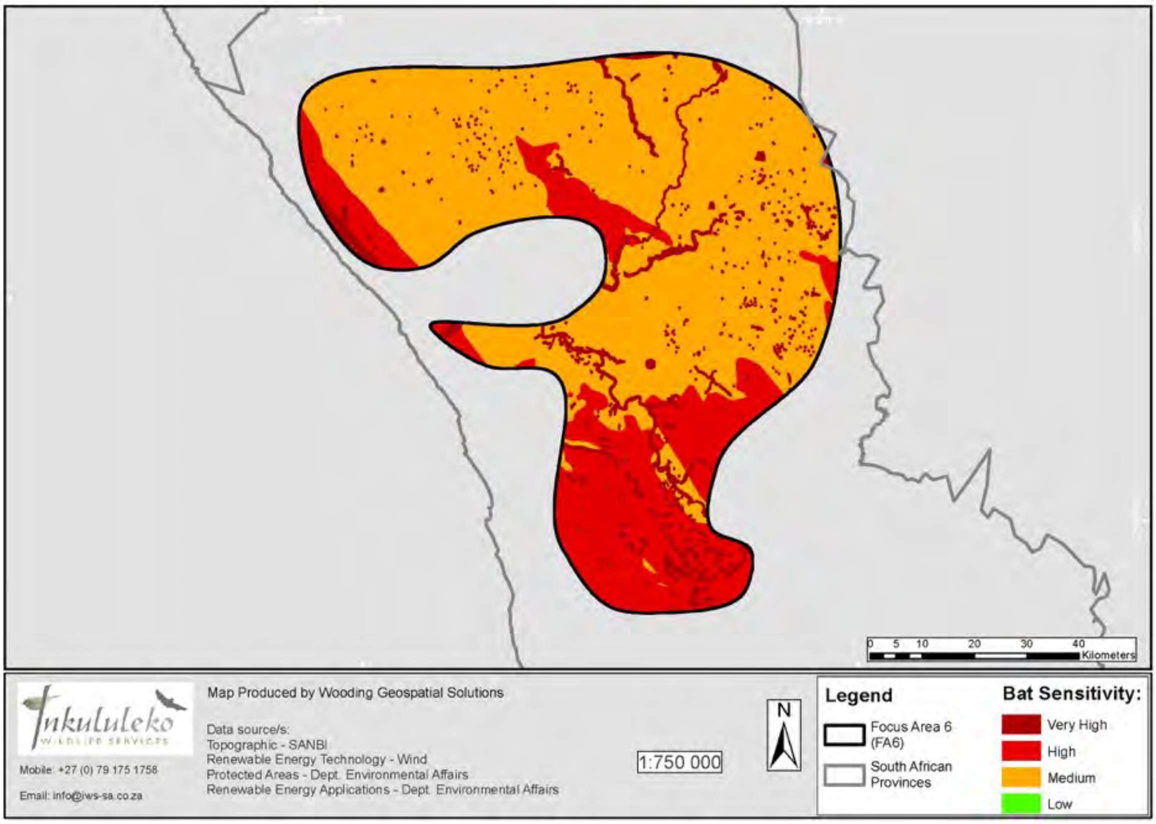
South African Provinces

4.3.2 Wind

4.3.2.1 FA5 wind development sensitivity

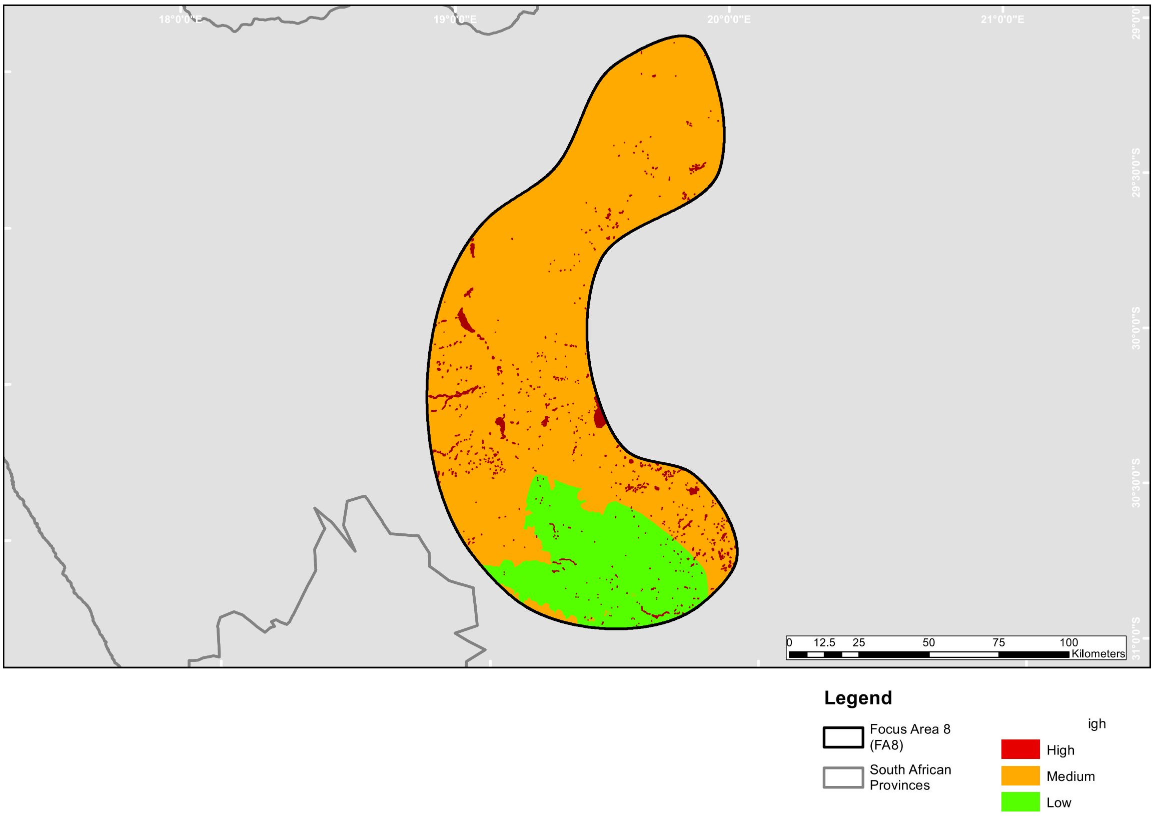


4.3.2.2 FA6 wind development sensitivity



4.3.2.3 FA7 wind development sensitivity

4.3.2.4 FA8 wind development sensitivity



5. KEY POTENTIAL IMPACTS AND THEIR MITIGATION

5.1 Impact 1: Roost disturbance and/or destruction due to construction activities

5.1.1 Description of Impact 1

Construction of solar panels, wind turbines, roads, power lines, offices and maintenance buildings, substations and other infrastructure for proposed SPVFs or WEFs can destroy or cause disturbance to bat roosts if construction activities are close to roosts. The potential impacts could have low to high negative significance depending on the size and sensitivity of the roost and the vicinity of the development to the roost.

5.1.2 Mitigation of Impact 1

- Pre-construction surveys or monitoring should attempt to identify all roosts and potential roosts on and around the site of development.
- Minimise the construction footprint, for example, by minimising clearing of natural vegetation and agricultural areas.
- It is recommended that NO development (including the full rotor swept zone of wind turbines) takes place in BOTH Very High and High bat sensitivity areas. Strict operational mitigation measures will be recommended in such instances if there is no alternative.
- It is recommended that areas of Low bat sensitivity are the first-choice selection for all solar panels and turbine development (including the full rotor swept zone of wind turbines). Operational mitigation measures should also be recommended for wind turbines placed in Medium bat sensitive areas.
- Minimise impacts to natural and artificial wetlands and water bodies.

Specific to wind turbine rotation, additional mitigation measures to reduce bat fatalities are:

- Constructing a facility with the least rotor swept area is preferable.
- Once the site-specific sensitivity mapping is refined in the Basic Assessment or Scoping and EIA process, all turbines (including their full rotor swept zone) to be kept out of all Very High and High bat sensitive areas. Constructing a facility in areas of low sensitivity for bats is preferable.
- It is recommended that there should be at least a 500 m no turbine development zone around any existing or newly built or to be constructed sub-stations or office/ operations and maintenance buildings due to the attraction of bats to nocturnal lighting around buildings and the potential to find roosting space in walls and roofs. Should all of the below additional measures be implemented, the no turbine development buffer around buildings can be reduced to 200 m:
    - With the exception of compulsory civil aviation lighting, minimise artificial lighting at night, especially high-intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights at sub-station, offices and turbines. All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination.
    - All non-aviation internal turbine nacelle and tower lighting should be extinguished when unoccupied.
    - Bat-proof constructions for all new buildings.

- Bat fatality minimization measures such as curtailment (increasing the turbine rotation cut-in speed or stopping turbine movement) or ultrasonic deterrents should be recommended where appropriate, based on site specific preconstruction monitoring conducted according to Sowler *et al.* (2017) or subsequent versions and knowledge from already operational facilities.
- Operational monitoring according to Aronson *et al.* (2014) or subsequent versions to be conducted from the commencement of turbines spinning.
- Based on site specific results, the thresholds recommended in MacEwan *et al.* (2018) or subsequent versions and taking into consideration which turbines had the highest fatalities and which weather parameters bats were most active in, turbine specific mitigation measures should be implemented.
- During operational monitoring, annual monitoring reports to be submitted to SABAAP, EWT, the DEA, Provincial Conservation Authorities and to the South African National Biodiversity Institute (SANBI) Bird and Bat Database.

5.2 Impact 2: Fragmentation to and displacement from foraging habitat due to solar PV panel or wind turbine construction and operation

5.2.1 Description of Impact 2

Clearing of vegetation and other construction activities will generate dust, noise and vibrations which may cause more sensitive species to disperse either temporarily or permanently.

The physical infrastructure, movement, noise and lights of operational sites could act as barriers and disturbance to bats during foraging and movement. Lights could also act as an attractant to certain species and a deterrent to others. At some operational WFs in the Eastern Cape where IWS is monitoring, artificial light around the substation and operational buildings seem to attract insects and therefore foraging resilient bats, resulting in high activity recorded at the nearby bat monitoring stations. This potential foraging impact can have a low to moderate negative significance rating depending on the foraging potential and the bats utilizing the area. The site-specific consequences of ecological light pollution for both solar PV and wind should be considered during project specific EIAs.

5.2.2 Mitigation of Impact 2

- It is recommended that NO development (including the full rotor swept zone of wind turbines) takes place in BOTH Very High and High bat sensitivity areas.
- It is recommended that areas of Low bat sensitivity are the first-choice selection for all solar panels and turbine development (including the full rotor swept zone of wind turbines).
- With the exception of compulsory civil aviation lighting, minimise artificial lighting at night, especially high-intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights at sub-station, offices and turbines. All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination.
- Clearing of natural and agricultural areas be kept to a minimum.
- Minimise impacts to natural and artificial wetlands and water bodies.

5.3 Impact 3: Bat fatalities due to collision with or barotrauma caused by wind turbines while foraging or migrating

5.3.1 Description of Impact 3

Bat deaths by collision with or due to barotrauma caused by wind turbines have been reported worldwide (Kunz *et al*., 2007; Arnett *et al*., 2008; Baerwald *et al*., 2008; Rydell *et al*., 2010; Baerwald & Barclay, 2011; Hull & Cawthen, 2013; Voigt *et al*., 2012; Lehnert *et al*., 2014), including for SA (Doty and Martin, 2012; MacEwan, 2016). There is not a single WEF in SA, where operational monitoring is being conducted, that has not had any bat fatalities (Perold & MacEwan, 2017).

There are various hypotheses as to why certain species of bats are killed by wind turbines, but one common hypothesis that is emerging worldwide, is that bats that move and feed in less cluttered and more open-air space environments, are more vulnerable to collisions with wind turbines than those moving and feeding in more cluttered environments (Arnett, 2017).

Arnett and Baerwald (2013) did a comparison of bat fatality data from 123 studies at 72 operational WEFs from all over the USA and Canada for the period 2000 to 2011. The results varied substantially based on geographic locality and habitat type with the lowest mean fatalities being 1.39 bats/MW/year in Great Basin/Southwest Open Range-Desert to 8.03 bats/MW/year in North-eastern Deciduous Forest (with one study site yielding an outlying result of 41.17 bats/MW/year in the South-eastern Mixed Forest).

Perold and MacEwan (2017) did a comparison of bat fatality data from studies done in the first year of operation across 10 WEFs from the Eastern, Northern and Western Cape Provinces of South Africa (SA). The results varied with geographic locality and habitat type and ranged from 0.91 bats/MW/year at a site in the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion to 7.38 bats/MW/year at a site in the Nama Karoo ecoregion (with one study site yielding an outlying result of 16.8 bats/MW/year in the Lowland Fynbos ecoregion).

5.3.2 Mitigation of Impact 3

- Constructing a facility with the least rotor swept area is preferable.
- Once the site-specific sensitivity mapping is refined in the Basic Assessment or Scoping and EIA process, all turbines (including their full rotor swept zone) to be kept out of all Very High and High bat sensitive areas. Constructing a facility in areas of low sensitivity for bats is preferable.
- It is recommended that there should be at least a 500 m no turbine development zone around any existing or newly built or to be constructed sub-stations or office/ operations and maintenance buildings due to the attraction of bats to nocturnal lighting around buildings and the potential to find roosting space in walls and roofs. Should all of the below additional measures be implemented, the no turbine development buffer around buildings can be reduced to 200 m:
    - With the exception of compulsory civil aviation lighting, minimise artificial lighting at night, especially high-intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights at sub-station, offices and turbines. All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination.
    - All non-aviation internal turbine nacelle and tower lighting should be extinguished when unoccupied.
    - Bat-proof constructions for all new buildings.
- Bat fatality minimization measures such as curtailment (increasing the turbine rotation cut-in speed or stopping turbine movement) or ultrasonic deterrents should be recommended where appropriate, based on site specific preconstruction monitoring conducted according to Sowler *et al.* (2017) or subsequent versions and knowledge from already operational facilities.
- Operational monitoring according to Aronson *et al.* (2014) or subsequent versions to be conducted from the commencement of turbines spinning.

- Based on site specific results, the thresholds recommended in MacEwan *et al.* (2018) or subsequent versions and taking into consideration which turbines had the highest fatalities and which weather parameters bats were most active in, turbine specific mitigation measures should be implemented.
- During operational monitoring, annual monitoring reports to be submitted to SABAAP, EWT, the DEA, Provincial Conservation Authorities and to the South African National Biodiversity Institute (SANBI) Bird and Bat Database.

6. DESCRIPTION OF THE POTENTIAL CUMULATIVE IMPACTS (USING A RECOGNIZED METHODOLOGY) ASSOCIATED WITH THE DEVELOPMENT OF WIND AND SOLAR PV PROJECTS AND ASSOCIATED ACTIVITIES

Whilst it is very important to consider the local impacts that may be caused by individual developments, it is equally important to consider the cumulative impacts of multiple developments in proximity to each other. The DEA releases quarterly updates on renewable energy project applications, therefore, all EIAs should consider the cumulative impact of the new development in light of other similar developments nearby for projects that have received Environmental Authorisation (EA). In order to ensure that cumulative impacts are not over-estimated due the inclusion of authorised projects that may never be built, the assessment should link with the maximum PV and wind energy allocated in the latest IRP (2018) and distribute that across the REDZs and/or the areas in the country with suitable resource potential.

The greater the area of development, the greater the impact will be on the high-risk species.

Bats are particularly susceptible to anthropogenic changes because of their low reproductive rate and high metabolic rates. The consequences of bat population declines are decreased pest-insect control by insectivorous bats, decreased pollination and seed dispersal by frugivorous bats and other ecosystem services provided by bats.

In the USA, Bat Conservation International (Hein & Schirmacher, 2016) has stated that, although population data are sparse or lacking for many bat species, current and presumed future level of fatality is considered to be unsustainable, and actions to reduce impact of wind turbines on bats should be implemented immediately.

South Africa should at all costs avoid the situation in the USA and Canada where hundreds to thousands of bats, both local and migratory bats, die annually (Arnett and Baerwald, 2013). Hoary bats (*Lasiurus cinereus*), once a widespread and common migratory species in the USA, are under serious threat due to wind energy and are facing population declines (Frick *et al.* 2017). This is because preventative and/or corrective action was not taken early enough.

The South African Bat Fatality Threshold Guidelines Edition 2 (MacEwan *et al.* 2018) has introduced a way to calculate a bat fatality threshold for development projects or greater cumulative areas based on the development area and the Ecoregion in which the development is located. This method could help reduce the possibility of population level declines. Should adjusted bat fatalities (adjusted for biases such as searcher efficiency and carcass persistence) equal or exceed the annual fatality threshold per species, then operational mitigation (examples of the types of measures that can be applied are found in Aronson *et al.* (2018)) must be implemented according to this Guideline or subsequent versions thereof.

7. BAT ASSESSMENT PROTOCOL

A description of how to interpret the four sensitivity classes, as illustrated on the wind and solar sensitivity maps above, is provided for each technology below.

<table>
<tr><th>Colour</th><th>Sensitivity[4]</th><th>Interpretation of the sensitivity</th><th>Wind</th><th>Solar PV</th></tr>
<tr><td>Dark red/ Maroon</td><td>Very High</td><td>Very High sensitivity areas due to very high roosting and/ or foraging potential and/ or due to very high bat activity levels and/ or potential occurrence of Vulnerable, Data Deficient, Endangered or high Turbine Fatality species.

The risk of severe bat-related impacts is very high. The risk of population level impacts on bats is very high.</td><td>It is recommended that the features identified as making these areas potentially very highly sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Based on the findings of the field verification, the developer must decide if they still wish to proceed. Should they still wish to proceed, proponents intending to develop a wind facility triggering an environmental assessment process must prove to the relevant competent authority and the South African Bat Assessment Advisory Panel (SABAAP) that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a comprehensive Bat Impact Assessment undertaken by a competent bat specialist, and in accordance with the National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment, is required. Such an assessment must include at least 24 months of pre-construction bat monitoring undertaken in accordance with best practice guidelines (Sowler et al. 2017 or subsequent versions). Quarterly progress and final reports and recommendations must be peer reviewed by the SABAAP. The proponent must provide funds for such a peer review, as SABAA is a voluntary organisation and panellists do not get paid by SABAA. Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.</td><td rowspan="2">It is recommended that the features identified as making these areas potentially very highly sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Based on the findings of the field verification, the developer must decide if they still wish to proceed. Should they still wish to proceed, proponents intending to develop a solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority and the South African Bat Assessment Advisory Panel (SABAAP) that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a SACNASP accredited and reputable bat specialist must consider significant bat impacts in accordance with the NEMA regulations pertaining to specialist reports and impact assessment. a Bat Impact Assessment study must include, but not be limited to:
Details and relevant expertise of the specialist preparing the assessment;
A field-based assessment of the roosting and foraging potential using the following techniques:
Visual habitat assessments through driven and walked transects.
Bat activity assessments:
For insectivorous bats: all night passive ultrasonic monitoring for minimum of 10 nights – five nights in late spring/ early summer and five nights in late summer/ early autumn.
For fruit bats, visual surveys and acoustic surveys of audible calls to determine</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas due to high roosting and/ or foraging potential and/ or due to</td><td>It is recommended that the features identified as making these areas potentially highly sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Based on the</td></tr>
</table>

[4] The various sensivity layers derived from the REDZ SEA should be included in the DEA's EIA Screening tool, to allow proponents and specialists the opportunity to ascertain what features have triggered the relevant sensivities on site. This will ensure that the appropriate specialist assessments are commissioned (if required).

Colour	Sensitivity[4]	Interpretation of the sensitivity	Wind	Solar PV
		high bat activity levels and/ or potential occurrence of conservation important or high-risk species. The risk of serious bat-related impacts is high. The risk of population level impacts on bats is high. the identified sensitivities will require assessment before any development can be considered.	findings of the field verification, the developer must decide if they still wish to proceed. Should they still wish to proceed, proponents intending to develop a wind facility triggering an environmental assessment process must prove to the relevant competent authority and the South African Bat Assessment Advisory Panel (SABAAP) that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a comprehensive Bat Impact Assessment undertaken by a competent bat specialist, and in accordance with the National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment, is required. Such an assessment must include at least 12 months of pre-construction bat monitoring undertaken in accordance with best practice guidelines (Sowler *et al*. 2017 or subsequent versions). Quarterly progress and final reports and recommendations must be peer reviewed by the SABAAP. The proponent must provide funds for such a peer review, as SABAA is a voluntary organisation and panellists do not get paid by SABAA. Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. In addition to the NEMA requirements the bat impact assessment report must contain: • Project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • a clear and justified opinion statement by the specialist recommending whether the project should from a bat perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and where required, • proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).	presence, type and abundance. - Live capture and release can be performed under provincial permits and if suitable habitat exists. - Landowner interviews to determine the presence of potential roosts. - Roost assessments. Roost searches to only be done by specialists with experience in such searches and under the correct health and safety protocol. • A detailed assessment of the potential impacts of the development on bats. Particular attention must be given to species of conservation importance, breeding season should also be considered. • A clear and justified opinion statement by the specialist recommending whether the project should, from a bat perspective, receive approval. • A site-specific sensitivity map should be produced. • If this statement is subject to any conditions these must also be clearly stated; and • Where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr). Final reports and recommendations prepared for significant bat sensitivities must be peer reviewed by the SABAAP. The proponent must provide funds for such a peer review, as SABAA is a voluntary organisation and panellists do not get paid by SABAA. Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. In addition to the NEMA requirements.
Yellow	Medium	Medium sensitivity areas due to moderate roosting and/ or foraging potential and/		Proponents intending to develop a solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority and the South African Bat Assessment Advisory Panel (SABAAP) that the proposed

Colour	Sensitivity[4]	Interpretation of the sensitivity	Wind	Solar PV
		or due to moderate bat activity levels and/ or due to unknown bat activity levels and/ or potential occurrence of Near-threatened or Rare species. These areas are potentially suitable for development if identified sensitivities are fully investigated and effective mitigation measures identified.		development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a SACNASP accredited and reputable ecologist must consider bat impacts in accordance with the NEMA regulations as part of the ecological/ faunal assessment. Final reports and recommendations prepared for significant bat sensitivities must be sent to SABAAP for comment. Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.
Green	Low	Low sensitivity areas due to low roosting and/ or foraging potential and/ or due to low bat activity levels and no known occurrence of conservation important species. These areas are probably more suitable for development than the Medium, High or Very High sensitivity areas, but present levels of knowledge preclude confident predictions on the sustainability of impacts and some level of assessment is still required.	In addition to the NEMA requirements, the Bat Impact Assessment study must follow the all the minimum requirements monitoring methods described the SA Preconstruction Bat Monitoring Guidelines for Wind Energy (Sowler *et al*., 2017 or subsequent versions), but the monitoring does not have to be for a continuous full 12 months. A minimum of two consecutive weeks of passive ultrasonic recordings in each of the four seasons, i.e. eight weeks in total at the minimum required number of monitoring stations and at the correct monitoring heights according to Sowler *et al*. (2017) or subsequent versions. In addition to the NEMA requirements the bat impact assessment report must contain: • Project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • a clear and justified opinion statement by the specialist recommending whether the project should from a bat perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and where required,	

Colour	Sensitivity[4]	Interpretation of the sensitivity	Wind	Solar PV
			• proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).	

8. GAPS IN KNOWLEDGE

Gaps in knowledge from a bat data perspective include:

- Lack of data on the impacts of solar PV development on bats in South Africa.
- Bat roost data is limited to data voluntarily supplied by bat specialists and published literature. The co-ordinates provided by some of the published sources are old and/ or they are only provided in degrees and minutes, therefore there are potentially accuracy concerns.
- It would be more accurate to map AoO vs EoO for species of conservation importance, but this level of detail was beyond the scope of this high-level SEA. Commissioning such a detailed mapping exercise of the AoO for all species of conservation importance, both plants and animals, would be a worthwhile exercise for the DEA to consider for future conservation planning.
- Bat migration route and dispersion data is lacking in SA. There are not small enough trackers to put on bats to get a more accurate indication of the routes and distances they travel during migration. We can only look at bat important habitat features and assume that they travel along routes with those features.
- Data on bat activity and mortality around WEFs are sparse or non-existent and concerted research is needed to understand the causes of both. Research into anomalously high fatality rates in areas of low bat activity would be particularly instructive in the causes of both bat activity and mortality at operational WEFs. For example, the fact that the Nama Karoo, listed as a region of low to moderate bat activity in section 4.1 (see description of FA8) has high fatality levels per MW (Perold & MacEwan 2017) warrants detailed research and highlights the importance of operational monitoring and adaptive mitigation.

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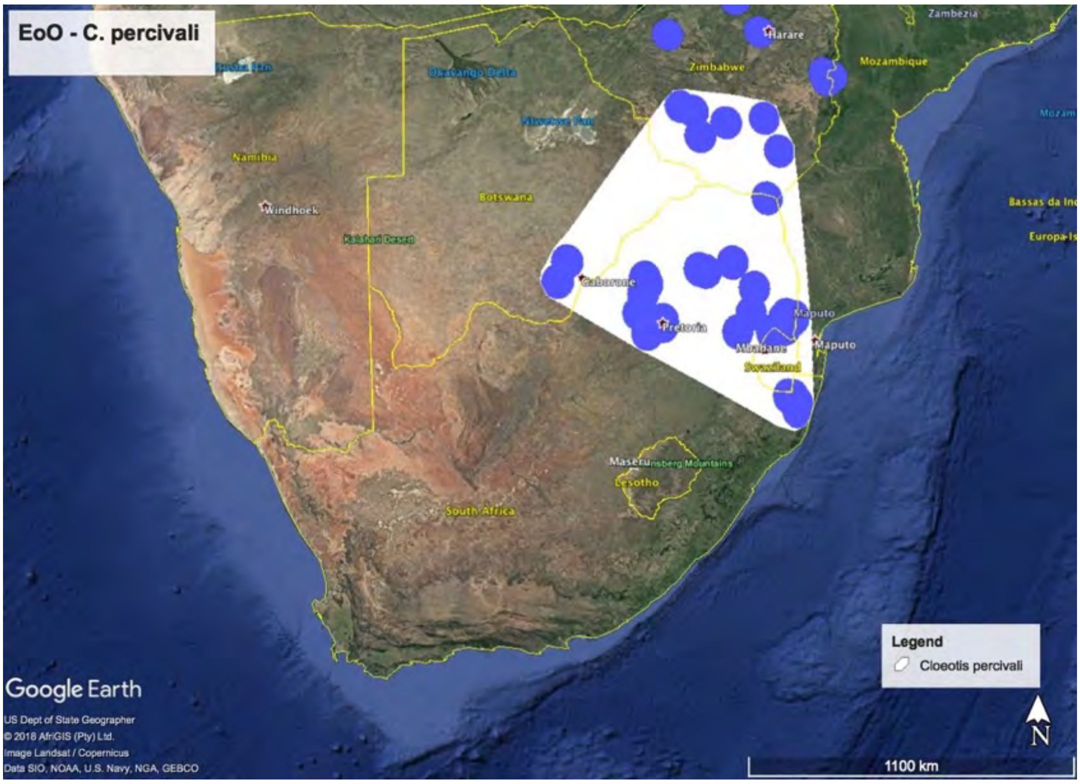
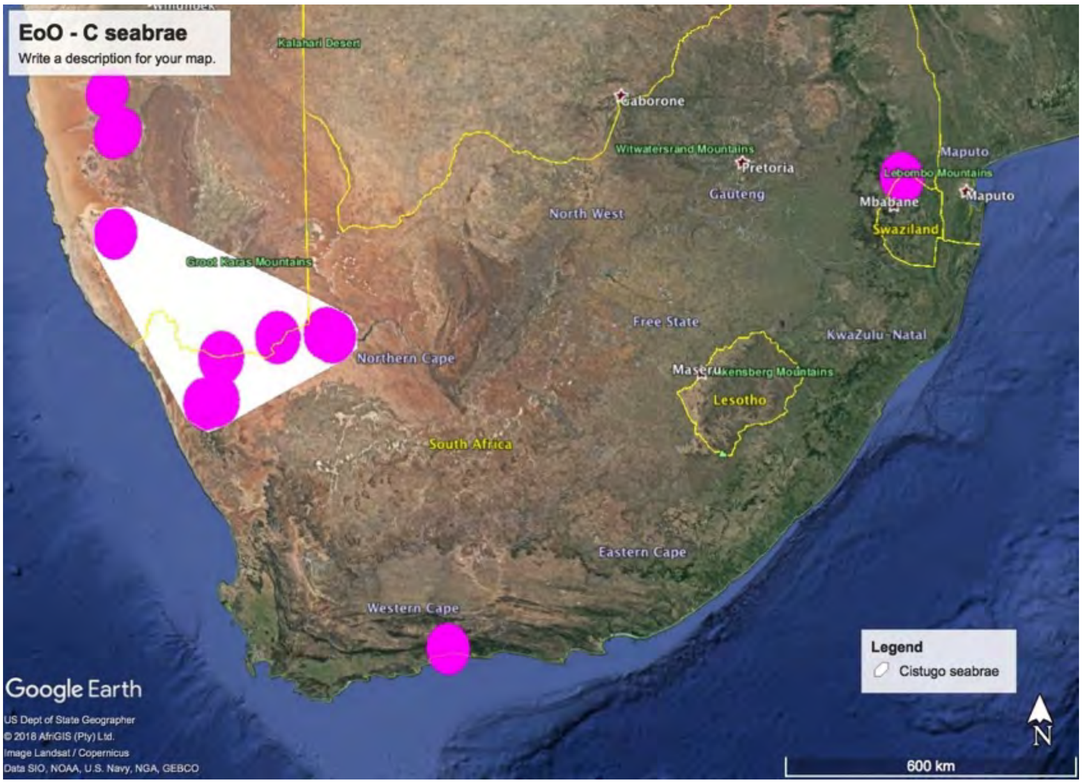
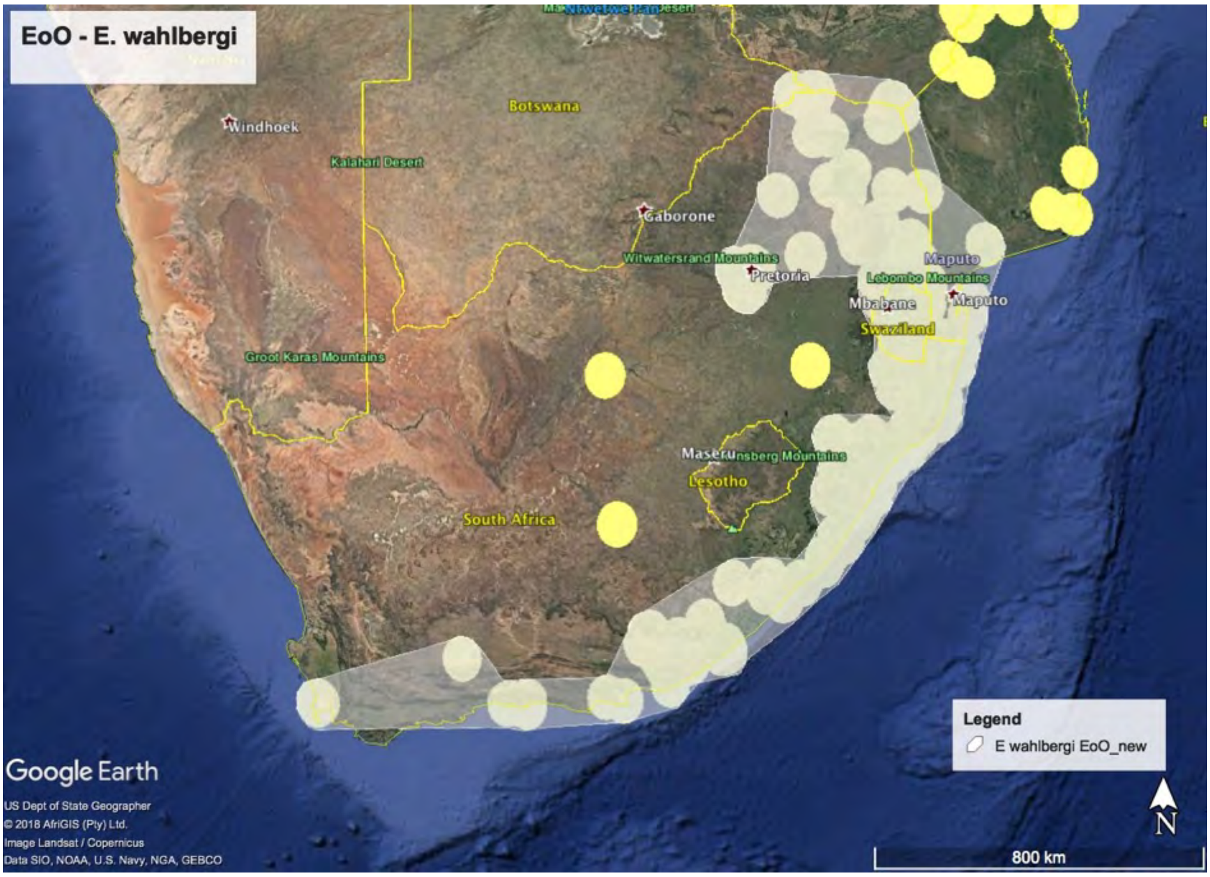
Appendix 1: Relevant Conservation Important or High Turbine Fatality Risk Bat Species EoOs[5]





[5] Where there were extreme outlier points, these were omitted from the EoO. These outliers are either errors or they are indivdusl bats outside of their normal range.


EoO - E. wahlbergi
Botswana
Windhoek
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
Lebombo Mountains
Mbabane
Maputo
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
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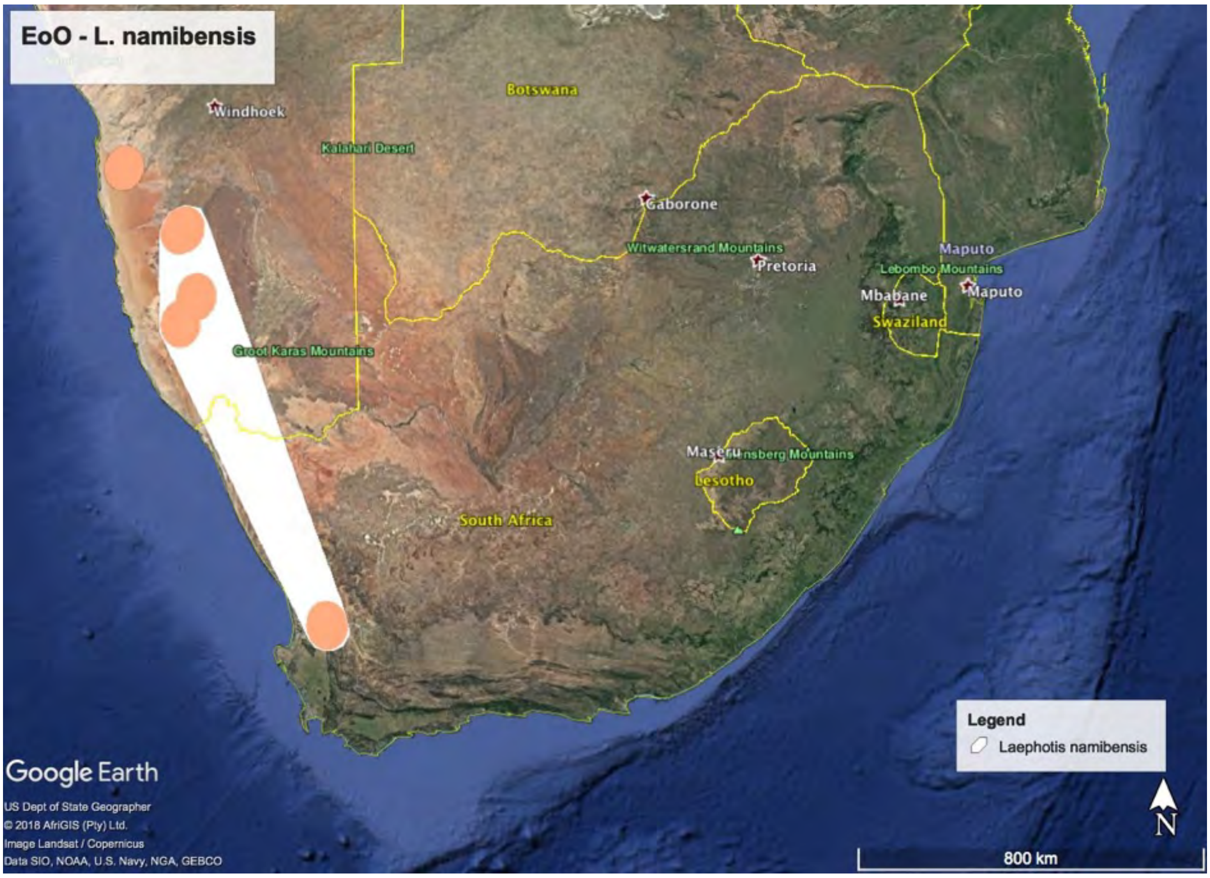
EoO - L. namibensis
Botswana
Windhoek
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
Lebombo Mountains
Mbabane
Maputo
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
Legend
Laephotis namibensis
Google Earth
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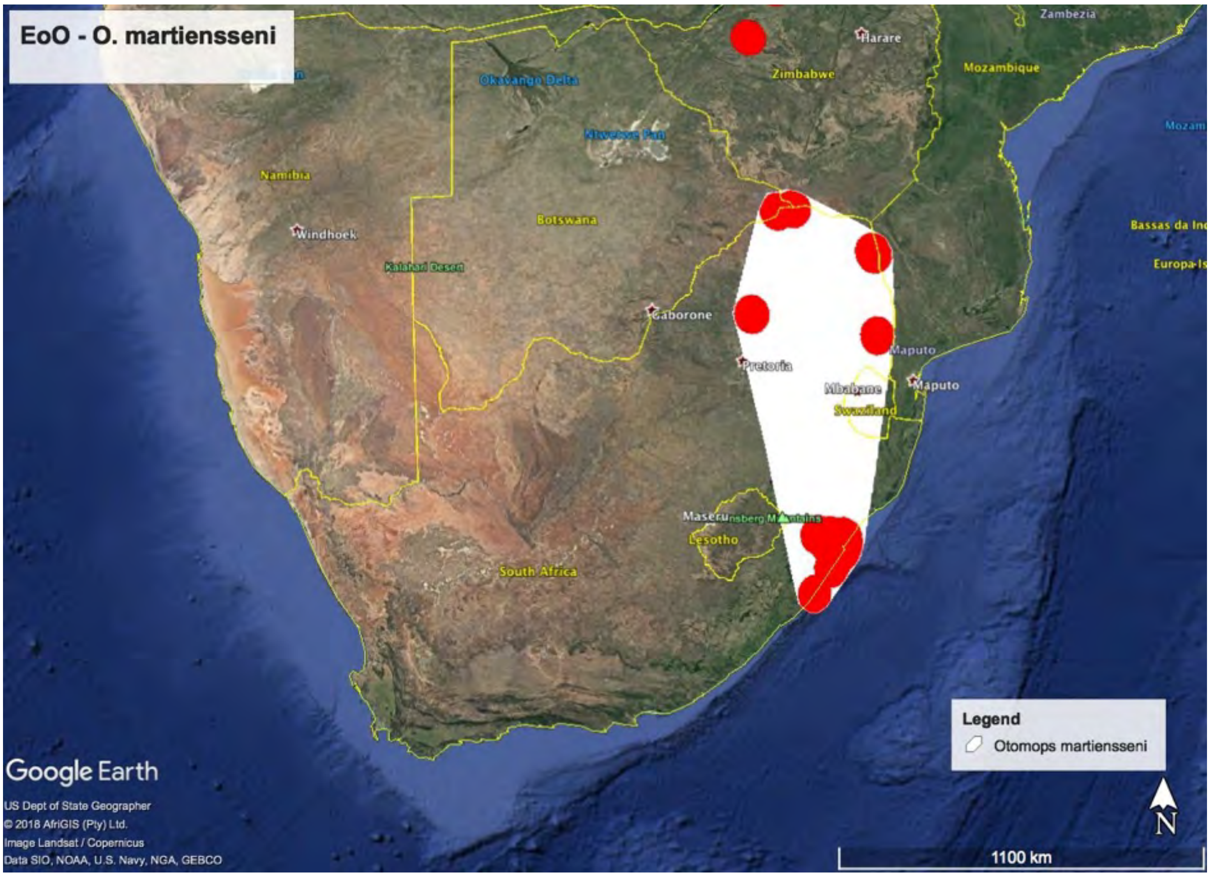
EoO - O. martiensseni
Harare
Zimbabwe
Zambezia
Mozambique
Okavango Delta
Namibia
Windhoek
Botswana
Kalahari Desert
Gaborone
Pretoria
Maputo
Mbabane
Swaziland
Maseru
Lesotho
South Africa
Bassas da India
Europa Island
Legend
Otomops martiensseni
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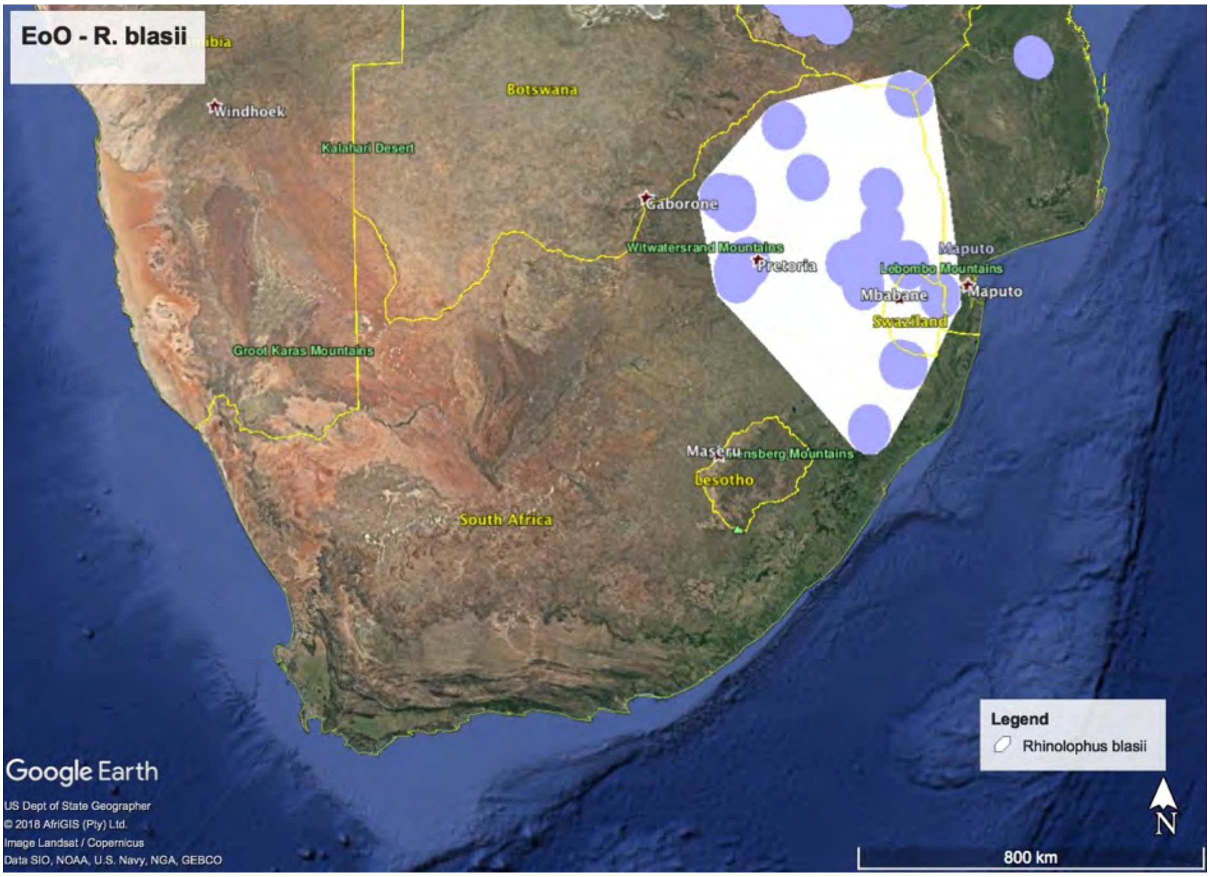
EoO - R. blasii
Botswana
Windhoek
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
Lebombo Mountains
Mbabane
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
Legend
Rhinolophus blasii
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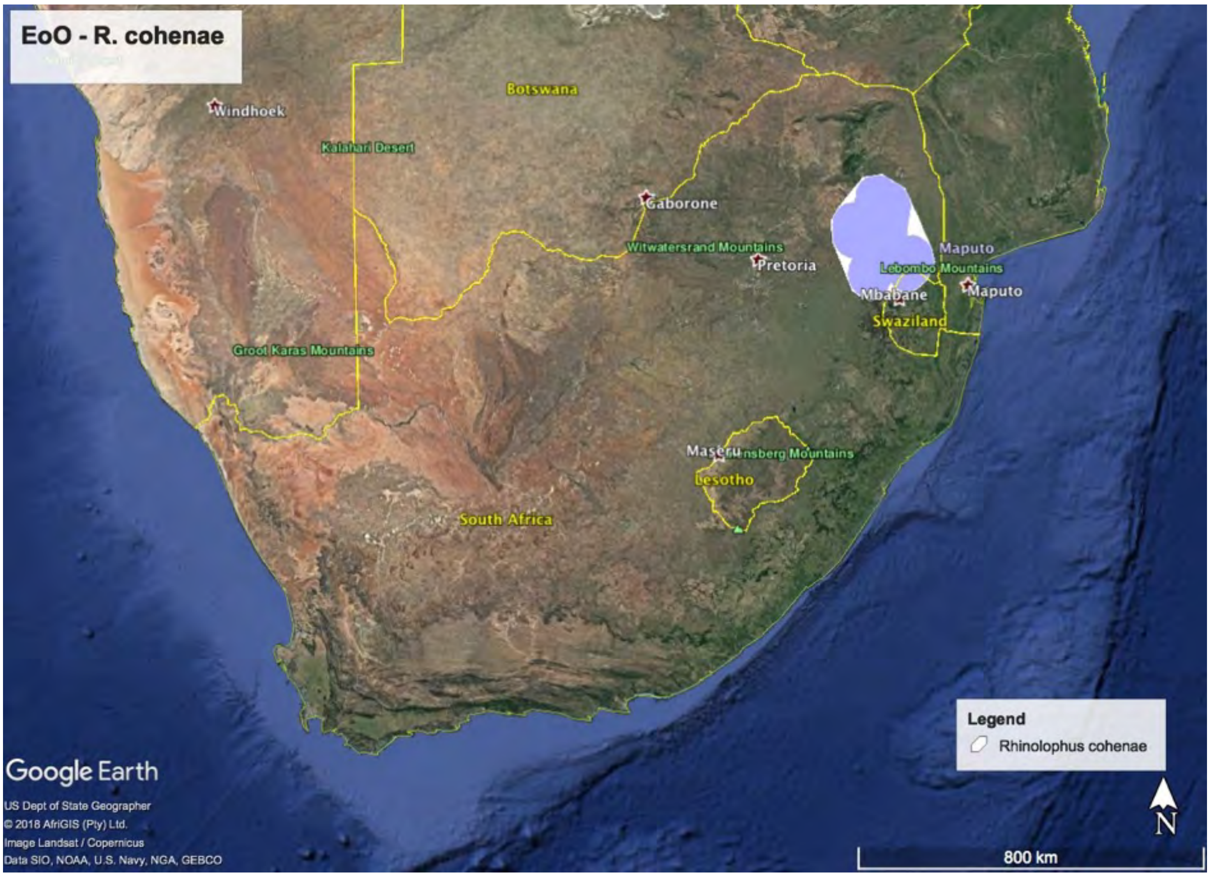
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Windhoek
Botswana
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
Lebombo Mountains
Mbabane
Maputo
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
Legend
Rhinolophus cohenae
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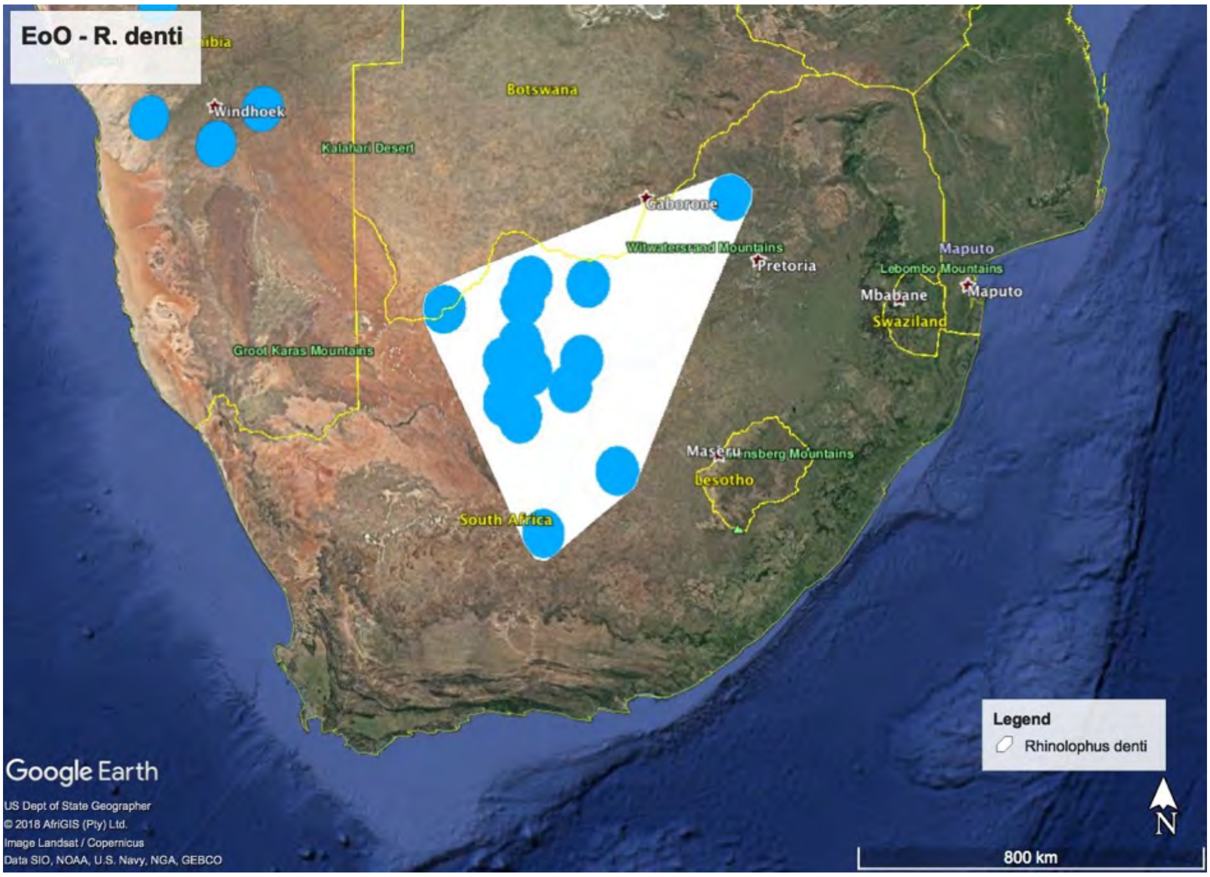
EoO - R. denti
Windhoek
Botswana
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
Lebombo Mountains
Mbabane
Maputo
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
Legend
Rhinolophus denti
Google Earth
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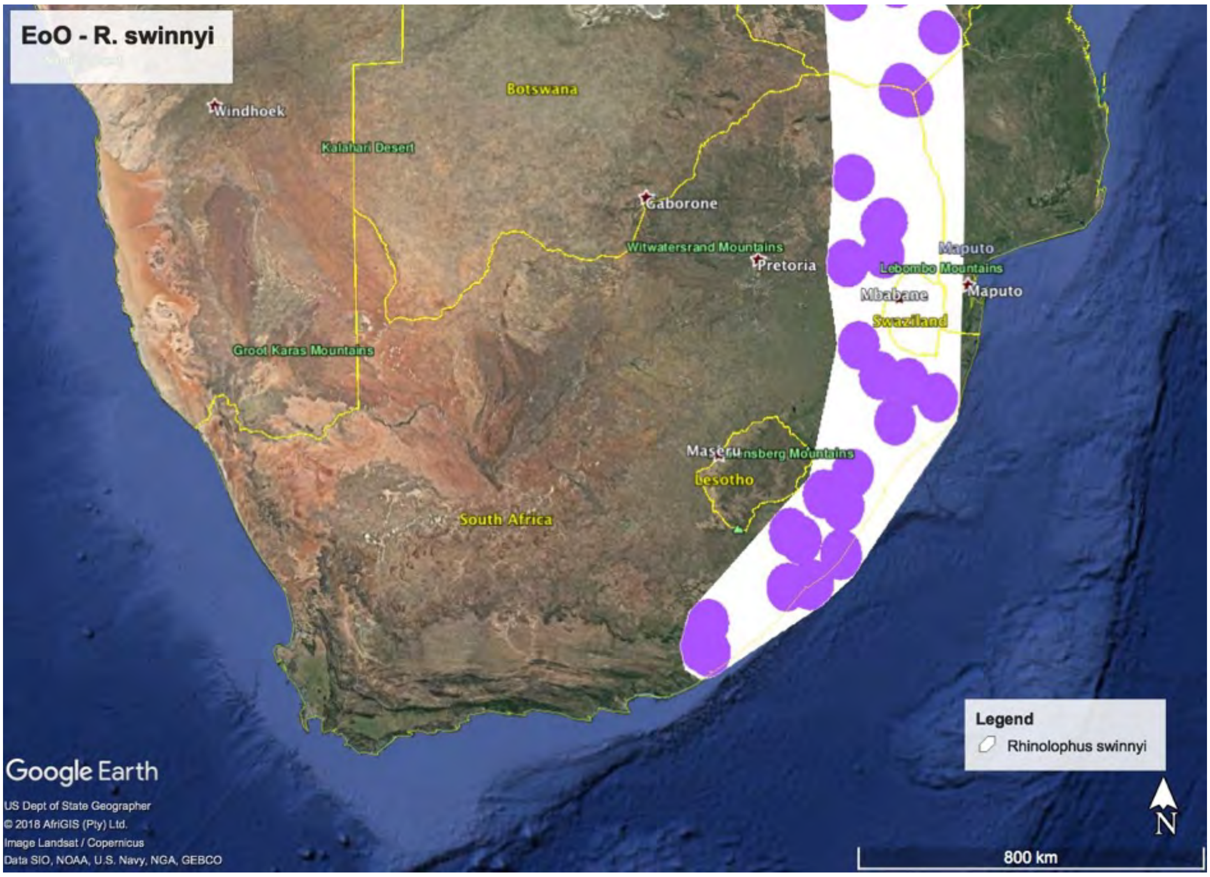
EoO - R. swinnyi
Botswana
Windhoek
Kalahari Desert
Gaborone
Witwatersrand Mountains
Pretoria
Maputo
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Mbabane
Swaziland
Groot Karas Mountains
Maseru
Lesotho
South Africa
Legend
Rhinolophus swinnyi
Google Earth
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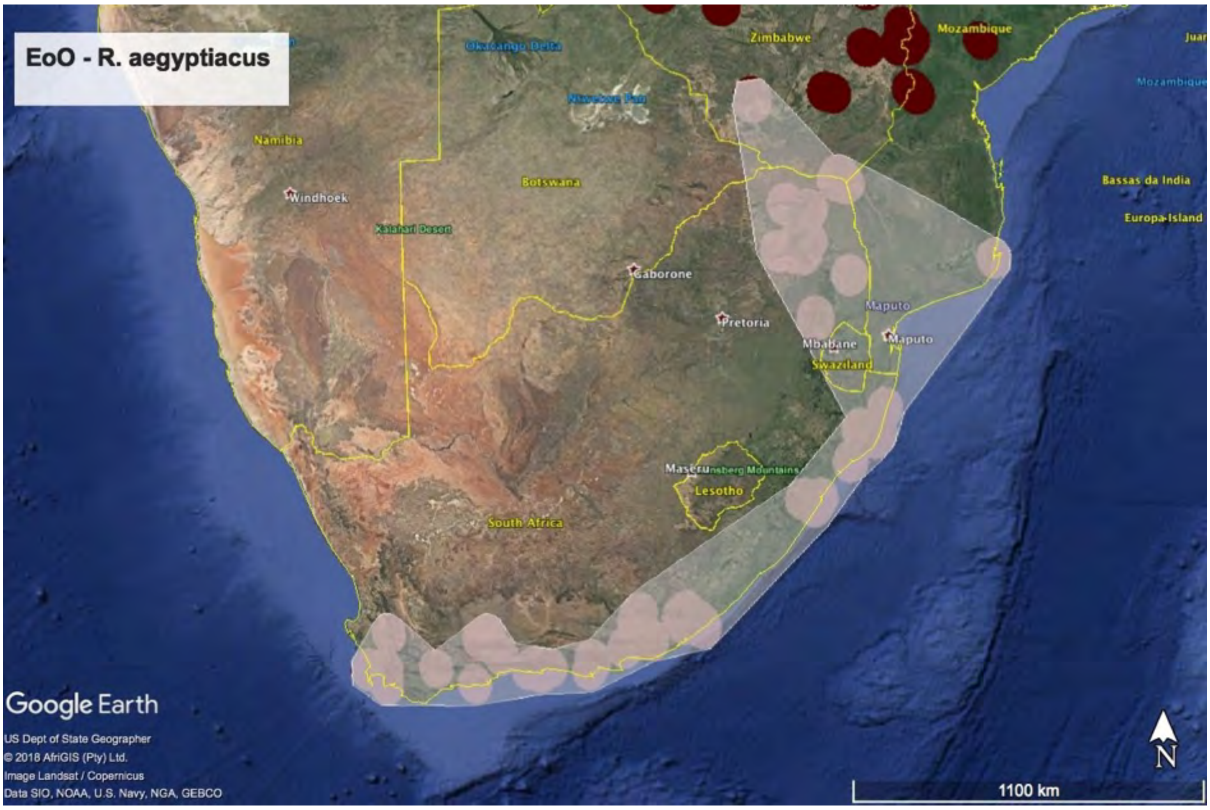
EoO - R. aegyptiacus
Okavango Delta
Zimbabwe
Mozambique
Namibia
Botswana
Windhoek
Kalahari Desert
Bassas da India
Europa Island
Gaborone
Pretoria
Maputo
Maputo
Mbabane
Swaziland
Maseru
Lesotho
South Africa
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US Dept of State Geographer
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PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A.2

Avifauna Scoping Assessment Report

Avifauna Scoping Assessment Report

Integrating Author	Dr Andrew Robert Jenkins

SUMMARY

Renewable energy development is expanding rapidly in South Africa but to date without a clear plan to maximise energy inputs to the power grid while minimising environmental impacts and ensuring true sustainability. Phase 1 of the national Strategic Environmental Assessment (SEA) for the construction and operation of new wind and solar PV projects aimed at bringing more effective strategy to the roll-out of renewable energy. The Phase 1 SEA identified a suite of eight optimal Focus Area (FAs) spread across the country, proactively mapped environmental sensitivities within each FA, and established impact-specific protocols for facilitating, expediting and encouraging development. These FAs have since been gazetted as formally recognised Renewable Energy Development Zones (REDZs).

The Phase 2 SEA is a continuation from Phase 1 and applies the same general approach, ultimately intended to identify further REDZs and complete the country's strategic plan for future renewable energy development. A further eight FAs were selected in a separate vetting process and submitted for consideration. Four (Emalahleni FA1 in Mpumalanga, Potchefstroom FA2 in North West/Free State, Postmasburg FA3 in Northern Cape, and Welkom FA4 in Free State) were designated for potential solar PV development only, one (Murraysburg FA5, Western Cape/Eastern Cape) was designated for wind energy development only, and three (Vredendal FA6, Western Cape, Prieska FA7, Northern Cape and Loeriesfontein FA8, Northern Cape) were designated for both technologies. Solar PV development mainly presents the risk of habitat loss, disturbance and/or displacement to birds in the receiving environment, wind energy development mainly presents the risk of collision mortality, displacement and disturbance, and the power infrastructure linking new facilities of either technology to the national grid (power lines, pylons, substations) presents the risk of collision and/or electrocution mortality.

Each of the FAs was assessed in terms of existing knowledge of their respective birdlife, avian habitats and declared conservation and biodiversity value (including bird atlas data and other 'citizen science' databases, archived survey data for key species solicited from conservation agencies – especially BirdLife South Africa and the Endangered Wildlife Trust, archived data for key species solicited from individual fieldworkers, mapping layers detailing the distribution of wetlands and rivers, protected and important biodiversity areas, threatened habitats and topography, modelled distributions or nesting distributions based on existing data). These various sources of information were used to derive lists of priority species for each FA (based on conservation status, endemism and susceptibility to the respective impacts of solar PV and wind energy development) and, ultimately, to delineate four-tier sensitivity maps for each, with known or predicted core areas for priority species and their surrounds designated as highest sensitivity.

The resulting maps of relative sensitivity to either solar PV or wind energy development yield the following conclusions and recommendations:

1. RE development is encouraged as a potentially sustainable option in terms of likely bird impacts in at least 6-7 of the eight proposed FAs, with solar PV less constrained by avian sensitivity than wind.

2. There are significant problems with wind energy development in at least three FAs (Murraysburg FA5, Vredendal FA6 and Loeriesfontein FA8).

3. In contrast, all of the relevant FAs have potential for solar PV development (with the best options being Postmasburg FA3, Welkom FA4 and Prieska FA7), while the least problematic area for wind energy development appears to be the Prieska FA7.

4. Given the lack of recent, reliable and extensive field data for the majority of the FAs assessed, the confidence around most of these findings is low and there is limited scope at present to relax the existing baseline monitoring requirements for new projects.

5. Targeted, supplementary fieldwork to improve the accuracy and value of these sensitivity maps is strongly recommended and could even result in opportunities to streamline the authorisation process.

6. By highlighting and mapping the known avian sensitivities within each FA the SEA Phase 2 offers developers greater certainty on bird impact issues in pursuing development options, and less likelihood of associated unexpected and costly delays.

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FIGURES

ABBREVIATIONS & ACRONYMS

ADU	Animal Demography Unit, University of Cape Town
BLSA	BirdLife South Africa
CAR	Coordinated Avifaunal Roadcount (ADU Citizen Science project)
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Waterbird Counts (ADU Citizen Science project)
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
DOE	Department of Energy
EIA	Environmental Impact Assessment
EWT	Endangered Wildlife Trust
FA	Focus Area
IBA	Important Bird and Biodiversity Area
NGO	Non-governmental organisation
PV	Photovoltaic
RE	Renewable Energy
REIPPP	Renewable Energy Independent Power Procurement Program
REDZ	Renewable Energy Development Zone
SABAP2	2nd Southern African Bird Atlas Project
SEA	Strategic Environmental Assessment
SEA1	Phase 1 of the DEA SEA project
SEA2	Phase 2 of the DEA SEA project
WEF	Wind Energy Facility

1. INTRODUCTION

1.1 Background

The South African government has been exploring the production of renewable energy (RE) by private companies as a means to rapidly grow the country's capacity to generate electricity. To this end, the national Department of Energy (DoE) has established the Renewable Energy Independent Power Producer Procurement Program (REIPPP) for processing applications to build and operate RE plants, which requires that all bidders for selection by REIPPP submit their projects for full Environmental Impact Assessment (EIA) before they can be granted an Environmental Authorisation (EA) by the Department of Environmental Affairs (DEA). DEA has since received many hundreds of development applications, mainly for wind and solar photovoltaic (PV) plants. These proposed renewable energy projects are widely distributed over most of the country. With the need to optimise strategic investment, particularly in the electricity grid, the wide distribution of projects together with the uncertainty inherent to a bidding process are becoming a significant challenge for sustaining the success of the REIPPP. There is, therefore, a growing need for strategic planning that enables a proactive approach to infrastructure development to ensure the continued success of renewable energy development in South Africa. In order to address delays in the EIA process as well as to facilitate strategic planning;, DEA has opted to conduct a Strategic Environmental Assessment (SEA) process for wind and solar PV development in South Africa, with a view to identifying Renewable Energy Development Zones (REDZs) in which environmental impacts are relatively low and/or at least partially pre-assessed, and where there are legitimate grounds for accelerating the authorisation of development applications.

The Council for Scientific and Industrial Research (CSIR) was selected by DEA to conduct this SEA process and completed Phase 1 in 2014 (Department of Environmental Affairs 2015), during which environmental sensitivity maps and associated development protocols were compiled for eight REDZs. The Phase 2 component of this initiative started in 2018 with a broad-scale assessment of environmental sensitivities to RE development across the country that identified a further eight development Focus Areas (FAs) (Fig. 1). As in SEA1, the second stage of SEA2 involves the scoping-level assessment of RE development sensitivities within each FA, to identify those areas of lowest sensitivity, where development applications can be fast-tracked without compromising the environmental sustainability of the RE industry. *AVISENSE* Consulting was contracted by the CSIR to do the avifaunal component of this second stage of the SEA2.

1.2 Birds and Wind farms

Wind farming offers a renewable means to generate much-needed electricity but have the capacity to inflict significant, population-level impacts on birds (Thomas *et al.* 2018, Law & Fuller 2018, May *et al.* 2019). With this in mind, WEFs must be sited, built and operated responsibly in order to achieve environmental sustainability (Drewitt & Langston 2006, 2008, Kuvlevsky *et al.* 2007,). Documented impacts of wind farms on birds have included (i) disturbance of resident (and possibly breeding) birds by the construction of the wind farm and/or the appearance and sound of the operating plant, which may result in displacement of populations and/or depress feeding rates and breeding success at local nests, (ii) habitat loss to the construction footprint of the wind farm, and even broader scale displacement of resident populations or preferred flight-lines from turbine-occupied areas (Fernández-Bellon *et al.* 2019), and (iii) injury or mortality of birds flying through or resident within the development area, in collisions with turbine blades or associated power lines, or in electrocutions on live power infrastructure (Drewitt & Langston 2006, Lehman *et al.* 2007, Jenkins *et al.* 2010, 2015).

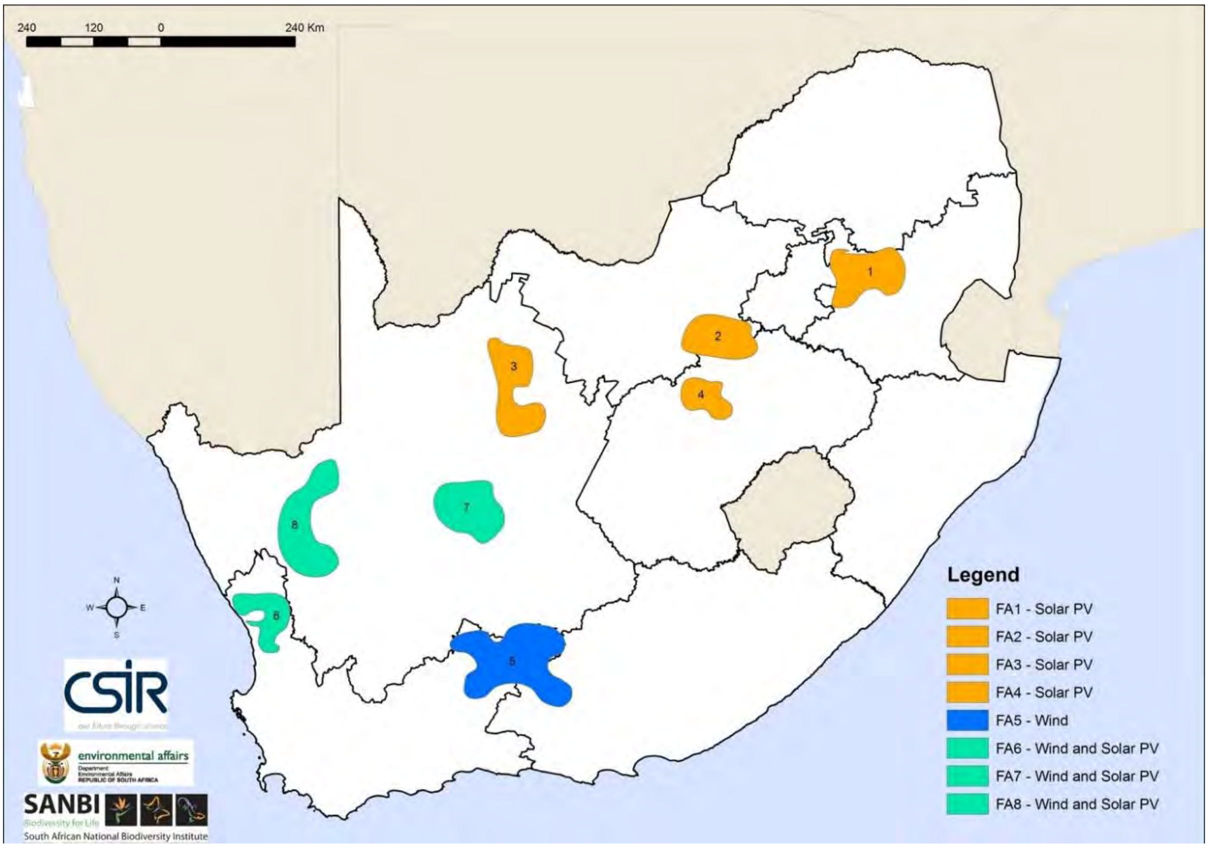


Figure 1. The eight Phase 2 Focus Areas (FAs) identified in the first stage of the study.

While the nature and severity of wind farm impacts can be highly site- and taxon-specific, they are simultaneously very difficult to predict (Drewitt & Langston 2006, Smallwood *et al.* 2009, Ferrer *et al.* 2012, Jenkins *et al.* 2018a). Poorly sited wind farms, or just one or two badly-placed turbines within a much bigger array, can have a significant detrimental effect on birds at the population level, and even threaten the regional, national or global conservation status of particularly impact susceptible species (Carrete *et al.* 2009, Law & Fuller 2018). Hence, while wind energy development may offer an environmentally preferable alternative to many other sources of power generation, it is essential that the interface between a proposed wind farm and the avifauna of its receiving environment is well understood before the project goes to construction.

Predicting the impacts of wind farms on birds

Multiple factors influence the number of birds killed in collisions at wind energy facilities. These can be classified into three broad groupings: (i) avian variables, (ii) location variables, and (iii) facility-related variables. Although only one study has so far shown a direct relationship between the abundance of birds in an area and the number of collisions (Everaert 2003), it would seem logical to assume that the more birds there are flying through an array of turbines, the higher the chances of a collision occurring. The nature of the birds present in the area is also very important as some species are more vulnerable to collision with turbines than others and feature disproportionately frequently in collision surveys (Drewitt & Langston 2006, 2008, de Lucas *et al.* 2012, Beston *et al.* 2016). Species-specific variation in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision (Barrios & Rodríguez 2004, Smallwood *et al.* 2009). There may also be seasonal and temporal differences in behaviour, for example breeding males engaging in aerial displaying may be particularly at risk.

Predicting which species are most susceptible to wind farm impacts

Collision-prone birds are generally either (i) large species and/or species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (e.g. cranes, bustards, vultures, waterfowl), (ii) species which fly at high speeds (raptors, gamebirds, aerial insectivores), (iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines), (iv) species which habitually fly in low light conditions, and (v) species with narrow fields of forward binocular vision (Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010, Herera-Alsina *et al.* 2013, Beston *et al.* 2016). These traits confer high levels of *susceptibility*, which may be compounded by high levels of *exposure* to man-made obstacles such as wind farms and associated overhead power lines (Jenkins *et al.* 2010). Exposure is greatest in (i) very aerial species, (ii) species inclined to make regular and/or long distance movements (migrants, any species with widely separated resource areas - food, water, roost and nest sites), (iii) species that regularly fly in flocks (increasing the chances of incurring multiple fatalities in a single collision incident).

Soaring species may be particularly prone to colliding with wind turbines where they are placed along ridges to exploit the same updrafts favoured by such birds - vultures, storks, cranes, and most raptors - for cross-country flying (Erickson *et al.* 2001, Kerlinger & Dowdell 2003, Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010, Péron *et al.* 2017). Large soaring birds – for example, many raptors and storks - depend heavily on external sources of energy for sustainable flight (Pennycuick 1989). In terrestrial situations, this generally requires that they locate and exploit pockets or waves of rising air, either in the form of bubbles of vertically rising, differentially heated air – thermal soaring - or in the form of wind forced up over rises in the landscape, creating waves of rising turbulence – slope soaring. Certain species are morphologically specialized for flying in open landscapes with high relief and strong prevailing winds and are particularly dependent on slope-soaring opportunities for efficient aerial foraging and travel. South African examples might include Cape Vulture *Gyps coprotheres*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Peregrine Falcon *Falco peregrinus*, Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra* and, to a lesser extent, most other open-country raptors. Such species are potentially threatened by wind energy developments where turbines are situated to exploit the wind shear created by hills and ridge-lines. In these situations, birds and industry are competing for the same wind resource, and the risk that slope soaring birds will collide with the turbine blades, or else be prevented from using foraging habitat critical for their survival, is greatly increased (e.g. Péron *et al.* 2017).

1.3 Birds and Solar PV farms

The environmental impacts of solar PV developments globally have not been well-researched (Tsoutsos *et al.* 2005, Gunerhan *et al.* 2009, Lovich & Ennen 2011, Turney & Fthenakis 2011), and the impacts of these plants on birds are poorly understood (RSPB 2011, DeVault *et al.* 2014). Solar PV facilities cover large areas (about 2-5 ha per MW) and in many cases require the complete removal of vegetation from the inclusive footprint of the installed plant (Lovich & Ennen 2011, Ong *et al.* 2013, DeVault *et al.* 2014, Visser *et al.* 2019). It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that stimulates most concern about the implications for avifauna of large-scale solar PV development (Lovich & Ennen 2011, RSPB 2011, Smit 2012, Hernandez *et al.* 2014, Visser *et al.* 2019), particularly in relation to species with restricted ranges and very specific habitat requirements. Recent findings at facilities in North America suggest that collision mortality impacts may be underestimated at solar PV plants, with collision trauma with the PV panels – perhaps associated with polarised light pollution and/or with waterbirds mistaking large arrays of PV panels as waterbodies (Horváth *et al.* 2009, Lovich & Ennen 2011, Kagan *et al.* 2014, Walston *et al*. 2016). Other possible impacts of solar PV farms include noise and disturbance generated by construction and maintenance activities, collision and electrocution mortality associated with newly installed power infrastructure (Bevanger 1994, 1998, Lehman *et al.* 2007, Jenkins *et al.* 2010, 2011, Dwyer *et al.* 2014), the attraction of novel species to an area by the artificial provision of otherwise scarce resources – for example perches, nest sites and shade (DeVault *et al.* 2014, Visser *et al.* 2019), and chemical pollution, mostly associated with measures taken to keep the PV panels clean, such as the use of dust suppressants (Lovich & Ennen 2011).

1.4 Birds and associated infrastructure

Infrastructure commonly associated with renewable energy facilities may also have detrimental effects on birds. The construction and maintenance of substations, power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance, and overhead power lines pose a collision and possibly an electrocution threat to certain species (Lehman *et al.* 2007, Jenkins *et al.* 2010, Phipps *et al.* 2013, Biasotto & Kindel 2018). Some habitat destruction and alteration inevitably takes place during the construction of power lines, substations and associated roadways. Also, power line service roads or servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the power line corridor, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line (e.g. King & Byers 2002). Power line collision risk affects a particular suite of susceptible species, mainly comprising large, heavy birds (such as bustards, cranes and large raptors), and smaller, fast-flying birds (such as gamebirds, waterfowl and small raptors - Bevanger 1994, 1998, Janss 2000, Anderson 2001, Drewitt & Langston 2008, Jenkins *et al.* 2010, Loss *et al.* 2014, Shaw *et al.* 2018), while electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components (Lehman *et al.* 2007, Dwyer *et al.* 2014, Loss *et al.* 2014).

2. APPROACH

2.1 Understanding impacts

Clearly, the earlier bird impacts are considered in the schedule of a RE project, the less the risk to both the environment and the developer. Ideally, avian issues should be addressed at the screening or site-selection phase of the process, with strategic reference to broad scale maps of avian sensitivity to wind/solar farm impacts (e.g. Bright *et al.* 2008, Retief *et al.* 2012, Thomas *et al.* 2018, Department of Environmental Affairs 2015, this study). Failing this, active collection of data describing the avifauna of a selected site should be completed before proposed projects are authorised, and the results of such monitoring should inform the findings of the avian component of the resulting report (Jenkins *et al.* 2015).

The level of project-specific knowledge required to support a legitimate RE development application in South Africa is presently informed by two best practice guidelines documents compiled by BirdLife South Africa (BLSA) and the Endangered Wildlife Trust (EWT) (Jenkins *et al.* 2015, BirdLife South Africa 2017). Because there is (a) some uncertainty around the southern African bird species likely to be susceptible to the negative impacts of wind and solar energy development (Retief *et al.* 2012, although see Ralston-Paton *et al.* 2017), (b) generally only limited knowledge of the current distributions of those species thought most likely to be susceptible, and (c) very little understanding of the patterns of bird movements (on any scale) likely to profoundly influence impact susceptibility, the pre-authorisation bird survey and monitoring requirements for proposed new renewable energy projects in this country are necessarily time-, labour- and cost-intensive.

The main object of the present study is to examine and map avian impact sensitivity within the SEA2 selection of eight, large, pre-selected FAs, and to look for areas within each FA where these sensitivities are low enough to allow some abbreviation or streamlining of the baseline monitoring requirements. Because resources were limited, the study was based initially on a desk-top integration and interpretation of existing data, including consultation and data-sharing with the most relevant local conservation NGOs – BirdLife South Africa and the Endangered Wildlife Trust. Unfortunately, this prescribed approach rather overestimated the quality of the available data, and hence limited the possibility of reducing the duration and scope of baseline fieldwork required to inform individual development applications within the majority of the FAs.

Note that a proposal has been submitted to conduct targeted fieldwork at strategically selected FAs to increase the accuracy and confidence of avian impact sensitivity mapping and possibly create the opportunity to relax development application requirements.

2.2 Methods

In accumulating and collating as much desk-top data for each of the FAs as possible, the aim of the study was to address three primary questions:

(i) What species occur on site, and which of these should be prioritised to form the basis of the sensitivity mapping process?

(ii) Where are the key areas in each FA for the relevant suite of priority species?

(iii) What protective measures are required to insulate these key areas and their birds from the negative impacts of renewable energy development?

Using Citizen Science data

Southern African Bird Atlas Project 2 (SABAP2) data for each FA (collected at a 5′ x 5′ or pentad resolution) was used to assess the total known or predicted avifauna in each case, and a short-list of priority species for each FA was derived from this, based substantially on BLSA's assessment of the ±100 species most likely to be negatively affected by wind energy development (Retief *et al.* 2012, as revised in terms of the most recent national - Taylor *et al.* 2015 - and global - http://www.iucnredlist.org/search - assessments of threat status). These are generally rare and/or threatened birds, or restricted-range endemics, that may also be collision-prone and/or sensitive to disturbance or displacement. Each short-list of priority species per FA informed all further investigations. Note that this level of exclusivity was adopted to address the challenge of rapidly making multiple, landscape-scale decisions about the suitability of widespread industrial development. The selection of priority species in each FA had the effect of simplifying each scoping-level assessment and assumed that the suite of species used served as an adequate surrogate for the entire species compliment present. This approach is not necessarily applicable at the project level, and a variety of species not directly considered in the mapping exercises presented here may become relevant to project-specific priorities and decisions made within each FA.

In addition to the SABAP2 data, another citizen science database – Coordinated Waterbirds Count (CWAC) - was also used in this study, although it quickly became clear that neither of these databases served the purposes of the project that well. The SABAP2 coverage was generally limited and the CWAC data only cover a small fraction of the wetlands present in any FA. As a result, in the absence of any better information, the two sets of data were used and integrated as judiciously as possible, to estimate where key species were most likely to occur. For example, atlas data were used in terms of simple presence/absence distributions (rather than using "Reporting Rate" as a more nuanced index of relative abundance) to partially counteract biases in observer coverage. Also, atlas data were aggregated for suites of species with similar levels of regional threat status, with Critically Endangered and Endangered species (Taylor *et al.* 2015) grouped together and given a higher sensitivity weighting than other priority species. Also, CWAC data were used to identify important wetlands in each FA, gauged simply in terms of the average aggregate count, the total species count, and the relative presence of red-listed or priority species. In effect, this meant that most CWAC sites were mapped as sensitive, with only a small minority of sites (those which support demonstrably lower numbers of waterbirds), were excluded.

Other sources of data

Wherever possible, information from a variety of sources on the specific location of nest or roost sites, or other important resource areas (e.g. wetlands, vulture restaurants) within or close to each of the FAs was used to supplement or supplant the "Citizen Science" data. Such sources included taxon-specific databases (detailing the results of nest or roost surveys or tracking studies) curated by conservation agencies and NGOs, and information solicited directly from professional or amateur ornithologists or birders (see Section 2.3 Data Sources for details).

Predicting distributions

In addition to using data describing known distributions of priority species, some habitat mapping layers were used as cues for predicting distributions in remote areas where such bird data were lacking. For example, a wetland layer was used to locate waterbodies above an arbitrary threshold size (*ca* 200 m x 100 m or 20 000 m^2), on the grounds that (all other factors being equal) larger wetlands are likely to support a greater diversity and biomass of waterbirds than smaller ones (Froneman *et al.* 2001), and a digital elevation model (DEM) was used to plot the distribution of cliffs (areas with slopes >75°) across each FA, in order to predict the distributions of threatened, impact-sensitive, cliff-nesting birds (e.g. Verreaux's Eagle). The latter approach had the added benefit of highlighting most of the major ridgelines in each FA for special attention. Such areas of high relief are known to attract slope-soaring birds and are commonly associated with increased collision risk for these species (Barrios & Rodriguez 2004, Fielding *et al.* 2006, Smallwood *et al.* 2009, Tapia *et al.* 2009, Miller *et al.* 2013).

All South Africa's Important Bird Areas (except the Overberg which is extremely large and is dominated by highly modified farmland), the major river courses in each FA (given that these generally serve as flyways for many bird species), the coastline (an important flyway for coastal and other species), all proclaimed Protected Areas, and all power transmission lines (given that the pylons supporting these lines are regularly used as nest sites by large, threatened raptors – e.g. Anderson & Hohne 2007, Jenkins *et al.* 2013b) were also isolated as impact sensitive areas.

Given the large development footprints of RE plants, and especially of solar PV projects, it may also be appropriate to approach strategic development planning in terms of impacts on important avian habitats, and the taxa or assemblages that these habitats support. Of particular relevance in this context would be potential incursions of RE development into scarce habitats that support threatened, range-restricted and/or endemic birds. To achieve usable, relatively fine-scale predictive mapping for a suite of the most highly selective, threatened and potentially impact sensitive species, modelled distributions were generated by Robin Colyn of BLSA for White-winged Flufftail *Sarothura ayersi*, Rudd's Lark *Heteromirafra ruddi*, Red Lark *Calendulauda burra*, Yellow-breasted Pipit *Anthus chloris* and Black Harrier *Circus maurus* based on pre-existing, unpublished sightings and nest sites curated and/or co-owned by BirdLife South Africa, and vetted bird atlas data provided by BirdLasser (https://www.birdlasser.com/).

Species distribution modelling (SDM) incorporates a predictive modelling framework that utilises species locality data and environmental covariate data to create probabilities of habitat suitability maps. In order to map areas of at least High sensitivity for target species, Ensemble SDMs were used which employ various predictive SDM algorithms to map a statistically robust consensus of species' distributions, combining the strength of the various individual SDM algorithms (Ranjitkar *et al.* 2014; Kalle *et al.* 2017; Mezquida *et al.* 2018). For some species, micro-habitat quality was assessed through a combination of field work and spatial analyses, with known favoured areas (in some instances nest sites) as well as new areas surveyed to assess the actual presence and status of focal species. The resulting data allowed the SDM analyses to delineate more accurately the core breeding habitats of the respective species that are still viable/optimal. Such core areas are mapped here as Very High sensitivity. All species SDMs were conducted using the software package R in combination with ArcGIS. Given the varied performance of different niche modelling approaches and algorithms, ModEco (Guo & Liu 2010) was used to run multiple models on each set of binary presence data and evaluate the best performing model.

Buffers and the principles of mapping

Once all the various sources of point, raster and shape information had been accumulated and mapped for each FA, appropriate buffer distances were allocated. As far as possible these were based on published information on foraging ranges, sensitivity to disturbance or susceptibility to collision (e.g. BirdLife South Africa 2018, Pfeiffer & Ralston-Paton 2018, Simmons & Ralston-Paton In prep. – species-specific guidelines documents for Verreaux's Eagle, Cape Vulture and Black Harrier respectively), but often requiring the use of conservative estimates based on experience. The general approach was to err on the side of protective caution when making these estimations, and when determining the levels of sensitivity to allocate in each instance. In some instances, the buffer distances imposed have exceeded those routinely applied by bird specialists in assessing and mitigating impacts of individual RE developments at the EIA level. This is because the intention is to strategically guide development away from sensitive areas and to avoid impacts, rather than to mitigate impacts where project-level planning decisions have (in many cases) already been made.

The default position adopted in the execution of this project was that in the absence of sufficient reliable data to show particularly low sensitivity in any given area, the existing constraints on development (i.e. the requirements of the two sets of best practice guidelines) should continue to apply. These are relatively well-defined for both wind energy and solar PV projects (Jenkins *et al.* 2015, BirdLife South Africa 2017).

2.3 Data Sources

Data title	Source and date of publication	Data Description
Southern African Bird Atlas (SABAP) 2	Percy FitzPatrick Institute of African Ornithology, University of Cape Town; ongoing atlas project started in 2007. http://sabap2.adu.org.za/,	Citizen science data set which collates bird distribution records collected by the public according to a specific field protocol, and at a 5′ x 5′ grid (pentad) resolution. Typically, these data are expressed as reporting rates per pentad, with the number of bird lists (atlas cards) submitted for the pentad which include at least one sighting of any given species expressed as a percentage of the total number of cards submitted for that pentad. Because the SABAP2 coverage for the eight FAs at the time of this analysis was generally poor, we used these data to reflect simple presence/absence of selected species only.
Coordinated Waterbird Counts (CWAC)	Animal Demography Unit, University of Cape Town; ongoing wetland survey project started in 1992 (Taylor *et al.* 1999). http://cwac.adu.org.za/	Citizen science data detailing the diversity and abundance of wetland bird species present at a sample of waterbodies spread across South Africa. Each registered wetland is generally counted twice annually – once in mid-summer and once in mid-winter.
South African Protected Areas Database (SAPAD)	Department of Environmental Affairs. South African Protected Areas Database, 2014.	The Department of Environmental affairs curates a database containing spatial data on all the various formally protected areas throughout South Africa. Most of these areas are classified as areas set aside for biodiversity and nature conservation.
Eskom Network	Eskom, 2013.	Spatial information on both the Eskom transmission and distribution networks.
Remaining Threatened Ecosystems	A product of SANBI (South African National Biodiversity Institute), prepared for the SEA 2013	Spatial information collated in terms of the Biodiversity Act (Act 10 of 2004), detailing the distributions of all threatened and protected ecosystems throughout South Africa. All listed ecosystems are classified according to four categories: Critically Endangered, Endangered, Vulnerable, and Protected. Data were used to identify areas where threatened of protected ecosystems, that could support important or impact sensitive bird species, overlap with any of the FAs.
National Freshwater Ecosystem Priority Areas (NFEPA), Rivers (classes 1-3),	National Freshwater Ecosystem Priority Areas. CSIR, 2007	The National Freshwater Ecosystems Priority Areas project is the product of a collaboration between the CSIR, the SANBI, the Department of Water Affairs (DWA), the Water Research Commission (WRC), WWF South Africa, South African National Parks (SANParks), the South African Institute for Aquatic Biodiversity (SAIAB) and DEA. Freshwater systems were categorised based on various criteria with the aim of identifying valuable freshwater conservation areas. The results of this study were used to identify important river systems within or bordering each FA that could support important bird populations or important avian flyways.
Digital Elevation Model	The Shuttle Radar Topography Mission (SRTM)	Using ArcMap 10.6.x and its Spatial Analyst Extension (Environmental Research

Data title	Source and date of publication	Data Description
	30m Digital Elevation Model data was used. The SRTM was a partnership between the United States National Geospatial-Intelligence Agency (NGA) and the National Aeronautics and Space Administration (NASA). The required tiles were downloaded from the United States Geological Surveys (USGS) EarthExplorer website (https://earthexplorer.usgs.gov/).	Institute, Redlands California), the DEM was converted to a slope suface (degrees). Using the Raster Calculator, the slope raster cells with slope greater than 50 degrees were extracted. These were then converted to a vector layer which was then buffered by 3km for the wind analysis.
BirdLife South Africa, Important Bird and Biodiversity Areas (IBAs)	BirdLife International & BirdLife South Africa, Important Bird and Biodiversity Areas (Marnewick *et al.* 2015) http://www.birdlife.org.za/conservation/important-bird-areas/iba-directory	The BLSA IBA Programme identifies and conserves areas or sites that are considered critical to the long-term survival of globally threatened or range-restricted bird species. Six such IBA's overlap or partially overlap with the RE FAs: Loskop Dam Nature Reserve (SA015), Steenkampsberg (SA016), Bitterputs (SA036), Olifants River Estuary (SA099), Cederberg-Koue Bokkeveld Complex (SA101) and Karoo National Park (SA102).
Lesser Kestrel *Falco naumanni*, Red-footed Falcon *Falco vespertinus* and Amur Falcon *Falco amurensis* Roost data	Provided by Rina Pretorius of the EWT's Migrating Kestrel Project.	The Migrating Kestrel Programme coordinates the annual census of Lesser Kestrel, Amur Falcon and Red-footed Falcon roosts across South Africa. GPS coordinates of roost locations within FAs were buffered accordingly.
Modelled distributions of highly threatened, high-priority species	Robin Colyn, Terrestrial Bird Conservation Programme, BLSA	Breeding or residency distributions (probability of occurrence) of a suite of highest priority, threatened, restricted range species – White-winged Flufftail, Rudd's Lark, Red Lark, Yellow-breasted Pipit, Black Harrier and Verreaux's Eagle – based on existing nest site and/or sightings data
Martial Eagle *Polemaetus bellicosus* nest sites	From various sources, particularly from the EWT Knowledge Management Database, the Birds & Renewable Energy bird specialist community, the CSIR dataset used in compiling sensitivity maps for the Power Line SEA process, and various unpublished, incidental nest records.	Credible locations of currently or recently occupied and active Martial Eagle nesting territories. Mostly concentrated in the Western, Eastern and Northern Cape Provinces

Data title	Source and date of publication	Data Description
Verreaux's Eagle nest sites	From various sources, particularly from Lucia Rodrigues, Western Cape Black Eagle Project and including the EWT Knowledge Management Database, the Birds & Renewable Energy bird specialist community, the CSIR dataset used in compiling sensitivity maps for the Power Line SEA process and various unpublished, incidental nest records	Credible locations of currently or recently occupied and active Verreaux's Eagle nesting territories. Mostly concentrated in the Western, Eastern and Northern Cape Provinces
Tawny Eagle *Aquila rapax* nest sites	From various sources, particularly from the EWT Knowledge Management Database, the CSIR dataset used in compiling sensitivity maps for the Power Line SEA process and various unpublished, incidental nest records	Credible locations of currently or recently occupied and active Tawny Eagle nesting territories. Mostly in the Northern Cape Province
African Grass Owl *Tyto capensis* nest sites	From the EWT Knowledge Management Database	Credible locations of currently or recently occupied and active African Grass Owl nesting areas. Concentrated in Mpumalanga
Black Stork *Ciconia nigra* nest sites	From the BLSA Terrestrial Bird Conservation Programme	Credible locations of currently or recently occupied and active Black Stork nesting territories
Black Harrier *Circus maurus* nest sites	From the BLSA Terrestrial Bird Conservation Programme	Credible locations of currently or recently occupied and active Black Harrier nesting territories, mostly originally sourced from the "Black Harriers – Ecology & Fitness" project of the FitzPatrick Institute, UCT
Southern Bald Ibis *Geronticus calvus* breeding colonies and roosts	From the BLSA Terrestrial Bird Conservation Programme	Credible locations of currently or recently occupied and active Southern Bald Ibis breeding colonies or roosts
Peregrine Falcon *Falco peregrinus* nest sites	Andrew Jenkins, Research Associate, FitzPatrick Institute, UCT	Credible locations of currently or recently active Peregrine Falcon nesting territories
Lanner Falcon *Falco biarmicus* nest sites	Andrew Jenkins, Research Associate, FitzPatrick Institute, UCT	Credible locations of currently or recently active Lanner Falcon nesting territories
Crane nest sites	From the EWT Knowledge Management Database	Credible locations of currently or recently used Blue Crane *Anthropoides paradiseus* and Wattled Crane *Bugeranus carunculatus* nest sites
Miscellaneous nest and/or roost sites	From various sources, including the EWT Knowledge Management Database, and various unpublished, incidental nest and roost records.	Credible locations of currently or recently active nest or roost sites and/or nesting territories of various raptor and/or priority species, including Booted Eagle *Hieraaetus pennatus*, White-backed Vulture *Gyps africanus and* Lappet-faced Vulture *Torgos tracheliotus*

Data title	Source and date of publication	Data Description
Vulture Restaurant inventory	From Kerri Wolter, Vulpro, and the EWT Knowledge Management Database	Unpublished revision of the vulture restaurants inventory, initially compiled by Dr Steven Piper of the EWT's Vulture Study Group

2.4 Assumptions and limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Poor quality of existing data describing bird distribution and abundance – SABAP2, CWAC, other databases, solicited unpublished data. For most of the FAs, the data available were few, scattered and sometimes old. This applied particularly to data describing smaller, more cryptic species.	All of SABAP2, even though observer effort was generally very thin and patchy, and often concentrated around urban centres (Fig. 3). Most of CWAC, even though both probably reflect the distributions of observers at least as much as those of birds. Most unpublished data, especially those derived from formal research projects where efforts had been made to achieve representative coverage.	Some of the unpublished data were excluded because they were too old (generally observations made pre-1995 were not used).	That by integrating as much reliable and recent data into the process as possible, assessments of the distributions of key species will approximate reality. That sensitivity mapping based substantially on data for large, charismatic species caters adequately for smaller, cryptic species.
No usable information available to describe bird movement patterns within any of the FAs. These are key to understanding and mitigating collision risk	None	-	Distributional data and knowledge of resource requirements are sufficient to predict possible fly-ways between key areas.
Limited time available in project schedule to accumulate all the available data, so many potential sources of information remained untapped.	As much information as possible.	As little of the received information as possible.	The data accumulated and mapped are sufficient for purpose.
Not all sightings were made by reliable observers – problems with identification or interpretation of behaviour could bias data received.	All data received from reliable sources.	All data received from unreliable sources.	All the data used were accurate.
As yet, no resources available for field surveys to inform this study.	-	-	The desk-top approach used here is adequate for the purpose of the SEA.

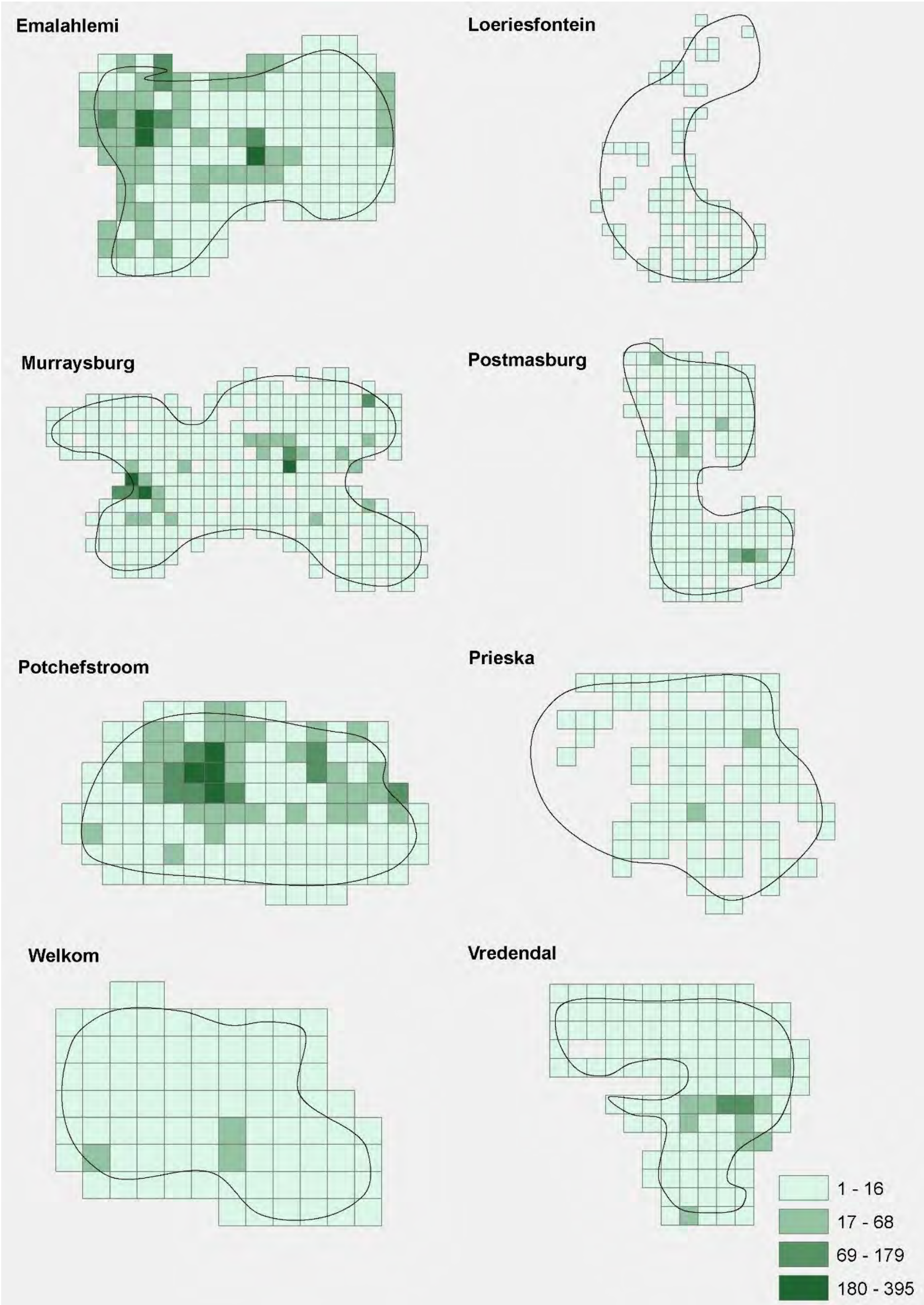


Figure 2. Levels of SABAP2 coverage (atlas cards per pentad) for each of the eight Focus Areas.

2.5 Relevant Regulatory Instruments

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Aims to conserve terrestrial, marine and avian migratory species throughout their range.
The Agreement on the Conservation of African-Eurasian Migratory Waterbirds, or African-Eurasian Waterbird Agreement (AEWA)	Intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago.
National Instrument	
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. Activity 12 in Listing Notice 3 (Government Notice R546 of 2010) relates to the clearance of 300 m² or more of vegetation,
National Environmental Management: Protected Areas Act, 2003. (Act 57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
National Environmental Management Act,1998 (Act 107 of 1998)	Promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
Environment Conservation Act, 1989 (Act 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
Marine Living Resources Act, 1998 (Act 18 of 1998)	To provide for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefit of all the citizens of South Africa; and to provide for matters connected therewith.
National Water Act, 1998 (Act 36 of 1998),	Part 3, The Reserve: The ecological reserve relates to the water required to protect the aquatic ecosystems of the water resource.
Provincial Instrument	
Western Cape Nature Conservation Board Act, 1998 (Act 15 of 1998)	To provide for the establishment, powers, functions and funding of the Western Cape Nature Conservation Board and the establishment, funding a control of a Western Cape Nature Conservation Fund, and to provide for matters incidental thereto. The object of the board shall be, (a)

Instrument	Key objective
	promote and ensure nature conservation and related matter in the Province.
Western Cape Nature Conservation Laws Amendment Act, 2000. (Act 3 of 2000)	To provide for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board; to amend the Western Cape Nature Conservation Board Act, 1998 to provide for a new definition of Department and the deletion of a definition; to provide for an increase in the number of members of the Board; to provide for additional powers of the Board; to amend the provisions regarding the appointment and secondment of persons to the Board; and to provide for matters incidental thereto.
Northern Cape Nature Conservation Act, 2009 (Act 10 of 2009).	To provide for the sustainable utilization of wild animals, aquatic biota and plants: to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act: to provide for the issuing of permits and other authorisations: and provide for the matter connected therewith.
Free State Nature Conservation Ordinance, 1969 (Act 8 of 1969)	To provide for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto
Ciskei Nature Conservation, 1987 (Act 10 of 1987, still in force)	To consolidate and amend the laws relating to the conservation, management and protection of fauna, flora, fish and the habitats generally, to provide for the establishment and management of nature reserves, hiking trails, water catchment areas and a coastal conservation area, to provide for matter relating to the sea and the seashore and the provide for the incidental matters.
Transvaal Nature Conservation Ordinance 12, 1983 (to be replaced by the Northwest Biodiversity Management Act of 2017 when this comes into effect	To consolidate and amend the laws relating to nature conservation and to provide for matters incidental thereto.
Mpumalanga Nature Conservation Act 10, 1998	To consolidate and amend the laws relating to nature conservation within the Province and to provide for matters connected therewith.

3. FOCUS AREAS DESCRIPTION

Site	Brief description
Emalahleni Focus Area 1	This FA (10 087 km²) is located in the Mesic Highveld Grassland Bioregion of the Grassland Biome (Mucina & Rutherford 2006). Unmodified habitats are dominated by Rand Highveld Grassland and Eastern Highveld Grassland, dotted with small patches of Eastern Temperate Freshwater Wetlands and with an area of Loskop Mountain Bushveld in the northern periphery, proximal to the Olifants River Valley and Loskop Dam (Mucina & Rutherford 2006). The terrain is generally open, and the topography is undulating but more mountainous in the north. The FA includes portions of two currently registered IBAs – Loskop Dam Nature Reserve in the north and the Steenkampsberg in the east (Marnewick *et al.* 2015). More than 450 bird species have been recorded within the FA by SABAP2 (161/161 pentads covered, 3798 full protocol atlas cards). At least 39 regionally or globally red-listed species could occur in the area (Taylor *et al.* 2015), including seven red-listed endemics or near-endemics (Cape Vulture, Southern Bald Ibis, Blue Crane, Blue Korhaan *Eupodotis caerulescens*, Black Harrier, Rudd's Lark, Yellow-breasted Pipit). The few remaining tracts of open Highveld grassland – most of which are located in protected areas in the eastern periphery of the FA - support important populations of Rudd's Lark (Maphisa *et al.* 2009), Yellow-breasted Pipit (Pietersen *et al.* 2018), White-bellied Korhaan *Eupodotis sengalensis* and Blue Korhaan (Little *et al.* 2005, Marnewick *et al.* 2015), while scattered, intact vleis in this area support Wattled Crane, Grey-crowned Crane *Balearica regulorum* and Blue Crane (McCann *et al.* 2007, Smith *et al.* 2016) and constitute critical habitat for White-winged Flufftail (Marnewick *et al.* 2015). Much of the central and western parts of the FA are degraded by coal mining, agriculture and urban development, but vestigial wetlands still support breeding pairs of African Grass Owl and (probably) African Marsh Harrier *Circus ranivorus*, and the the town of Middelburg hosts a large colonial roosts of Amur Falcon and Lesser Kestrel in the boreal winter. Cliff-lines in the northern and eastern sectors of this FA are used by breeding Southern Bald Ibis, Black Stork, Verreaux's Eagle and Lanner Falcon (Tarboton & Allan 1984, Manry 1985, Marnewick *et al.* 2015). A short-list of 37 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 1). Various red-listed grassland and wetland birds (including Wattled, Blue and Grey-crowned Cranes, White-winged Flufftail, White-bellied Korhaan, African Grass Owl, Southern Bald Ibis, Rudd's Lark and Yellow-breasted Pipit) were probably the most influential species in shaping these maps.

Site	Brief description
Potchefstroom Focus Area 2	This FA (8 496 km2) is spread across both the Dry and Mesic Highveld Grassland bioregions of the Grassland Biome (Mucina & Rutherford 2006). Untransformed vegetation features a mix of sandy and dolomite grassland, thornveld and bushveld, with a scattering of Highveld Salt Pans (Mucina & Rutherford 2006). The terrain is mainly open and flat, with some significant topographic relief in the vicinity of the Vredefort Dome to the south of Parys. The FA does not include any IBAs. SABAP2 lists 389 bird species for the pentads included in this FA (138/138 pentads covered, 3605 full protocol atlas cards). The area could support 24 regionally or globally red-listed, including one possible (Blue Korhaan) red-listed endemic (Taylor *et al.* 2015). The avifauna of this area is not well known and SABAP2 coverage is modest. Because it includes both moist and dry grasslands, various forms of savanna, salt pans and >150 km of the Vaal River it supports a relatively high diversity of birds, with a good mix of mainly grassland endemics, but the majority are relatively common, widespread species and the area may not support many important populations of threatened, impact susceptible species. This said, savanna habitats located mainly in the northern half of the FA probably support various large raptor species such as Martial Eagle, Tawny Eagle, Lappet-faced Vulture and White-backed Vulture, and there are two Vulture Restaurants located to the north and the east of the FA that may still be operational. Otherwise, the open grasslands are likely to hold Secretarybird (Hofmeyr *et al.* 2014), the salt pans and larger dams (e.g. Klerksdorp Dam) will attract numbers of both Lesser Flamingo *Phoeniconaias minor* and Greater Flamingo *Phoenicopterus roseus* and a variety of other waterbirds (including Maccoa Duck *Oxyura maccoa* and Caspian Tern *Sterna caspia*), the Vaal River is likely to support a healthy population of African Fish Eagle *Haliaeetus vocifer*, and the towns of Parys and Viljoenskroon each hold communal roosts of migrating kestrels. A short-list of 22 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 2). A suite of large savanna raptors and Lesser and Greater Flamingo were the most influential species in shaping the sensitivity maps for this area.
Postmasburg Focus Area 3	The Postmasburg FA (10 737 km²) is in the Eastern Kalahari Bushveld Bioregion of the Savanna Biome (Mucina & Rutherford 2006). Terrain is mostly open and flat or undulating, although rocky in parts with occasional low ridges or koppies, and with some significant, higher-lying ridgelines in the southwest of the FA. Unmodified vegetation is a fragmented mix of Ghaap Plateau Vaalbosveld, Kuruman Mountain Bushveld and Kuruman and Postmasburg Thornveld, with tracts of Southern Kalahari Saltpan just outside Limeacres in the southeast of the FA (Mucina & Rutherford 2006). Over 275 bird species have been recorded in this FA over the SABAP2 atlassing period (147/173 pentads covered, 664 full protocol atlas cards). The area could support 21 regionally or globally red-listed species, including two red-listed near-endemics (Blue Crane and Ludwig's Bustard). The FA is not located close to any registered national IBAs (Marnewick *et al.* 2015). Well-treed drainage lines, particularly those in the northwest of the FA proximal to the true Kalahari, probably support nest sites of large savanna raptors – White-backed and Lappet-faced Vulture, Martial Eagle and Tawny Eagle, while cliffs on koppies and ridges probably support pairs of Verreaux's Eagle, Lanner Falcon and other cliff-nesting species. Verreaux's Eagle, Martial Eagle, Lanner Falcon and possibly White-backed Vulture are likely to nest in power pylons and communications masts wherever they occur (e.g. Murn *et al.* 2007, De Swaardt 2013), and most large raptors will roost on such structures. A short-list of 18 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 3). White-backed Vulture, Martial Eagle, Tawny Eagle and Verreaux's Eagle were the most influential species in shaping the sensitivity maps for this area.

Site	Brief description
Welkom Focus Area 4	This FA (4 629 km²) is located in the Dry Highveld Grassland Bioregion of the Grassland Biome (Mucina & Rutherford 2006). Unmodified vegetation comprises a mix of various Highveld grassland and shrubland types – Vaal-Vet Sandy Grassland, Winburg Grassy Shrubland, Central Free State Grassland – with scattered, localised alluvial and salt pan habitat. Terrain is mainly flat or undulating, and land use includes widespread intensive agriculture and mining. Associated with the mines is a network of large, permanent waterbodies, concentrated mainly around the town of Welkom, while the western half of the FA features a system of natural, ephemeral pans. The Vaal River flow across the southern extremity of the FA. At least 290 species of birds have been recorded in this FA by SABAP2 (84/84 pentads covered, 317 full protocol atlas cards). Eighteen regionally or globally red-listed species could occur in the FA, including four regional endemics or near-endemics (Black Harrier, Blue Crane, Ludwig's Bustard and Blue Korhaan). The FA is not located close to any registered IBAs. The seasonal pans and wetlands characteristic of tracts of open Highveld grassland regularly support important populations of waterbirds, while the large pans and dams close to Welkom support up to 10 000s of Lesser and Greater Flamingos (e.g. Flamingo Pan), and a healthy population of African Fish-Eagles probably nests along the Vaal River. A short-list of 21 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 4). Lesser Flamingo, Greater Flamingo and Lesser Kestrel were the most influential species in shaping these maps.
Murraysburg Focus Area 5	This FA (19 719 km²) straddles the Upper Karoo and Lower Karoo bioregions of the Nama Karoo Biome (Mucina & Rutherford 2006). The terrain is mountainous around the escarpment edge with plateaux and plains above and below the escarpment respectively, characterised by various forms of karroid vegetation, interspersed with patches of grassy karoo in the uplands and acacia savanna along the main drainage lines (Mucina & Rutherford 2006). Over 300 species of birds have been recorded to date in this FA by SABAP2 (291/319 pentads covered, 2539 full protocol atlas cards). At least 23 regionally or globally red-listed species could occur in the FA, including five regional endemics or near-endemics (Ludwig's Bustard, Blue Crane, Black Harrier, Southern Black Korhaan and African Rock Pipit *Anthus crenatus*). On its western edge the FA directly abuts the Karoo National Park IBA (SA102 – Marnewick *et al.* 2015). The escarpment-related habitat in the northern half of the FA features very rugged terrain with a multitude of high cliffs supporting substantial populations of cliff-nesting birds, including high densities of Verreaux's Eagle (Davies 1994, Jenkins 2012, Jenkins & du Plessis 2014, Jenkins & du Plessis 2015b, Jenkins & du Plessis 2016), as well as good numbers of Booted Eagle, Lanner and Peregrine Falcon, Cape Eagle Owl *Bubo capensis* and Black Stork. Ridgelines support African Rock Pipit plains areas support breeding pairs of Martial Eagle, Tawny Eagle and Verreaux's Eagle, nesting either on Eskom transmission (and sometimes distribution) structures or communication masts (e.g. Boshoff 1993, Machange *et al*. 2008, Jenkins *et al.* 2013b), and pairs of Martial Eagle, Tawny Eagle and Secretarybird nesting either in trees along drainage lines or in alien plantations. The plains areas also feature nomadic populations of Ludwig's Bustard and Black Harrier (Shaw *et al.* 2015, Garcia-Heras *et al.* 2019), and more sedentary populations of Blue Crane, Kori Bustard, Karoo and Southern Black Korhaan.

Site	Brief description
	A short-list of 19 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 5). Suites of cliff-nesting raptors (including Verreaux's Eagle and Lanner Falcon), plains raptors (including Martial Eagle, Black Harrier, Secretarybird and Lesser Kestrel) and large terrestrial birds (including Blue Crane and Ludwig's Bustard) were the most influential species in shaping these maps.
Vredendal Focus Area 6	This FA (6 131 km²) spans the Succulent and Fynbos Biomes and includes (from east to west) strips of the Namaqualand Hardeveld, Northwest Fynbos and Namaqualand Sandveld Bioregions (Mucina & Rutherford 2006). The terrain is rugged mountainous in the southeast, grading into undulating with large, rocky outcrops, to open plains areas along the western coastal plain and in the north. Unmodified vegetation includes vygieveld, strandveld, sand fynbos and estuarine salt marsh at the mouths of the river courses running west to the coast (Mucina & Rutherford 2006). Nearly 250 species of birds have been recorded in this FA by SABAP2 (118/119 pentads covered, 1164 full protocol atlas cards). At least 25 regionally or globally red-listed species could occur in the area, including four regional endemics or near-endemics (Blue Crane, Ludwig's Bustard, Southern Black Korhaan and Black Harrier). The FA is sandwiched between the Cederberg-Kouebokkeveld Complex IBA (SA101) in the east and the Olifants River Estuary (SA099) to the west IBA (Marnewick *et al.* 2015). The steep-sided outcrops that are a feature of the southern, Sandveld region of the FA support breeding pairs of Verreaux's Eagle, Booted Eagle, Peregrine and Lanner Falcon and Cape Eagle Owl (Murgatroyd *et al.* 2016, Jenkins 2010, Jenkins 2011b), and the mountains that build up to the east towards the Cederberg feature a similar community of cliff-nesting birds but including Black Stork. The open flats of the Knersvlakte in the north and coastal plain in the west feature seasonal influxes of Ludwig's Bustard (and probably resident pairs of Secretarybird – Hofmeyr *et al.* 2014), while the fringes of the main river courses attract breeding Black Harrier after good rains (Curtis *et al.* 2004, Garcia-Heras *et al.* 2019) and Martial Eagle and Lanner Falcon breed on the power line support structures (Jenkins *et al.* 2013b). The Olifants River estuary holds a suite of threatened species including Black Harrier, African Marsh Harrier, Greater and Lesser Flamingo, Great White Pelican, Curlew Sandpiper *Calidris ferruginea* and Chestnut-banded Plover *Charadrius pallidus* (Jenkins 2011a, Marnewick *et al.* 2015), as well as good aggregations of more common wetland birds. A short-list of 22 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 6). Verreaux's and Martial Eagles, Black Harrier, a suite of threatened wetland birds and possibly Ludwig's Bustard were the most influential species in shaping the sensitivity maps for this area.
Prieska Focus Area 7	This FA (10 317 km²) is located in the Bushmanland Bioregion of the Nama Karoo Biome (Mucina & Rutherford 2006). Unmodified vegetation is a mix of Lower Gariep Brokenveld proximal to and in the catchment of the Orange River in the north, and Bushmanland Arid Grassland and Northern Upper Karoo on the plains areas to the south, interspersed with Bushmanland Basin Shrubland along the drainage lines (Mucina & Rutherford 2006). Terrain is mostly open and flat, with some topographic relief marking the southern boundary of the Orange River valley. Over 250 species of birds have been recorded in this FA by SABAP2 (94/165 pentads covered, 339 full protocol atlas cards). At least 18 regionally or globally red-listed species could occur in the area, including four regional endemics or near-endemics (Ludwig's Bustard, Black Harrier, Red Lark and Sclater's Lark). The FA is not located close to any registered national or global IBAs (Marnewick *et al.* 2015).

Site	Brief description
	While the fertile floodplain of the Orange River supports relatively high numbers of birds, including a variety of waterbirds and woodland species associated with the river itself, the avifauna of the southern interior is arguably more sensitive in terms of the presence of threatened and/or endemic species. Large, open savanna raptors such as Martial Eagle, Tawny Eagle and possibly Lappet-faced and White-backed Vulture occur here, and either nest or roost on power line support structures where they are available (e.g. Murn *et al.* 2007, Jenkins *et al.* 2013b), or in taller tress along drainage lines or plantations of alien trees. Large terrestrial species – Kori and Ludwig's Bustard are also present (Shaw *et al.* 2015), but the area is probably most significant for the presence of Sclater's Lark and possibly Red Lark (Dean *et al.* 1991, Jenkins *et al.* 2013a, Pretorius 2014, Jenkins & du Plessis 2018 b & c) – both threatened, endemic, restricted-range species that occur in this FA at relatively high densities. A short-list of 17 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 7). Suites of large savanna raptors and threatened, endemic passerines were the most influential species in the shaping the sensitivity maps for this FA.
Loeriesfontein Focus Area 8	This FA (13 188 km^2) straddles the Succulent and Nama Karoo Biomes, and includes sections of both the Trans-escarpment Succulent Karoo and Bushmanland Bioregions (Mucina & Rutherford 2006). Unmodified vegetation includes Hantam Karoo, Western Bushmanland Klipveld and Namaqualand Klipkoppe Shrubland in the south, grading into tracts of Bushmanland Arid Grassland in the north, with Bushmanland Basin Shrubland in the major drainage lines. The terrain is mostly open and flat, with some topographic relief in the south, towards Loeriesfontein. Nearly 150 species of birds have been recorded in this FA by SABAP2 (87/216 pentads covered, 217 full protocol atlas cards). At least 55 regionally or globally red-listed species could occur in the area, including four regional endemics or near-endemics (Ludwig's Bustard, Black Harrier, Red Lark and Sclater's Lark). The FA is located close to the Bitterputs IBA (SA036 – Marnewick *et al.* 2015). The avifauna of this FA is most notable for relatively high densities of the Red Lark - the northern, Bushmanland half of the FA probably holds a significant percentage of the world's population of the former endemic, range-restricted and globally Vulnerable species (Dean et al. 1991, Chris van Rooyen Consulting 2014, 2017a &b, R. Colyn pers comm.) - and Sclater's Lark. Otherwise Martial Eagles breed in power structures (e.g. Boshoff 1993, Jenkins *et al.* 2013b), larger trees along drainage lines or alien plantations, and the area experiences erratic influxes of Ludwig's Bustard (Shaw *et al.* 2015) A short-list of 15 threatened and/or impact susceptible priority species was identified to inform the sensitivity mapping for this FA (Table 8). Red Lark, Sclater's Lark, Martial Eagle and possibly Ludwig's Bustard were the most influential species in shaping the sensitivity mapping for this FA.

Table 1. List of priority species for the Emalahleni FA 1. Key species in the sensitivity mapping process.

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Black Stork	*Ciconia nigra*	Vulnerable	-	-	310	0.24	Low
Yellow-billed Stork	*Mycteria ibis*	Endangered	-	-	290	0.68	Moderate
Southern Bald Ibis	*Geronticus calvus*	Vulnerable	Vulnerable	Endemic	330	8.45	Moderate
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	-	-	290	3.77	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	290	1.71	Moderate
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	2.58	Low
Black-rumped Buttonquail	*Turnix nanus*	Vulnerable	-	-	170	0.08	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	2.40	Moderate
Cape Vulture	*Gyps coprotheres*	Near-threatened	Vulnerable	Near-endemic	385	0.26	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	-	-	360	2.45	Low
Tawny Eagle	*Aquila rapax*	Endangered	-	-	270	0.05	Moderate
Crowned Eagle	*Stephanoeatus coronatus*	Vulnerable	Near-threatened	-	270	0.18	Moderate
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	0.31	Moderate
African Hawk Eagle	*Aquila spilogaster*	-	-	-	180	1.18	Moderate
African Fish Eagle	*Haliaeetus vocifer*	-	-	-	290	0.00	Low
African Marsh-Harrier	*Circus ranivorus*	Endangered	-	-	300	1.29	Low
Pallid Harrier	*Circus macrourus*	Near-threatened	Near-threatened	-	260	0.79	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	0.00	Moderate
Peregrine Falcon	*Falco peregrinus*	-	-	-	290	0.71	Low
Lanner Falcon	*Falco biarmicus*	Vulnerable	-	-	280	2.42	Low
Amur Falcon	*Falco amurensis*	-	-	-	210	16.2	Moderate
Red-footed Falcon	*Falco vespertinus*	Near-threatened	Near-threatened	-	174	0.18	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	284	4.84	Moderate
Wattled Crane	*Bugeranus carunculatus*	Critically Endangered	Vulnerable	-	349	0.13	High
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	320	4.08	Moderate

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Grey Crowned Crane	*Balearica regulorum*	Endangered	Endangered	-	294	0.13	Low
Striped Flufftail	*Sarothrura affinis*	Vulnerable	-	-	-	0.00	Moderate
White-winged Flufftail	*Sarothrura ayresi*	Critically Endangered	Critically Endangered	-	250	0.00	Moderate
Denham's Bustard	*Neotis denhami*	Vulnerable	Near-threatened	-	300	1.37	Moderate
White-bellied Korhaan	*Eupodotis senegalensis*	Vulnerable	-	-	270	4.74	Moderate
Blue Korhaan	*Eupodotis caerulescens*	-	Near-threatened	Endemic	270	0.00	Moderate
Burchell's Courser	*Cursorius rufus*	Vulnerable	-	-	-	10.22	Moderate
Caspian Tern	*Sterna caspia*	Vulnerable	-	-	220	0.21	Low
African Grass-Owl	*Tyto capensis*	Vulnerable	-	-	289	0.00	Low
Cape Eagle Owl	*Bubo capensis*	-	-	-	250	0.00	Low
Rudd's Lark	*Heteromirafra ruddi*	Endangered	Endangered	Endemic	240	0.00	High
Yellow-breasted Pipit	*Anthus chloris*	Vulnerable	Vulnerable	Endemic	245	0.00	High

Table 2. List of priority species for the Potchefstroom FA 2. Key species in the sensitivity mapping process.

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Black Stork	*Ciconia nigra*	Vulnerable	-	-	310	0.08	Low
Yellow-billed Stork	*Mycteria ibis*	Endangered	-	-	290	2.97	Moderate
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	-	-	290	3.77	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	290	2.52	Moderate
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	0.97	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	0.63	Moderate
White-backed Vulture	*Gyps africanus*	Critically Endangered	Critically Endangered	-	280	0.14	Moderate

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	270	0.00	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	-	-	360	0.14	Low
Tawny Eagle	*Aquila rapax*	Endangered	-	-	270	0.00	Moderate
African Hawk Eagle	*Aquila spilogaster*	-	-	-	180	0.14	Moderate
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	0.11	Moderate
African Fish Eagle	*Haliaeetus vocifer*	-	-	-	290	9.24	Low
African Marsh Harrier	*Circus ranivorus*	Endangered	-	-	300	0.67	Low
Pallid Harrier	*Circus macrourus*	Near-threatened	Near-threatened	-	260	0.25	Low
Lanner Falcon	*Falco biarmicus*	Vulnerable	-	-	280	2.14	Low
Amur Falcon	*Falco amurensis*	-	-	-	210	9.76	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	284	6.16	Moderate
Blue Korhaan	*Eupodotis caerulescens*	-	Near-threatened	Endemic	270	0.08	Moderate
Black-winged Pratincole	*Glareola nordmanni*	Near-threatened	Near-threatened	-	242	0.80	Moderate
Caspian Tern	*Sterna caspia*	Vulnerable	-	-	220	1.14	Low
African Grass-Owl	*Tyto capensis*	Vulnerable	-	-	289	0.00	Low

Table 3. List of priority species for the Postmasburg FA 3. Key species in the sensitivity mapping process.

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Black Stork	*Ciconia nigra*	Vulnerable	-	-	310	0.30	Low
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	-	-	290	0.45	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	290	1.96	Moderate
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	1.96	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	1.05	Moderate
White-backed Vulture	*Gyps africanus*	Critically	Critically	-	280	1.66	Moderate

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
		Endangered	Endangered				
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	270	0.90	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	-	-	360	1.66	Low
Tawny Eagle	*Aquila rapax*	Endangered	-	-	270	0.45	Moderate
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	1.05	Moderate
Bateleur	*Terathopius ecaudatus*	Endangered	Near-threatened	-	260	0.00	Moderate
Black-chested Snake Eagle	*Circaetus pectoralis*	-	-	-	230	3.46	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	-	-	280	1.96	Low
Lesser Kestrel	*Falco naumanni*	-	-	-	284	3.77	Moderate
Red-footed Falcon	*Falco vespertinus*	Near-threatened	Near-threatened	-	174	0.00	Low
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	320	0.75	Moderate
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	280	2.11	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	2.26	Moderate

Table 4. List of priority species for the Welkom FA 4. Key species in the sensitivity mapping process

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Black Stork	*Ciconia nigra*	Vulnerable	-	-	310	0.95	Low
Yellow-billed Stork	*Mycteria ibis*	Endangered	-	-	290	6.31	Moderate
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	-	-	290	31.86	Moderate
Lesser Flamingo	*Phoenicomaias minor*	Near-threatened	Near-threatened	-	290	25.87	Moderate
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	20.50	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	4.10	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	-	-	360	0.00	Low
Tawny Eagle	*Aquila rapax*	Endangered	-	-	270	0.32	Moderate

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Solar PV
		Regional	Global				
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	0.00	Moderate
African Fish Eagle	*Haliaeetus vocifer*	-	-	-	290	11.99	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	0.32	Moderate
African Marsh-Harrier	*Circus ranivorus*	Endangered	-	-	300	0.00	Low
Lanner Falcon	*Falco biarmicus*	Vulnerable	-	-	280	1.89	Low
Amur Falcon	*Falco amurensis*	-	-	-	210	20.12	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	284	17.98	Moderate
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	320	0.32	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	0.32	Moderate
Blue Korhaan	*Eupodotis caerulescens*	-	Near-threatened	Endemic	270	15.77	Moderate
Chestnut-banded Plover	*Charadrius pallidus*	Near-threatened	Near-threatened	-	230	2.52	Low
Black-winged Pratincole	*Glareola nordmanni*	Near-threatened	Near-threatened	-	242	2.21	Moderate
African Grass Owl	*Tyto capensis*	Vulnerable	-	-	289	0.32	Low

Table 5. List of priority species for the Murraysburg FA 5. Key species in the sensitivity mapping process

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Wind
		Regional	Global				
Black Stork	*Ciconia nigra*	Vulnerable	_	-	310	2.09	High
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	-	-	290	2.32	High
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	1.69	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	7.52	Very high
Booted Eagle	*Hieraaetus pennatus*	-	-	-	230	9.77	Very high
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	_	-	360	19.30	Very high
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	2.88	Very high
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	1.85	Very high

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to Wind
		Regional	Global				
Peregrine Falcon	*Falco peregrinus*	-	-	-	290	0.35	High
Lanner Falcon	*Falco biarmicus*	Vulnerable	_	-	280	4.37	High
Amur Falcon	*Falco amurensis*	-	-	-	210	1.02	High
Lesser Kestrel	*Falco naumanni*	-	-	-	284	2.41	Very high
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	320	26.23	High
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	280	5.87	High
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	18.98	High
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	_	Near-endemic	190	47.11	High
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	200	4.57	Moderate
Cape Eagle Owl	*Bubo capensis*	-	-	-	250	3.82	High
African Rock Pipit	*Anthus crenatus*	Near-threatened	_	Endemic	-	15.04	Moderate

Table 6. List of priority species for the Vredendal FA 6. Key species in the sensitivity mapping process

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar PV
Great White Pelican	*Pelecanus onocrotalus*	Vulnerable	_	-	310	0.09	Very high	Low
Black Stork	*Ciconia nigra*	Vulnerable	_	-	310	0.17	High	Low
Greater Flamingo	*Phoenicopterus roseus*	Near-threatened	_	-	290	1.20	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	290	0.43	High	Moderate
Maccoa Duck	*Oxyura maccoa*	Near-threatened	Vulnerable	-	-	1.20	Moderate	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	1.20	Very high	Moderate
Booted Eagle	*Hieraaetus pennatus*	-	-	-	230	3.69	High	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	_	-	360	5.24	Very high	Low

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar PV
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	1.12	Very high	Moderate
African Fish Eagle	*Haliaeetus vocifer*	-	-	-	290	2.49	High	Low
African Marsh-Harrier	*Circus ranivorus*	Endangered	_	-	300	0.34	High	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	3.95	Very high	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	_	-	280	1.63	High	Low
Peregrine Falcon	*Falco peregrinus*	-	-	-	290	1.20	High	Low
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	14.00	High	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	_	Near-endemic	190	5.93	Moderate	Moderate
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	200	16.49	High	Moderate
Chestnut-banded Plover	*Charadrius pallidus*	_	Near-threatened	Endemic	230	0.00	Moderate	Moderate
Curlew Sandpiper	*Calidris ferruginea*	-	Near-threatened	-	-	0.43	Moderate	Low
Caspian Tern	*Sterna caspia*	Vulnerable	-	-	220	0.86	Moderate	Low
Damara Tern	*Sterna balaenarum*	Critically Endangered	Vulnerable	-	264	0.00	Moderate	Low
Cape Eagle Owl	*Bubo capensis*	-	-	-	250	0.00	Moderate	Low

Table 7. List of priority species for the Prieska FA 7. Key species in the sensitivity mapping process

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar PV
Black Stork	*Ciconia nigra*	Vulnerable	_	-	310	0.30	High	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	2.65	Very high	Moderate
White-backed Vulture	*Gyps africanus*	Critically Endangered	Critically Endangered	-	280	2.95	Very high	Moderate
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	270	2.65	Very high	Moderate

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar PV
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	_	-	360	5.31	Very high	Low
Tawny Eagle	*Aquila rapax*	Endangered	_	-	270	0.30	Very high	Moderate
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	2.94	Very high	Moderate
Black-chested Snake Eagle	*Circaetus pectoralis*	-	-	-	230	5.60	Very high	Moderate
African Fish Eagle	*Haliaeetus vocifer*	-	-	-	290	7.96	High	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	0.89	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	_	-	280	2.36	High	Low
Peregrine Falcon	*Falco peregrinus*	-	-	-	290	1.20	High	Low
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	280	13.86	High	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	24.48	High	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	_	Near-endemic	190	45.72	High	Moderate
Red Lark	*Calendulauda burra*	Vulnerable	Vulnerable	Endemic	260	0.30	High	High
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Near-threatened	Near-endemic	240	4.42	Low	High

Table 8. List of priority species for the Loeriesfontein FA 8. Key species in the sensitivity mapping process

Common Name	Scientific Name	Threat status		Endemism	National sensitivity rating	SABAP2 reporting rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar PV
Black Stork	*Ciconia nigra*	Vulnerable	_	-	310	0.46	High	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	320	0.92	Very high	Moderate
Booted Eagle	*Hieraaetus pennatus*	-	-	-	230	2.30	High	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	Vulnerable	_	-	360	0.92	Very high	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	330	10.60	Very high	Moderate
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	325	0.46	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	_	-	280	6.45	High	Low

Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	280	0.92	High	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	320	44.70	High	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	_	Near-endemic	190	80.18	Moderate	Moderate
Chestnut-banded Plover	*Charadrius pallidus*	_	Near-threatened	Endemic	230	0.00	Moderate	Moderate
Burchell's Courser	*Cursorius rufus*	Vulnerable	-	-	-	11.06	Moderate	
Cape Eagle Owl	*Bubo capensis*	-	-	-	250	0.00	Moderate	Low
Red Lark	*Calendulauda burra*	Vulnerable	Vulnerable	Endemic	260	47.92	High	High
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Near-threatened	Near-endemic	240	22.11	Low	High

4. ABSOLUTE SENSITIVITY MAPPING

4.1 Identification of absolute sensitivity criteria

The criteria listed here are inclusive of the sensitivity features submitted by the CSIR as requisite for the project brief, and are largely inclusive of the features contributing to the SANBI wall-to-wall environmental sensitivities map. The sensitivities and buffers applied to each feature are at least consistent with the original SANBI and CSIR buffers, with additional sensitivities and new or more extensive buffers applied in some cases to provide better protection for sensitive species, as informed by the availability of new research or species-specific guidelines.

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Relevant to all Focus Areas	Solar	All wetlands with a surface area >20 000 m²	Improved wetlands layer from SEA project freshwater specialist team: WSSEA Wetlands, 2014	Medium: 1 km from edge
		All protected areas	SAPAD layer, 2014	Very High: 1 km from edge
		From DEM slopes >50°, that probably constitute sheer cliffs that may be used by cliff-nesting/slope soaring birds	The Shuttle Radar Topography Mission (SRTM) 30m Digital Elevation Model	High: 0 km
		Power lines >132 kV possibly used by nesting or roosting raptors, storks and ibises	Eskom Networks layer, 2014	Medium: 2 km
		SABAP2 pentads with High (>5 spp.) richness of priority species	SABAP2, FitzPatrick Institute, UCT	High: 0 km
		SABAP2 pentads with Medium (1-5 spp.) richness of priority bird species	SABAP2, FitzPatrick Institute, UCT	Medium: 0 km
		Threatened Ecosystem fragments	SIPs Remaining Threatened Ecosystems layer, 2013 – Critically Endangered and Endangered habitats	High: 0 km
		Threatened Ecosystem fragments	SIPs Remaining Threatened Ecosystems layer, 2013 – Vulnerable habitats	Medium: 0 km
	Wind	All wetlands with a surface area >20 000 m²	Improved wetlands layer from SEA project	Medium:2 km from edge

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
			freshwater specialist team: WSSEA Wetlands, 2014	
		All protected areas	SAPAD layer, 2014	Very High: 2 km from edge
		From DEM slopes >50°, that probably constitute sheer cliffs that may be used by cliff-nesting/slope soaring birds	The Shuttle Radar Topography Mission (SRTM) 30m Digital Elevation Model	High: 3 km
		Power lines >132 kV possibly used by nesting or roosting raptors, storks and ibises	Eskom Networks layer, 2014	Medium: 5 km
		SABAP2 pentads with High (>5 spp.) richness of priority species	SABAP2, FitzPatrick Institute, UCT	High: 0 km
		SABAP2 pentads with Medium (1-5 spp.) richness of priority bird species	SABAP2, FitzPatrick Institute, UCT	Medium: 0 km
		Threatened Ecosystem fragments	SIPs Remaining Threatened Ecosystems layer, 2013 – Critically Endangered and Endangered habitats	High: 0 km
		Threatened Ecosystem fragments	SIPs Remaining Threatened Ecosystems layer, 2013 – Vulnerable	Medium: 0 km
Emalahleni Focus Area 1	Solar	Large river systems (especially including Olifants River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		Important Bird and Biodiversity Areas (Marnewick *et al.* 2015) – Loskop Dam Nature Reserve and Steenkampsberg	BLSA	Very High: 1 km from edge
		CWAC sites: Loskop Dam (IBA, high diversity and abundance of waterbirds), Kanhym Pan 3 (Lesser Flamingo numbers), Blinkpan (Arnot) and Grootpan (Greater Flamingo numbers)	CWAC data base, FitzPatrick Institute, UCT	Very High: 1 km from edge
		Modelled White-winged Flufftail distribution	Robin Colyn, BLSA	Very High: 0 km
		Modelled Rudd's Lark distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Rudd's Lark distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Modelled Yellow-breasted Pipit distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Yellow-breasted Pipit distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
		Known African Grass Owl nest sites	EWT Knowledge Management Database	Very High: 1 km
		Known Southern Bald Ibis colony sites	BLSA	Very High: 1 km
		Known Amur Falcon and/or Lesser Kestrel roost sites	Rina Pretorius, convener of the Migrating Kestrel Project	Very High: 1 km
		Known Wattled Crane nest sites	EWT Knowledge Management Database	Very High: 2 km
		Known Blue Crane nest sites	EWT Knowledge Management Database	Very High: 500 m
Potchefstroom Focus Area 2	Solar	Large river systems (especially including Vaal River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		CWAC sites: Klipplaatfontein Farm Dams (Caspian Tern numbers), Witpan (Maccoa Duck numbers)	CWAC data base, FitzPatrick Institute, UCT	Very High: 1 km from edge
		Known Amur Falcon and/or Lesser Kestrel roost sites:	Rina Pretorius, convener of the Migrating Kestrel Project	Very High: 1 km
		Active or previously active vulture restaurants	EWT Knowledge Management Database, Kerri Wolter, Vulpro	Very High: 3 km
Postmasburg Focus Area 3	Solar	Large river systems	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		CWAC sites: Great Pan and Rooipan (no access to count data but potential to support large numbers of Lesser and Greater Flamingos)	CWAC data base, FitzPatrick Institute, UCT	Very High: 1 km from edge
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
Welkom Focus Area 4	Solar	Large river systems (especially including Vaal River)	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		CWAC sites: Flamingo Pan (Maccoa Duck and Lesser Flamingo numbers), Hartebeesdraai Farm Dam (Maccoa Duck numbers), St Helena Mine Dams (Lesser Flamingo numbers), Toronto Pan (Maccoa Duck numbers)	CWAC data base, FitzPatrick Institute, UCT	Very High: 1 km from edge
Murraysburg Focus Area 5	Wind	Large river systems	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 1 km from edge of full river
		Known Black Harrier nest sites	BLSA (originally sourced from UCT's "Black Harriers – Ecology and Fitness" project	Very High: 3 km
		Modelled Black Harrier nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Black Harrier nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, J. Smallie unpublished data, C. Van Rooyen & A. Froneman unpublished data, A. Pearson unpublished data, ARJ unpublished data, Jenkins 2011c, Jenkins 2012, Jenkins & du Plessis 2014, 2015b, 2016, Jenkins et al. 2013b	Very High: 3 km High: 6 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively medium probability of occurrence	Robin Colyn, BLSA	High: 0 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Martial Eagle nest sites	EWT Knowledge Management Database, J. Smallie unpublished data, C. Van Rooyen & A. Froneman unpublished data, A. Pearson unpublished data, ARJ unpublished data, Jenkins 2011c, Jenkins 2012, Jenkins & du Plessis 2014, 2015b, 2016, Jenkins et al. 2013b	Very High: 5 km High: 10 km
		Known Booted Eagle nest sites	Various sources: ARJ unpublished data, Jenkins 2011c, Jenkins 2012, Jenkins & du Plessis 2014, 2015b, 2016	Very High: 1 km High: 2 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2011c, Jenkins 2012, Jenkins & du Plessis 2014, 2015b, 2016	Very High: 1 km High: 2 km
		Known Peregrine Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2011c, Jenkins 2012, Jenkins & du Plessis 2014, 2015b, 2016	Very High: 1 km High: 2 km
		Known Black Stork nest sites	Jenkins & du Plessis 2016	Very High: 5 km High: 10 km
Vredendal Focus Area 6	Solar	Large river systems (especially including Olifants River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		CWAC sites: Litaue Dam (high diversity and abundance of waterbirds), Olifants River Mouth – South Bank (IBA)	CWAC data base, FitzPatrick Institute, UCT	Very High: 1 km from edge
		Known Black Harrier nest sites	BLSA (originally sourced from UCT's "Black Harriers – Ecology and Fitness" project	Very High: 1 km
		Modelled Black Harrier nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Black Harrier nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, Jenkins 2010a & b, 2011 a & b, Jenkins *et al.* 2013b	Very High: 1 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, Jenkins 2010a & b, 2011 a & b, Jenkins *et al.* 2013b	Very High: 2 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2010a & b, 2011 a & b	Very High: 1 km
		Known Peregrine Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2010a & b, 2011 a & b	Very High: 1 km
Vredendal Focus Area 6	Wind	Large river systems (especially including Olifants River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 1 km from edge of full river
		CWAC sites: Litaue Dam (high diversity and abundance of waterbirds), Olifants River Mouth – South Bank (IBA)	CWAC data base, FitzPatrick Institute, UCT	Very High: 2 km from edge
		Known Black Harrier nest sites	BLSA (originally sourced from UCT's "Black Harriers – Ecology and Fitness" project	Very High: 3 km
		Modelled Black Harrier nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Black Harrier nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, Jenkins 2010a & b, 2011 a & b, Jenkins *et al.* 2013b	Very High: 3 km High: 6 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, Jenkins 2010a & b, 2011 a & b, Jenkins *et al.* 2013b	Very High: 5 km High: 10 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2010a & b, 2011 a & b	Very High: 1 km High: 2 km
		Known Peregrine Falcon nest sites	Various sources: ARJ unpublished data, Jenkins 2010a & b, 2011 a & b	Very High: 1 km High: 2 km
Prieska Focus Area 7	Solar	Large river systems (especially including Orange River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, J. Smallie unpublished data, A. Pearson unpublished data, Jenkins *et al.* 2013a & b, Jenkins & du Plessis 2018b & c	Very High: 1 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
		Known Tawny Eagle nest sites	Various sources: EWT Knowledge Management	Very High: 1 km

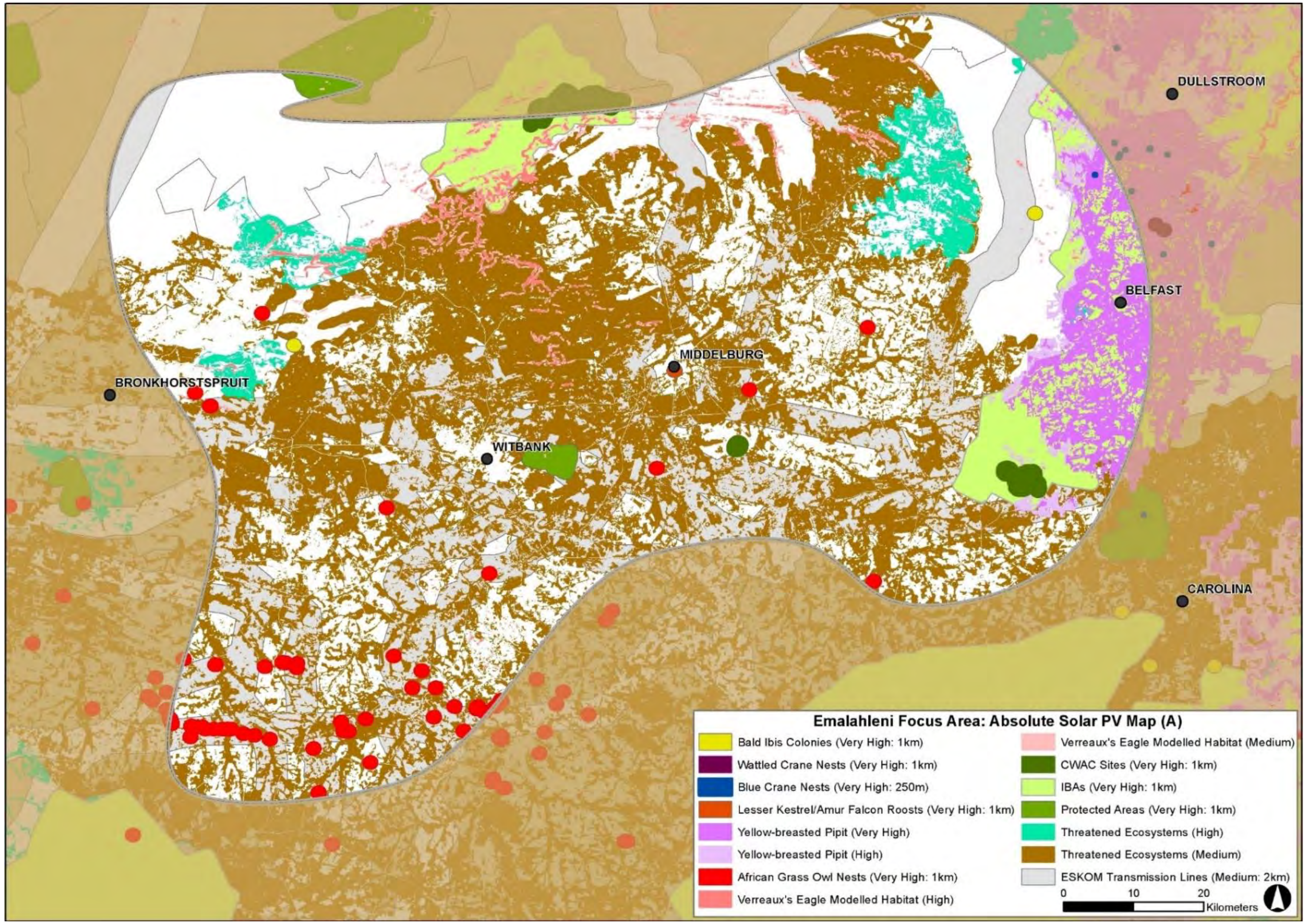
Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
			Database, ARJ unpublished data, Jenkins *et al.* 2013b,	
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, Jenkins *et al.* 2013a & b, Jenkins & du Plessis 2018b & c	Very High: 2 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data, Jenkins & du Plessis 2018b & c	Very High: 1 km
		Known Lappet-faced Vulture and/or White-backed Vulture roosts	C. Van Rooyen & A. Froneman unpublished data	Very High: 3 km
Prieska Focus Area 7	Wind	Large river systems (especially including Orange River)	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 1 km from edge of full river
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, J. Smallie unpublished data, A. Pearson unpublished data, Jenkins *et al.* 2013a & b, Jenkins & du Plessis 2018b & c	Very High: 3 km Medium: 6 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Tawny Eagle nest sites	Various sources: EWT Knowledge Management Database, ARJ unpublished data, Jenkins *et al.* 2013b,	Very High: 2 km High: 4 km
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, Jenkins *et al.* 2013a & b, Jenkins & du Plessis 2018b & c	Very High: 5 km High: 10 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data, Jenkins & du Plessis 2018b & c	Very High: 1 km High: 2 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Lappet-faced Vulture and/or White-backed Vulture roosts	C. Van Rooyen & A. Froneman unpublished data	Very High: 5 km
Loeriesfontein Focus Area 8	Solar	Large river systems	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 500 m from edge of full river
		Modelled Red Lark distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Red Lark distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Black Harrier nest sites	BLSA (originally sourced from UCT's "Black Harriers – Ecology and Fitness" project	Very High: 1 km
		Modelled Black Harrier nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Black Harrier nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, Jenkins *et al.* 2013b	Very High: 1 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, J. Smallie unpublished data, Jenkins *et al.* 2013b	Very High: 2 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data	Very High: 1 km
Loeriesfontein Focus Area 8	Wind	Large river systems	NFEPA Rivers layer, 2011 (Classes 1-3)	Very High: 1 km from edge of full river
		Modelled Red Lark distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km

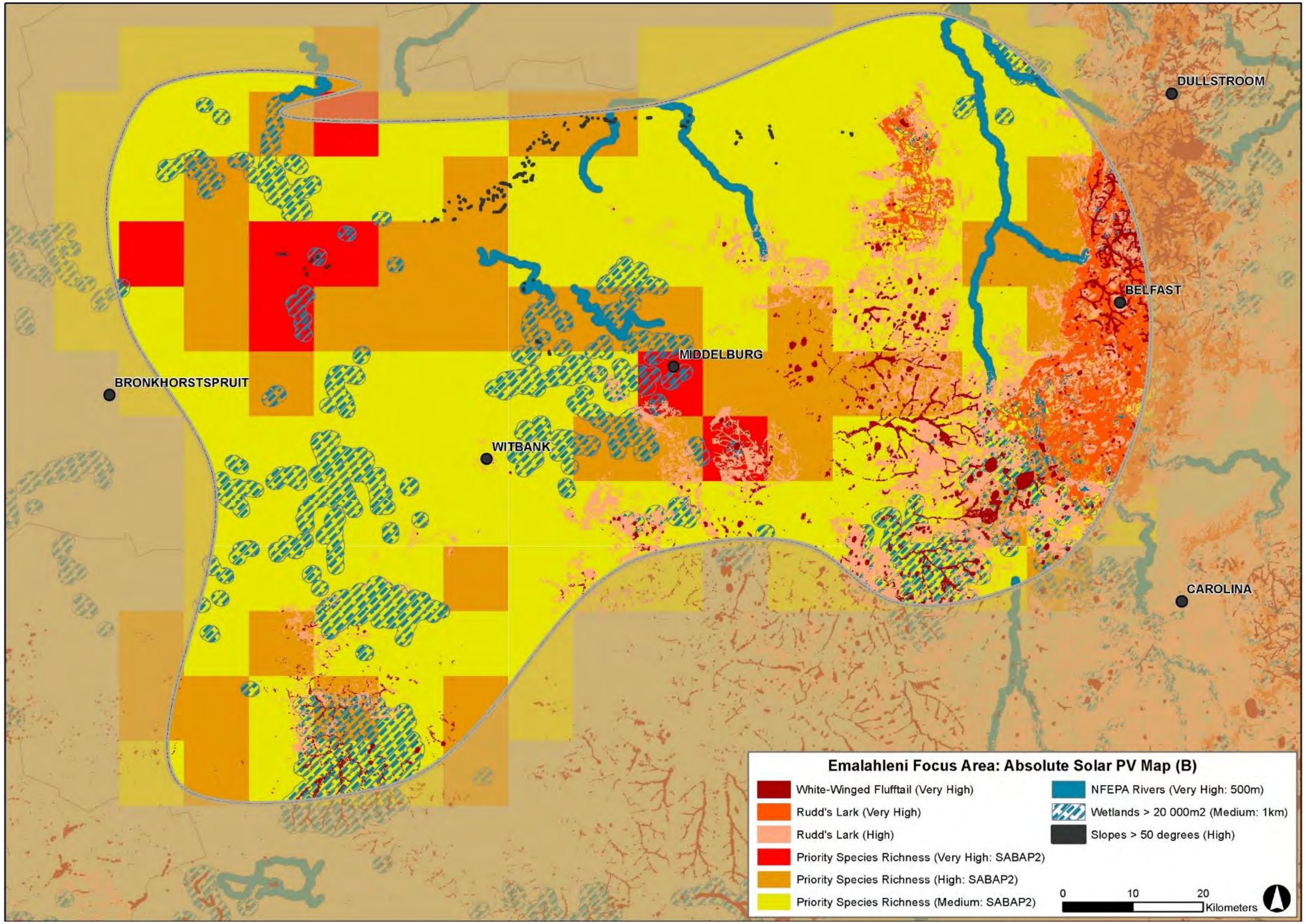
Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Modelled Red Lark distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Black Harrier nest sites	BLSA (originally sourced from UCT's "Black Harriers – Ecology and Fitness" project	Very High: 3 km
		Modelled Black Harrier nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Black Harrier nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Verreaux's Eagle nest sites	Various sources: EWT Knowledge Management Database, L. Rodrigues unpublished data, ARJ unpublished data, Jenkins *et al.* 2013b	Very High: 3 km High: 6 km
		Modelled Verreaux's Eagle nesting distribution: areas of relatively high probability of occurrence	Robin Colyn, BLSA	Very High: 0 km
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	High: 0 km
		Known Martial Eagle nest sites	Various sources: EWT Knowledge Management Database, ARJ unpublished data, C. Van Rooyen & A. Froneman unpublished data, J. Smallie unpublished data, Jenkins *et al.* 2013b	Very High: 5 km High: 10 km
		Known Lanner Falcon nest sites	Various sources: ARJ unpublished data	Very High: 1 km High: 2 km

4.2 Absolute sensitivity maps

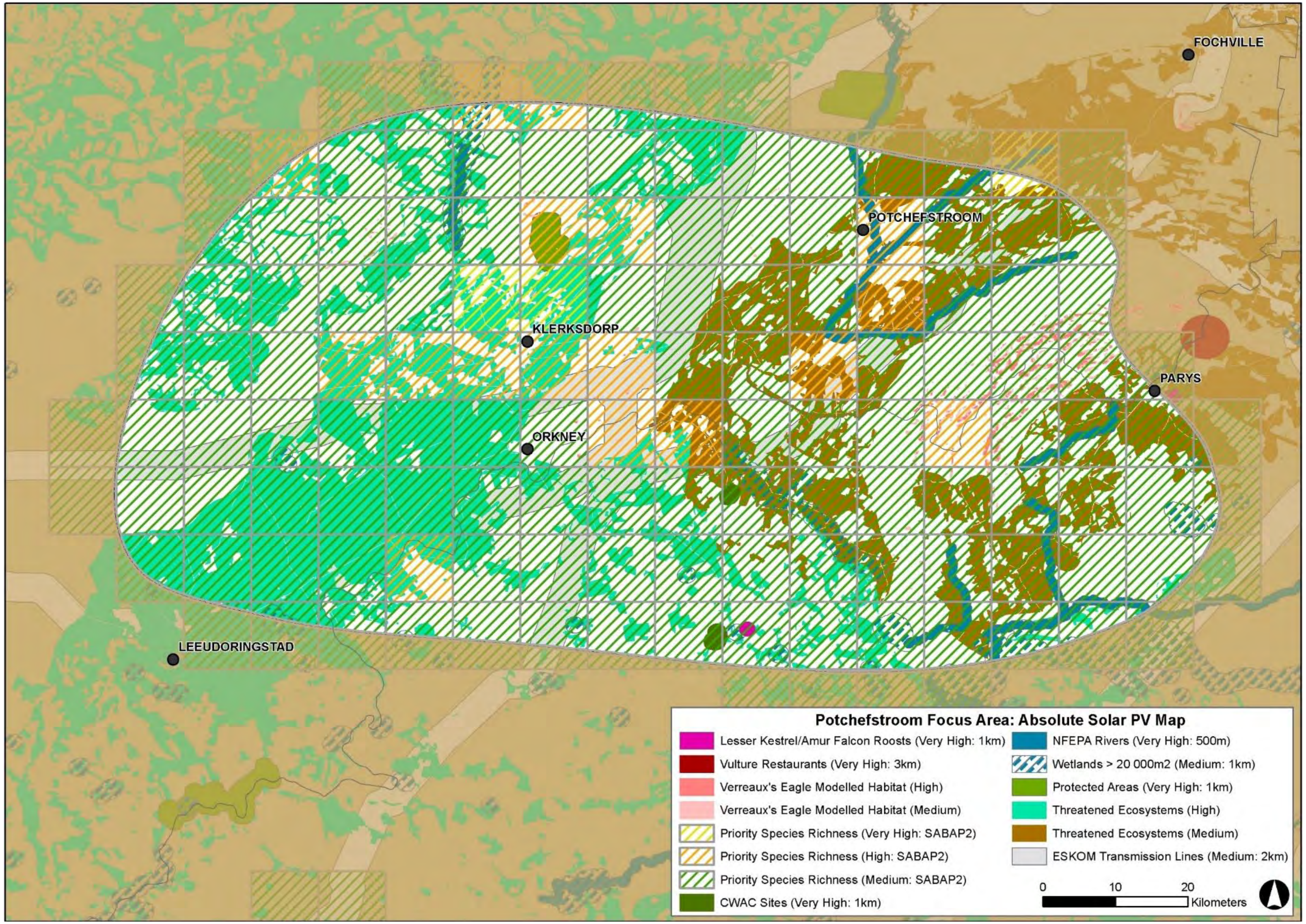
4.2.1 Emalahleni Focus Area 1 – Solar PV (a)



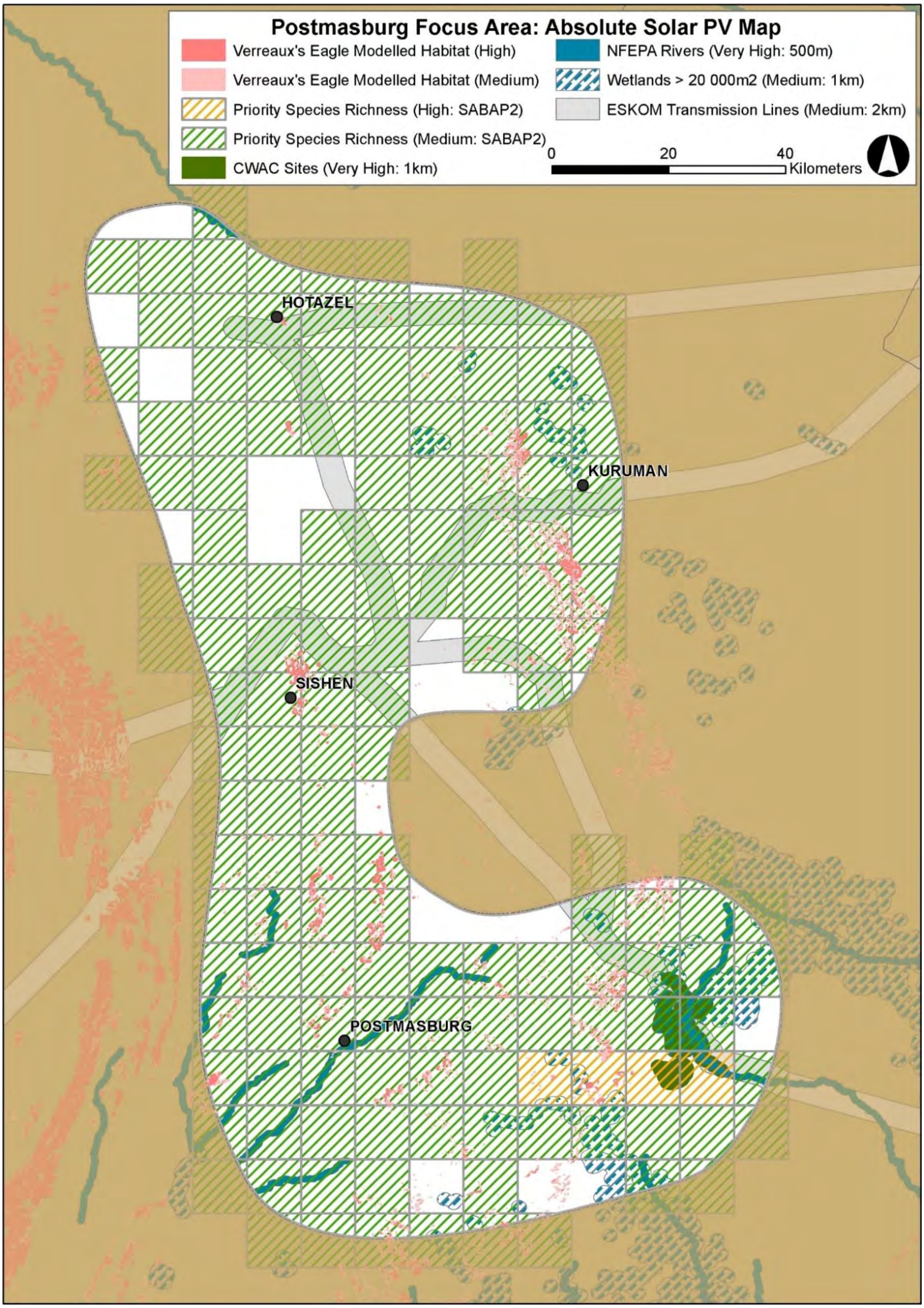
4.2.2 Emalahleni Focus Area 1 – Solar PV (b)


DULLSTROOM
BELFAST
MIDDELBURG
BRONKHORSTSPRUIT
WITBANK
CAROLINA
Emalahleni Focus Area: Absolute Solar PV Map (B)
White-Winged Flufftail (Very High)
Rudd's Lark (Very High)
Rudd's Lark (High)
Priority Species Richness (Very High: SABAP2)
Priority Species Richness (High: SABAP2)
Priority Species Richness (Medium: SABAP2)
NFEPA Rivers (Very High: 500m)
Wetlands > 20 000m2 (Medium: 1km)
Slopes > 50 degrees (High)
0
10
20
Kilometers

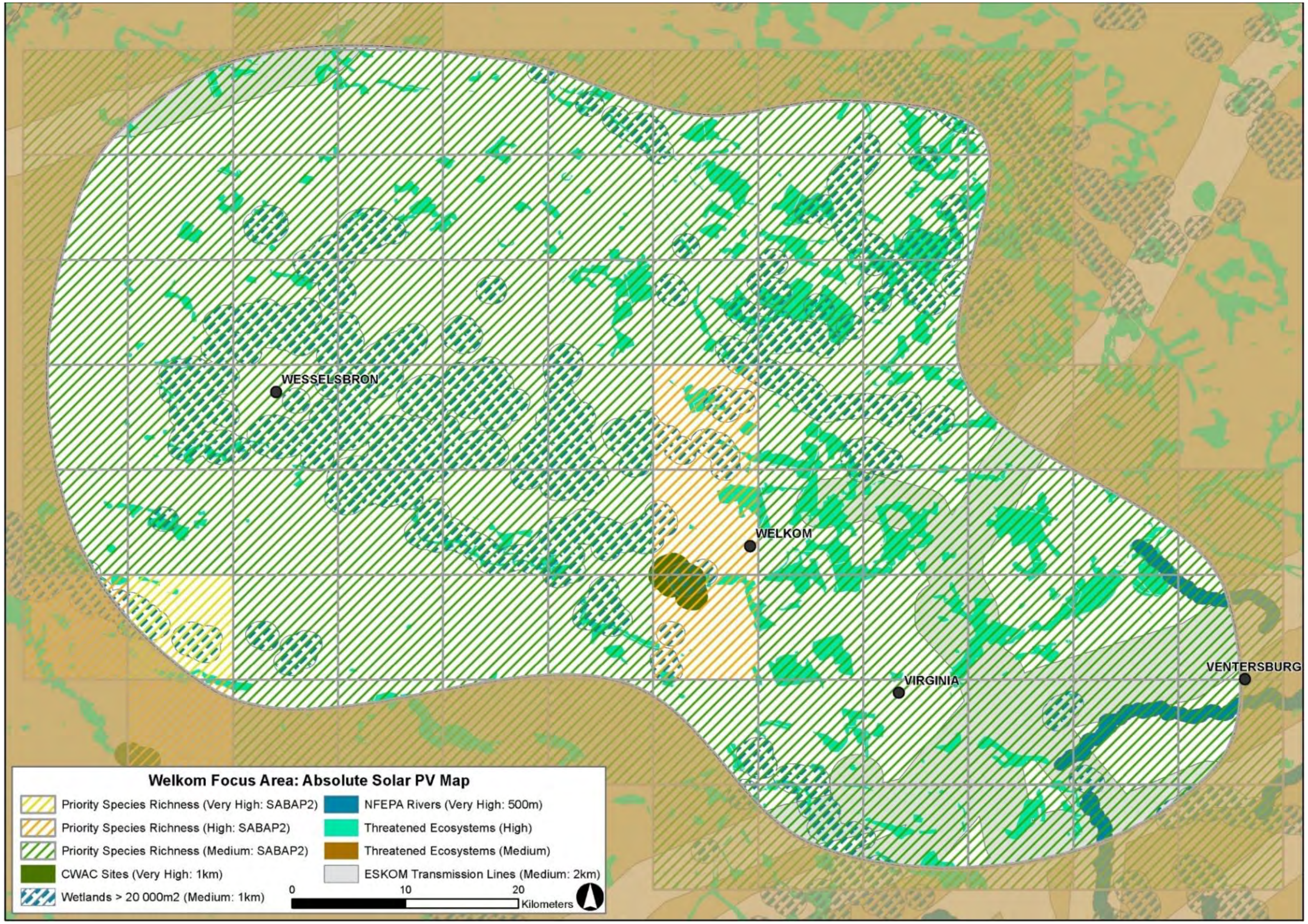
4.2.3 Potchefstroom Focus Area 2 – Solar PV



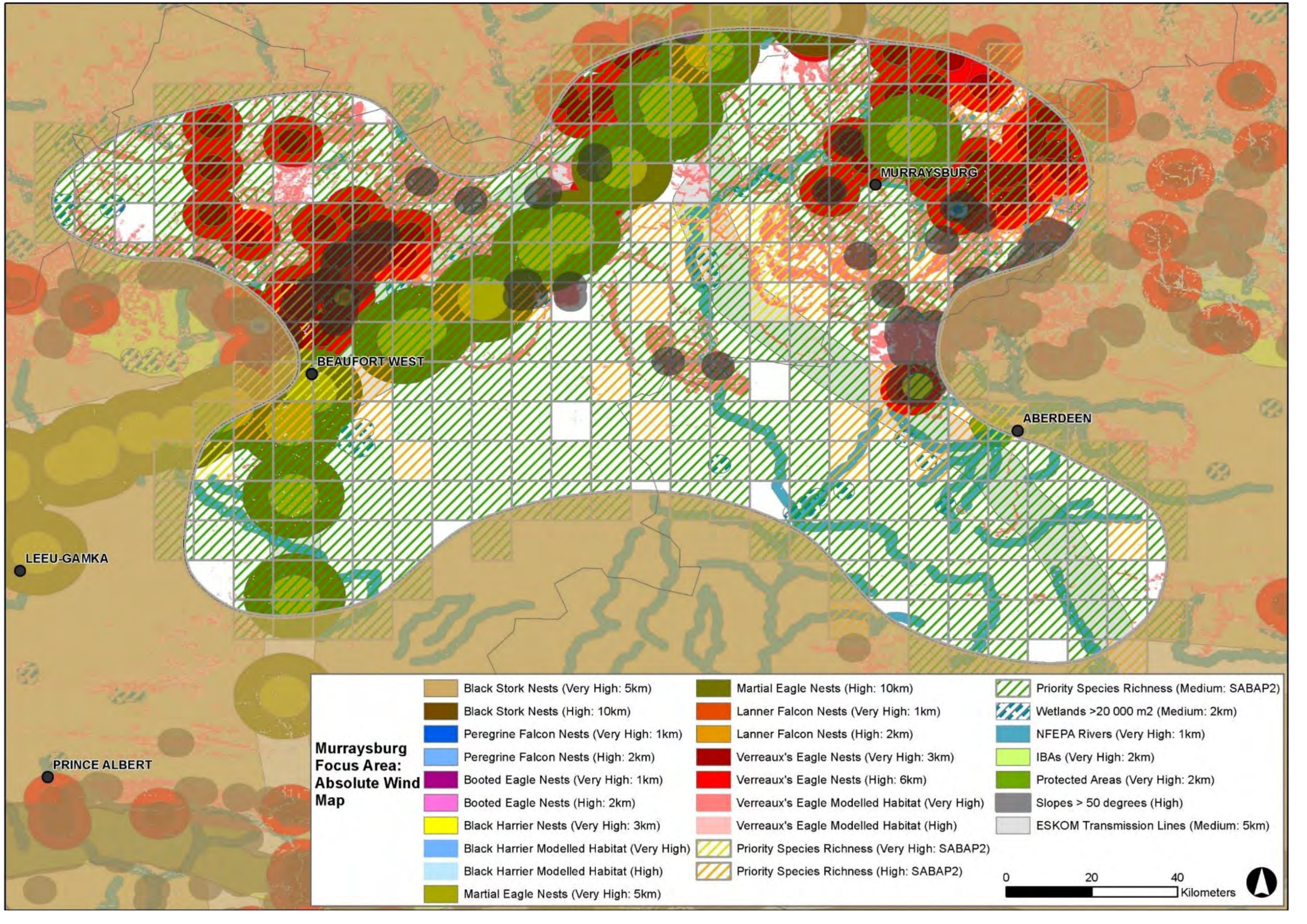
4.2.4 Postmasburg Focus Area 3 – Solar PV



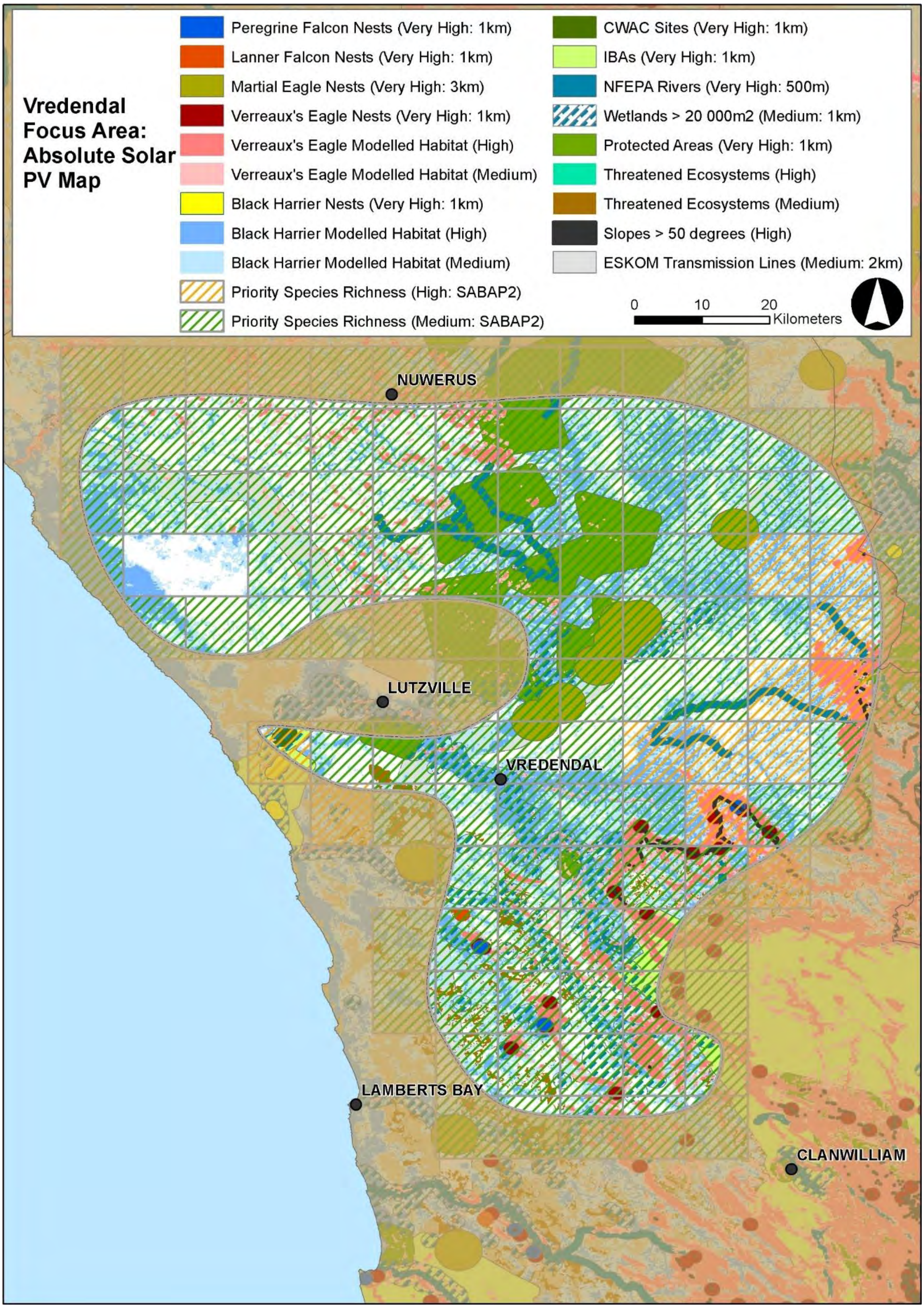
4.2.5 Welkom Focus Area 4 – Solar PV



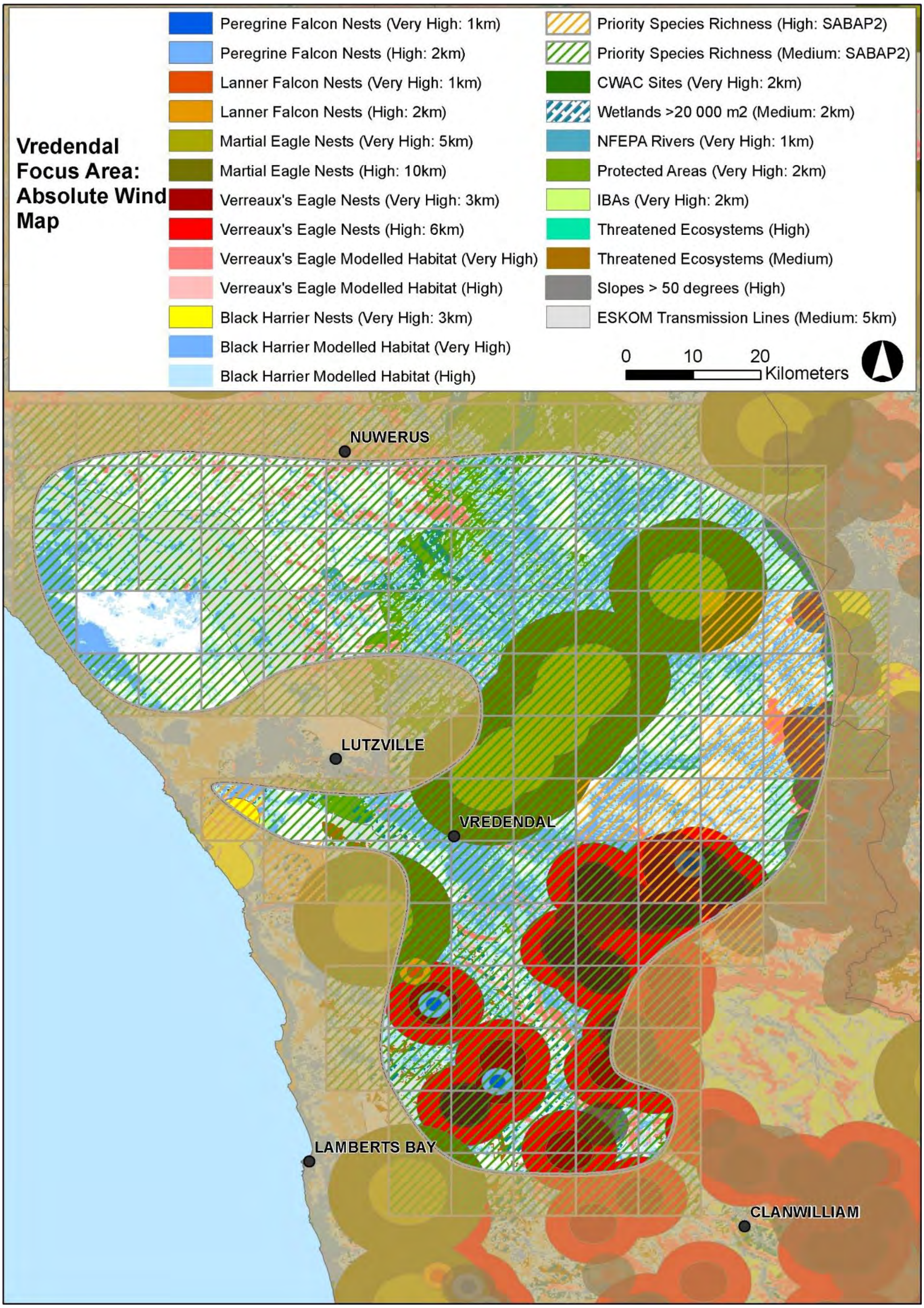
4.2.6 Murraysburg Focus Area 5 – Wind



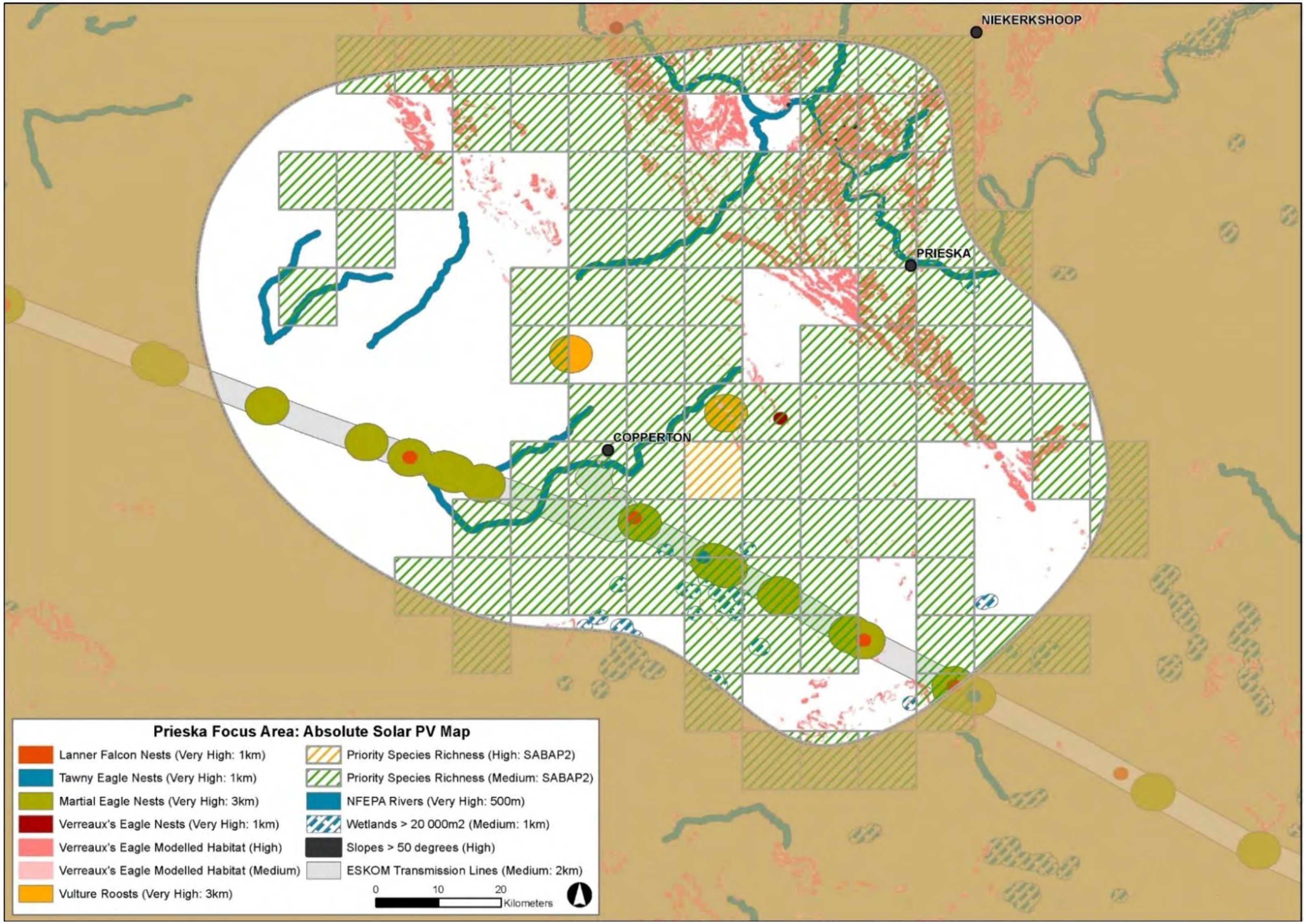
4.2.7 Vredendal Focus Area 6 – Solar PV



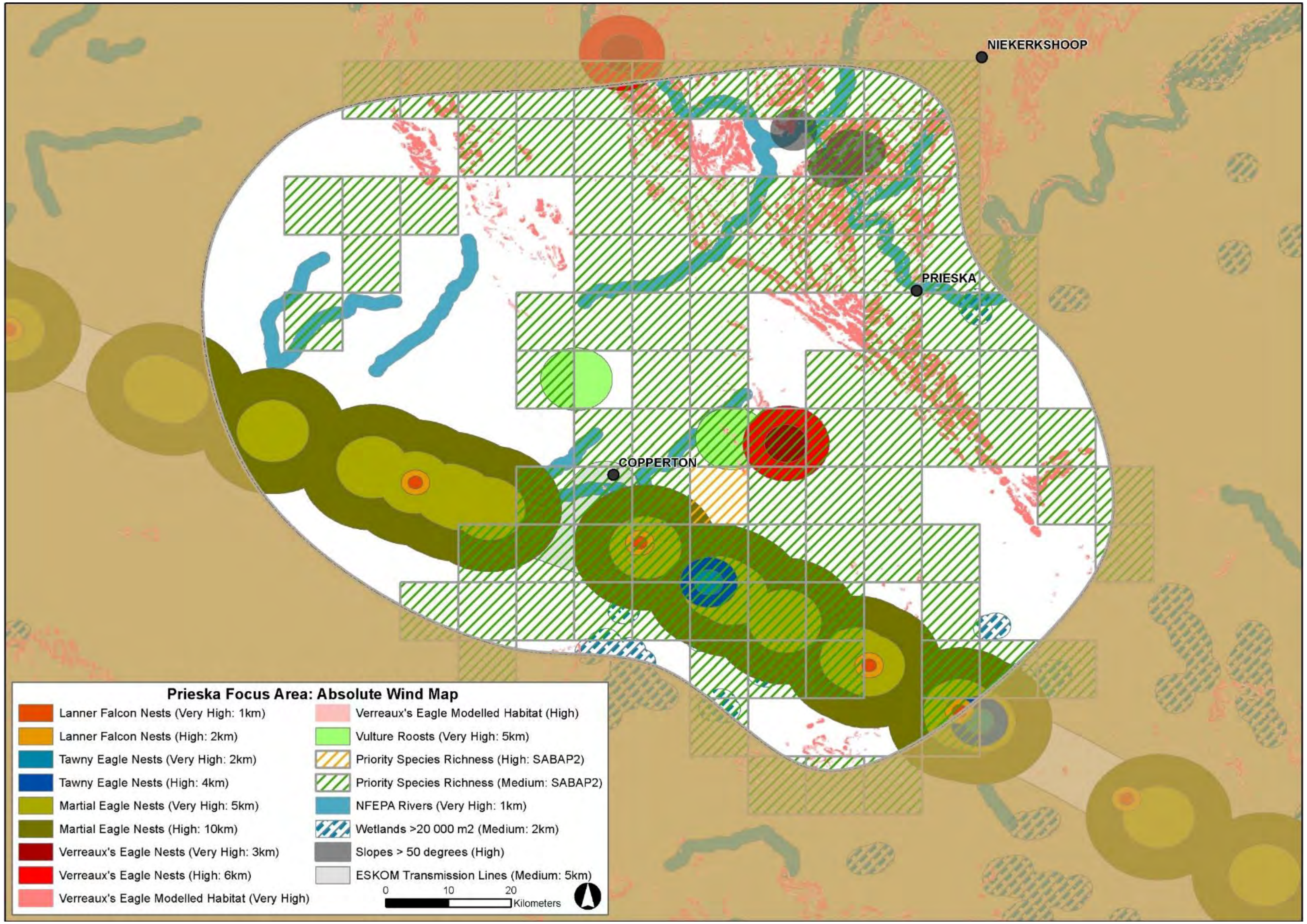
4.2.8 Vredendal Focus Area 6 – Wind



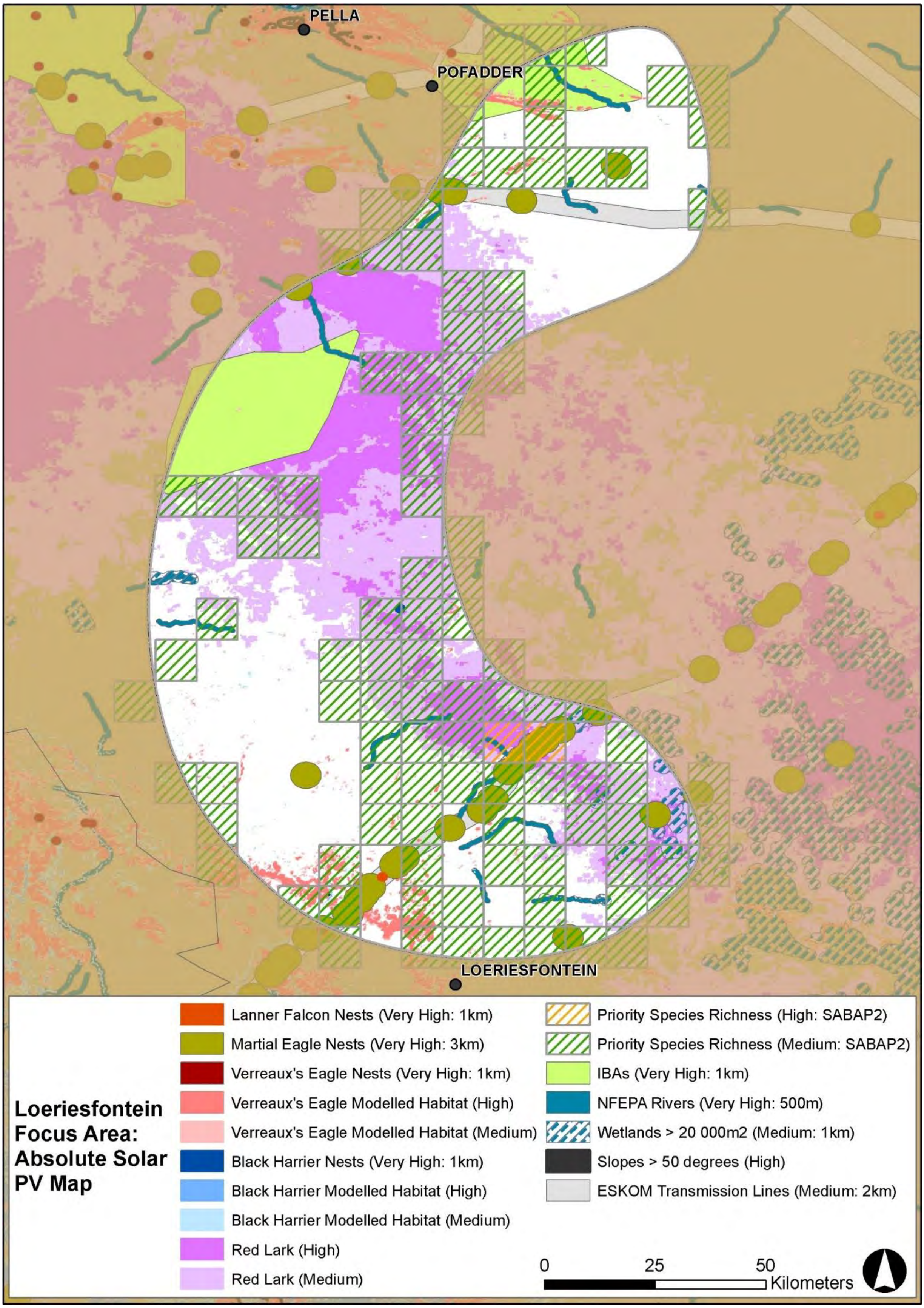
4.2.9 Prieska Focus Area 7 – Solar PV



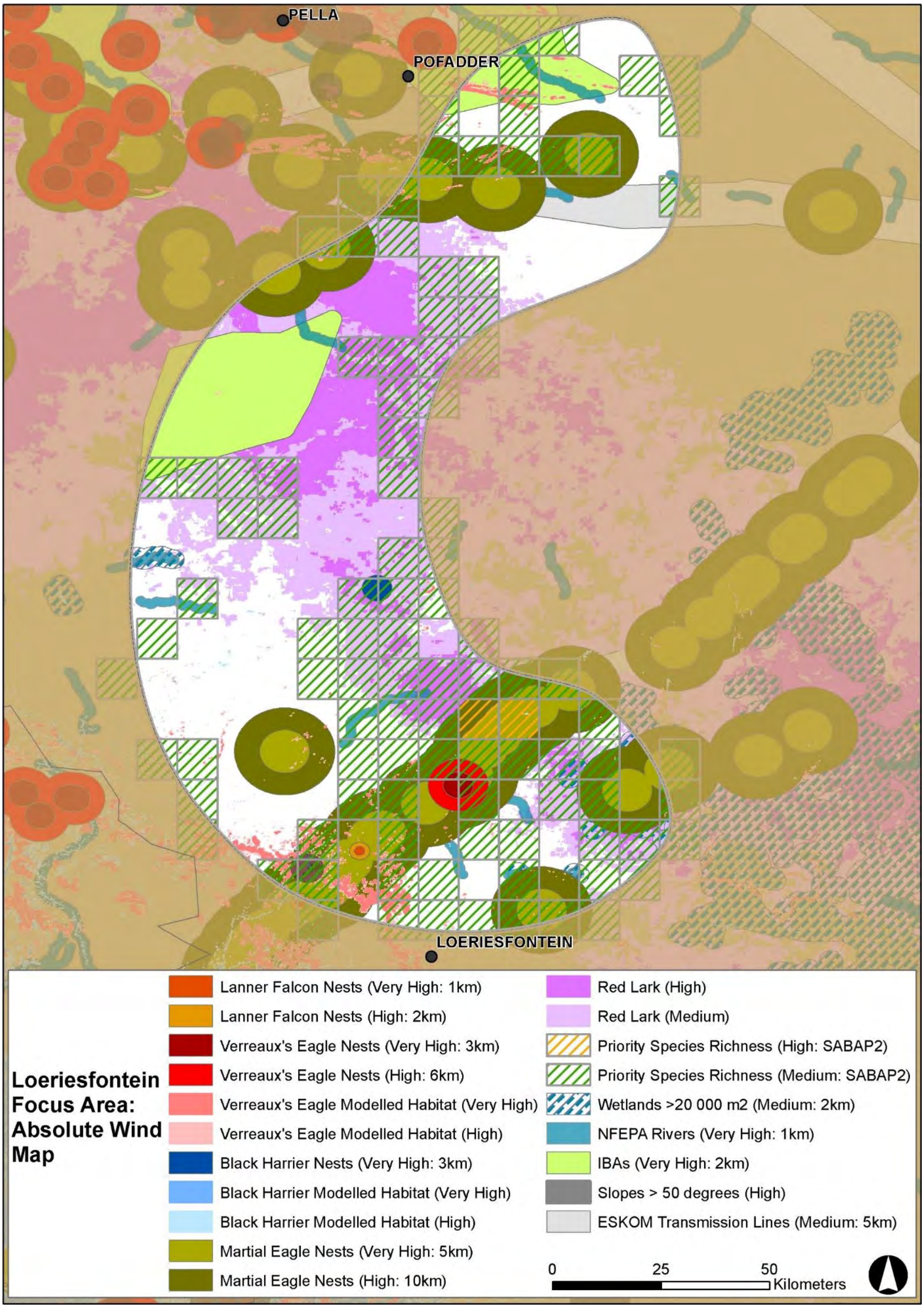
4.2.10 Prieska Focus Area 7 – Wind



4.2.11 Loeriesfontein Focus Area 8 – Solar PV



4.2.12 Loeriesfontein Focus Area 8 – Wind



5. COMPARATIVE SENSITIVITY MAPPING

5.1 Very High sensitivity zones

Several Very High sensitivity (colour code = dark red in comparative sensitivity maps) areas have been identified in each FA, generally in terms of common area- (land-use designation, habitat) or taxon-specific considerations or criteria, including buffers of sufficient size to adequately mitigate potential impacts. These areas are not considered suitable for development.

As a rule, Very High sensitivity buffers were larger for wind energy projects than for solar PV, given that the former technology exposes wide-ranging birds to collision risk over a much broader area, while impacts of the latter technology stem mostly from localised disturbance and displacement effects. For the same reason, and given the general lack of accurate information on the ranging behaviour of most of the affected species, core buffer areas for wind energy development were generally enclosed by wider, High sensitivity buffers, intended to encourage consideration of collision risk for birds at the extent of their foraging ranges when planning development in such areas.

By default, all registered national Important Bird and Biodiversity Areas (as identified and delineated by the BLSA IBA evaluation and selection process (Marnewick *et al.* 2015), and all proclaimed Protected Areas (assumed to be important conserved natural habitat for birds generally, and threatened species in particular (e.g. Herremans & Herremans-Tonnoeyr 2000, Thiollay 2006, McClure *et al.* 2018) were considered as Very High sensitivity zones, and were buffered differentially for wind and solar development. Similarly, it was assumed that the courses of all major rivers constitute relatively unique avian wetland and riparian habitat and often serve as flyways for large volumes of commuting birds, and so should remain as free as possible from RE development. Selected CWAC wetlands - those that feature particularly diverse and abundant waterbird faunas, and/or those that at least occasionally support important populations of threatened wetland birds - were also considered to be Very Highly sensitive, again on the grounds that they are scarce and important resource areas for waterbirds, and because waterbirds are prone to aggregate at and commute between such locations – behaviours that raise the risk of collision with RE infrastructure (Drewitt & Langston 2006, 2008, Bevanger 1998, Jenkins *et al.* 2010).

Certain species were considered to be more inherently susceptible to the impacts of RE development than others, and were identified mainly in terms of collision, displacement or habitat loss studies of similar taxa from other parts of the world, or on the basis of impact sensitivities observed to date in South African birds (Ralston-Paton *et al.* 2017). The factors contributing to such susceptibility include current population and conservation status (risk being greater for rare, endemic and/or threatened species), habitat preferences (risk being greater for species found mainly in open, sunny or windy areas, and for species with very restrictive habitat requirements), morphology (risk being greater for large, heavy or fast-flying species), and behaviour (risk being greater for slope-soarers, predators, flock-forming species, species with aerial displays and those that regularly fly at night - Janss 2000, Bevanger 1998, Drewitt & Langston 2006, 2008, NWCC 2011, Smallwood *et al.* 2009, Jenkins *et al.* 2010, Herera-Alsina *et al.* 2013). These various contributing factors have all been considered and integrated in a broad-scale assessment of sensitivity to the impacts of wind energy development in South African birds (Retief *et al.* 2012). The present study was conducted substantially in terms of this list in prioritising the impact sensitivities of certain species, and the imposition of Very High sensitivity zones around locations or habitats considered important for these birds in each of the FAs. As a result, buffered areas around known nest sites (and in some cases predicted nesting habitat) of species such as large eagles, other raptors and cranes were essentially excluded from development, with the extent of the buffers imposed generally reflecting the known or predicted spatial requirements of each taxon. These buffers were necessarily larger for wind energy development than for solar development, given the risk of collision and displacement posed by large wind farms for many of these large, scarce species. However, the disturbance impacts and scales of habitat destruction associated with solar PV projects should not be underplayed, and the imposition of smaller buffers against solar PV development in such situations is equally defensible.

Verreaux's Eagle nests were buffered by a Very High sensitivity area with a 3 km radius (for wind energy projects – BirdLife South Africa 2016) and a 1 km radius for solar PV projects, with the additional requirement for wind energy developers to investigate space and habitat use by the eagles (by direct observation or even with the use of tracking devices) within a broader, High sensitivity area extending to a 6 km radius around the core zone of Very High sensitivity. This approach is advocated by the BLSA guidelines for this species (BirdLife South Africa 2016) and allows for the possible siting of developments in low use areas quite close to eagle nests but ensures that the predicted core of each eagle territory remains development and hazard free. The buffer distances applied are consistent with the findings of high-resolution tracking studies of this species in at least three areas of the country (Davies 1994, R. Davies Unpubl. data, M. Murgatroyd *et al.* 2016b), are broadly comparable with those applied around nests of the very similar Golden Eagle *Aquila chrysaetos* in Europe and North America (Fielding *et al.* 2006, Tapia *et al.* 2009, Martinéz *et al.* 2010, US Fish & Wildlife Service 2013), and approximate the area around the nest cliff that is most frequently used by the eagle pair and (seasonally) by their dependent young (or half the expected mean inter-nest distance for the species – US Fish & Wildlife 2013). Clearly, actual eagle foraging ranges are not uniform in size across different habitats, and they are usually not circular, but shaped to follow the local distribution of optimal foraging habitat. In reality, it might be possible to place wind turbines (or solar panels) well within the buffer distances prescribed here and have no detrimental effects on the birds if their activity focus is located elsewhere. However, in the context of this study, and in the absence of accurate, site-specific information on foraging patterns, the circular buffer approach is the only practical one to apply. In addition to this, for wind energy proposals areas modelled as most likely to contain Verreaux's Eagle nest sites were designated as Very High sensitivity, while areas with a medium likelihood of containing nests were designated as High sensitivity.

Martial Eagle nest sites were protected by 5 km Very High sensitivity buffers for wind energy projects (and High sensitivity buffers extending out to a 10 km radius) and by a 2 km Very High sensitivity buffer for solar PV projects, reflecting their considerable space requirements (Van Zyl 1992, Hockey *et al.* 2005), with no clear expectation that these open-country eagles are likely to use certain habitats more than others. Nests of this species on power lines in the Karoo are spaced about 20-30 km apart (Boshoff 1993, Machange *et al.* 2005), suggesting that foraging birds fly far as 10-15 km in any direction, and that a core, 5 km buffer around the nest probably includes the highest-use 30-50% of the total range. Similar principles were applied in applying buffers around Tawny Eagle, Secretarybird and Black Stork nests, although with much less clear understanding of the spacing or ranging behaviour of breeding pairs of these birds. In the absence of such information, a precautionary approach was adopted in determining buffer extent.

Very High sensitivity buffers were extended to 3 km around all known Black Harrier nest sites, in keeping with the requirements of the drafted guidelines document for this species for wind energy development (Simmons & Ralston-Paton In prep.). Consistent with the approach adopted for Verreaux's Eagle, areas modelled as highly likely to contain Black Harrier nest sites were designated as Very High sensitivity for wind energy projects, while areas with a medium likelihood of containing nests were designated as High sensitivity.

Smaller Very High sensitivity buffers were imposed on other, smaller raptor sites (e.g. Booted Eagle, Lanner Falcon, Peregrine Falcon, African Grass Owl) for wind energy development according to their known or estimated core foraging ranges (Allan 2001, Pepler *et al.* 2001, Jenkins 2000, Hockey *et al.* 2005, Jenkins & Van Zyl 2005), again erring on the cautious side in the absence of hard data on foraging ranges.

Very High sensitivity buffers of 5 km (for wind energy projects) were imposed on the nest or roost sites of Lappet-faced Vulture and White-backed Vulture despite the fact that the foraging ranges of these birds far exceed this distance (e.g. Phipps *et al.* 2013, Spiegel *et al.* 2013). This was mainly because of uncertainty about how to reasonably insulate such wide-ranging species from exposure to turbine collision risk or disturbance/displacement.

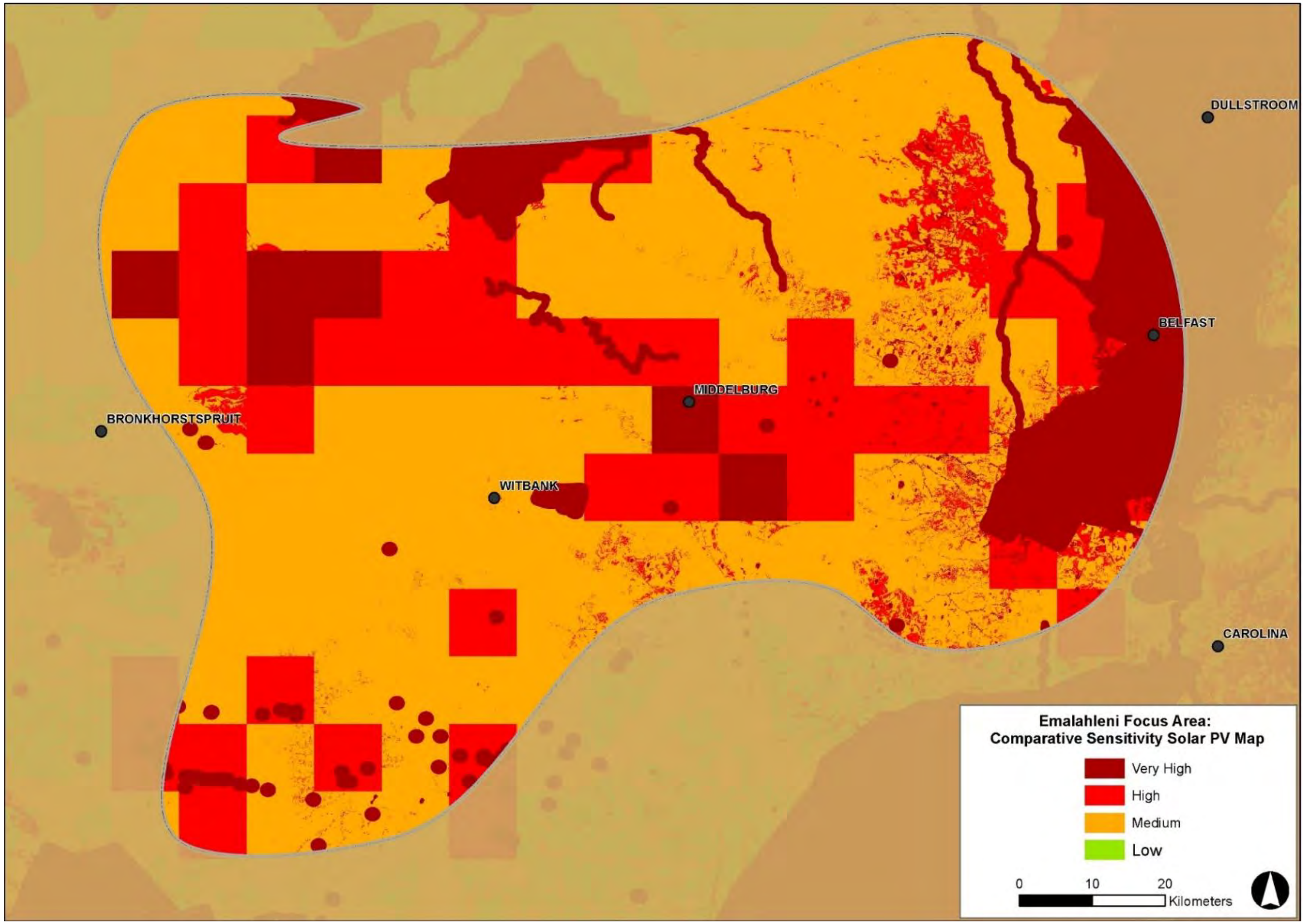
Migrating kestrels – Lesser Kestrels, Amur Falcons and Red-footed Falcons - occupy summer roost sites (each holding up to 10s of thousands of birds) in town centres in at least three of the FAs. These were buffered by a Very High sensitivity area of 5 km radius for wind energy projects, sufficient to protect birds as they aggregate around the roost in the evening, or leave it in the early morning, and a High sensitivity buffer out to 10 km, requiring would-be developers to ensure that their proposed development does not coincide with an area of concentration of these two potentially collision-prone species.

All the above species, and including breeding colonies of Southern Bald Ibis, were protected by proportionately sized but appreciably smaller Very High sensitivity buffers for solar energy development.

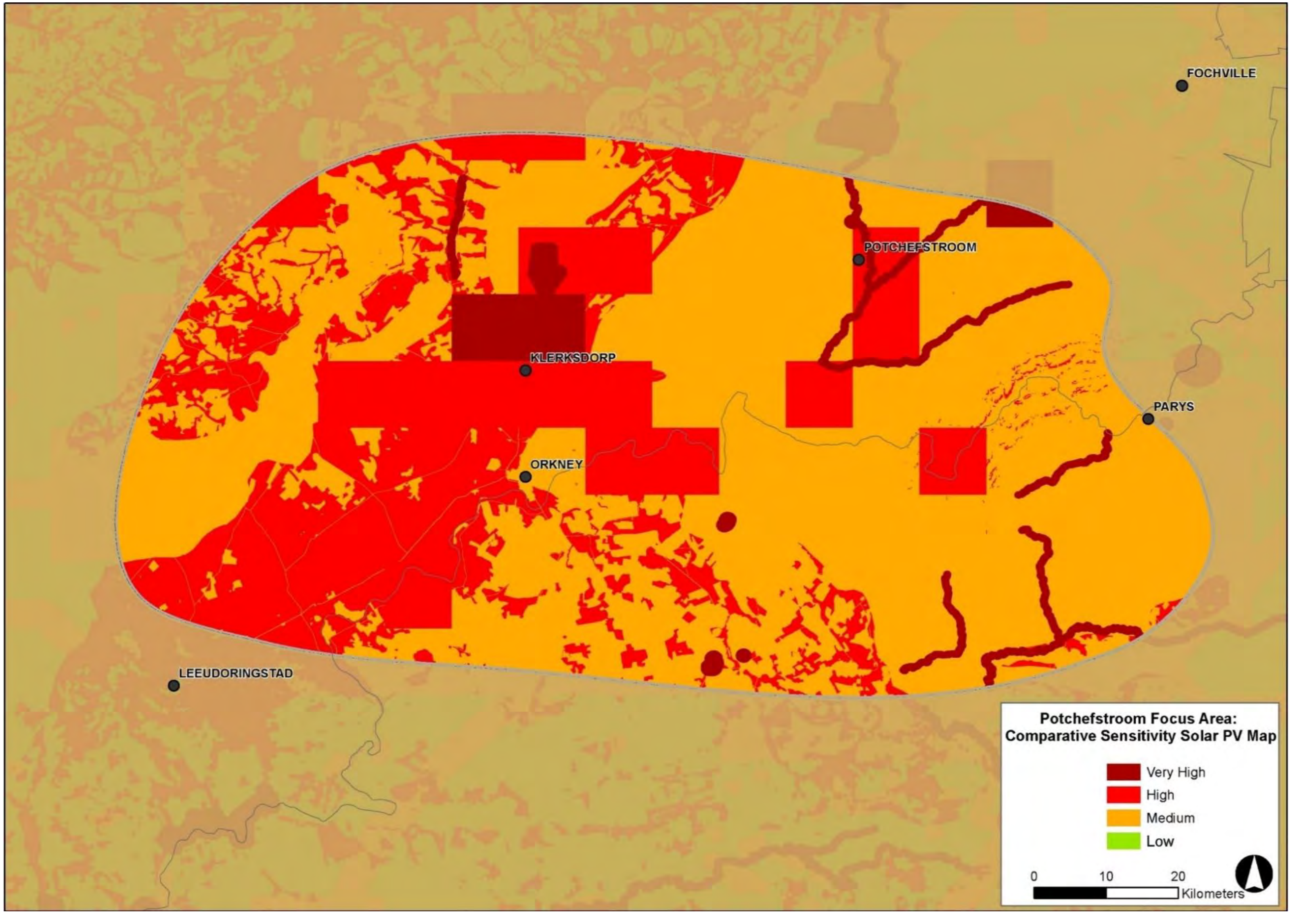
Un-buffered, Very High sensitivity constraints were also imposed on the modelled core distributions of selected globally threatened and/or range-restricted and/or endemic species – White-winged Flufftail, Rudd’s Lark, Yellow-breasted Pipit and Black Harrier - justified in terms of the possibility that widespread RE development could result in damaging levels of habitat loss or degradation and/or unsustainable collision rates for these species of greatest conservation concern.

5.2 Four tier sensitivity maps

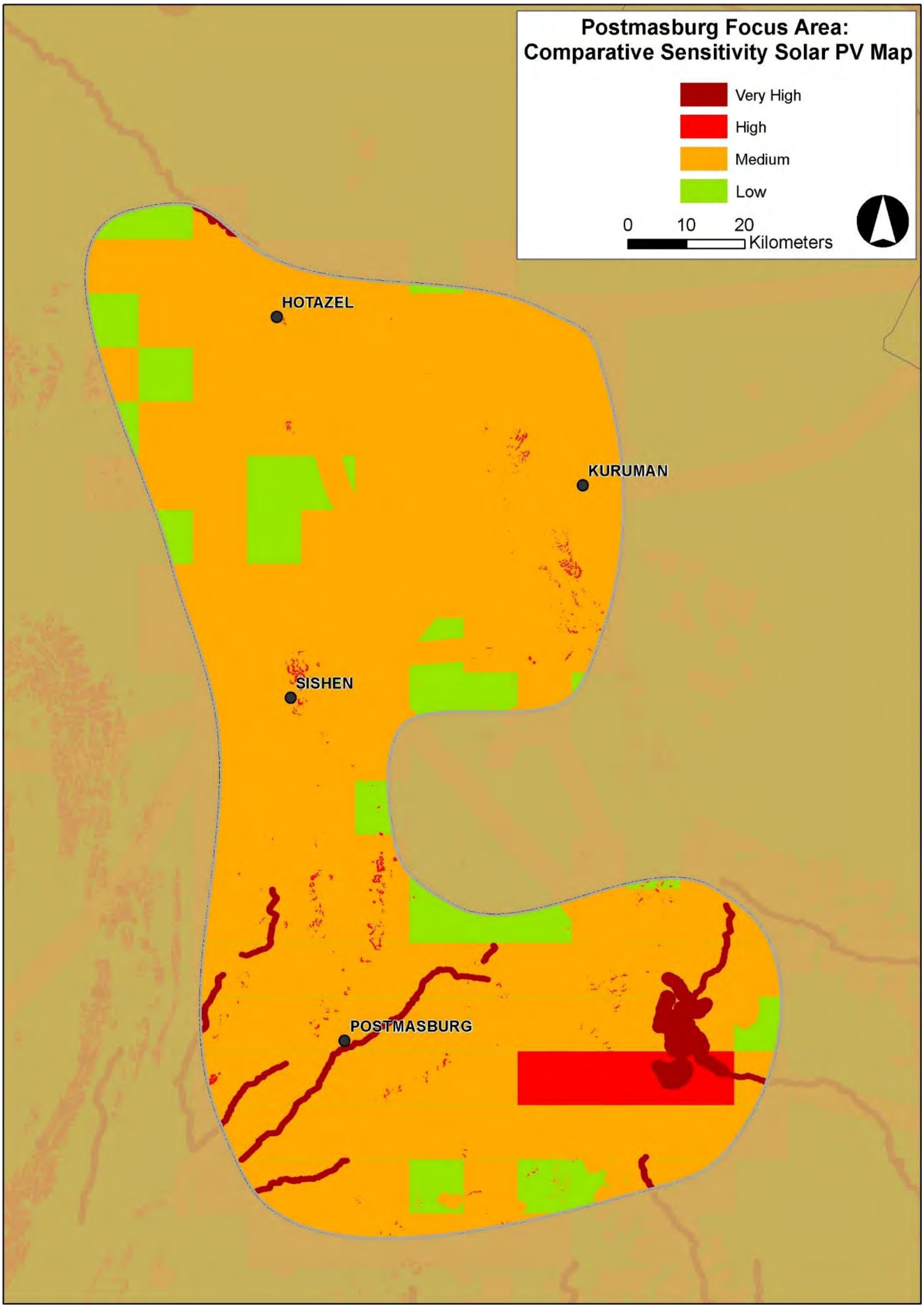
5.2.1 Emalahleni Focus Area 1 – Solar PV


DULLSTROOM
BELFAST
MIDDELBURG
BRONKHORSTSPRUIT
WITBANK
CAROLINA
Emalahleni Focus Area:
Comparative Sensitivity Solar PV Map
Very High
High
Medium
Low
0
10
20
Kilometers

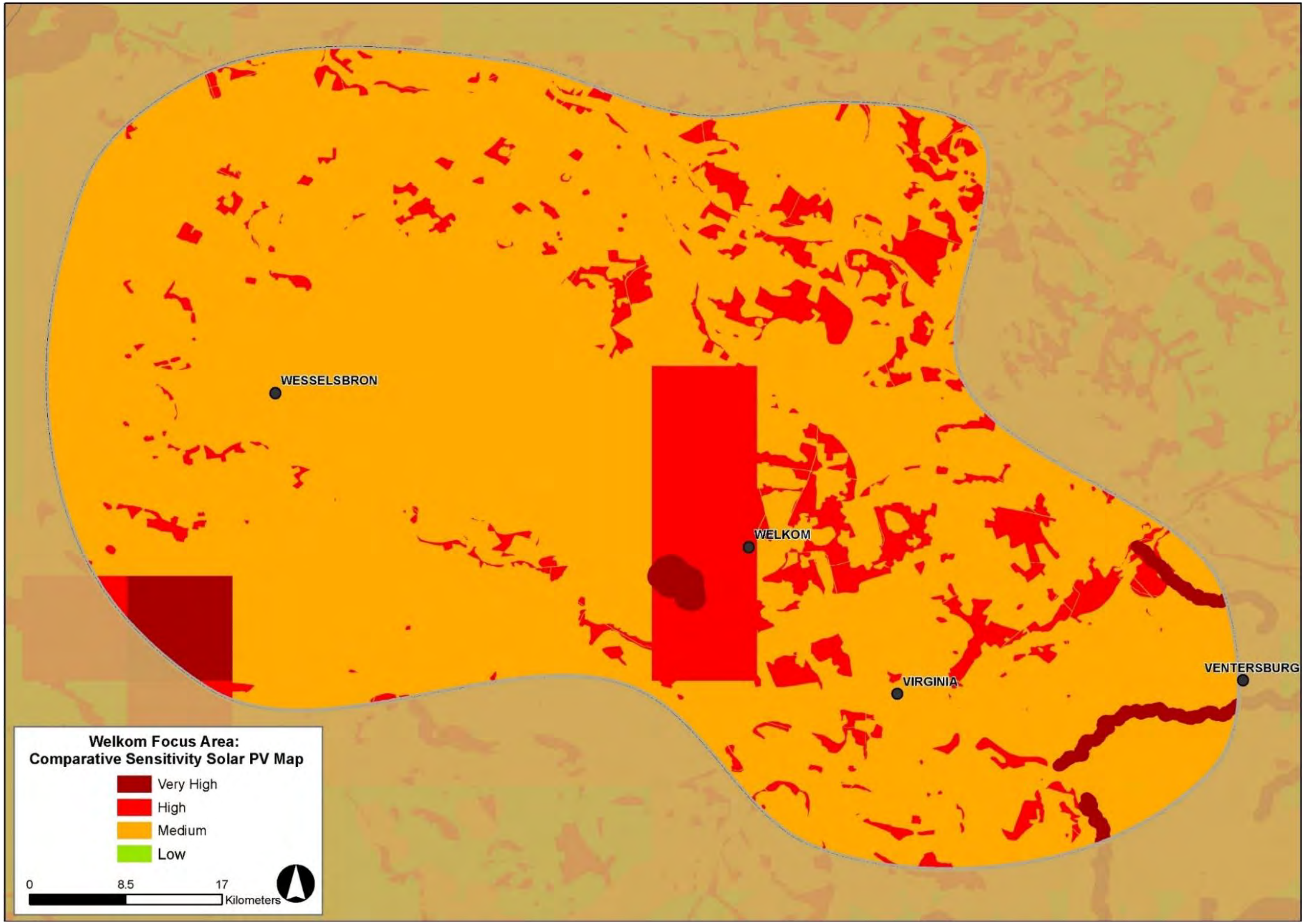
5.2.2 Potchestroom Focus Area 2 – Solar PV



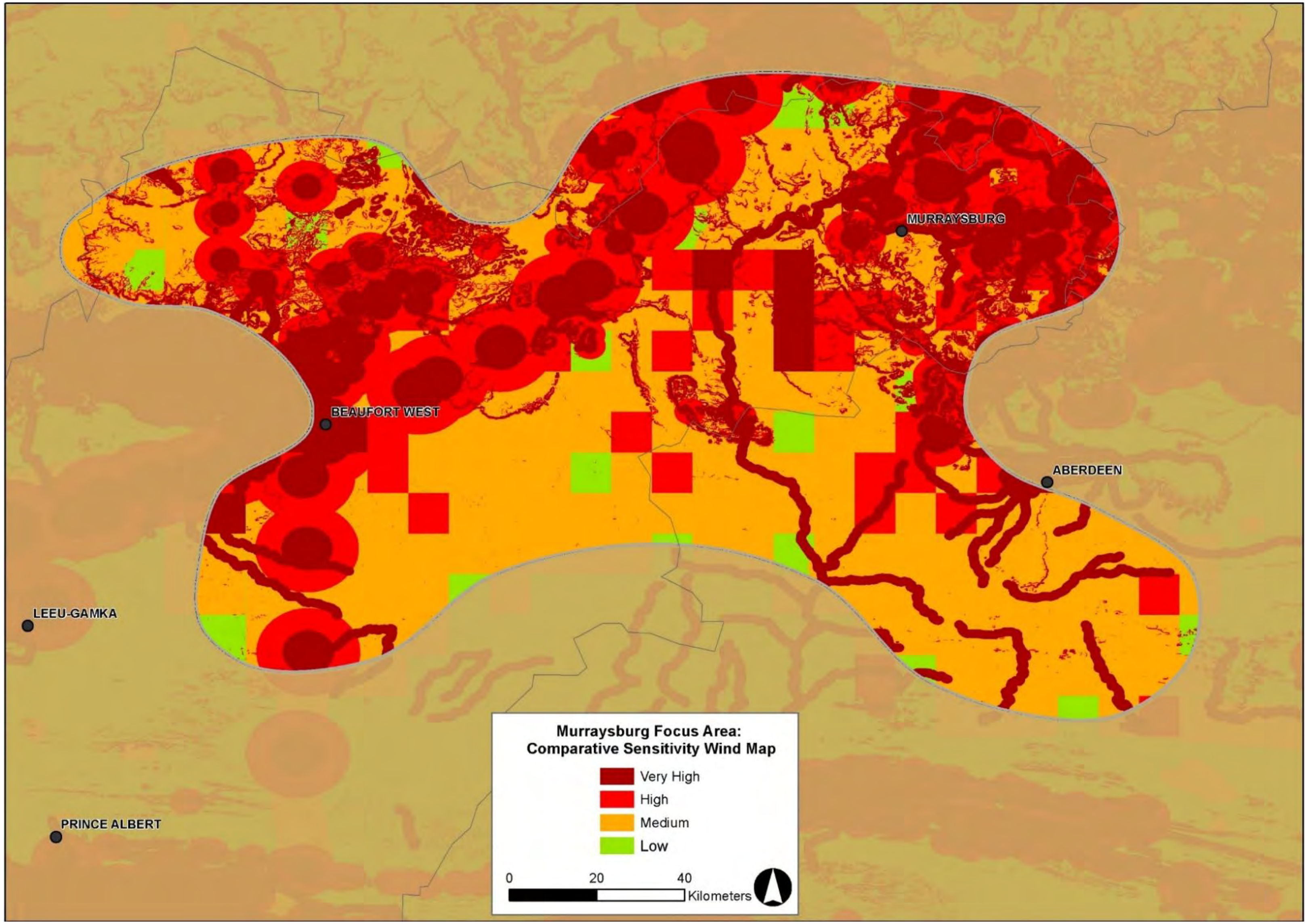
5.2.3 Postmasburg Focus Area 3 – Solar PV



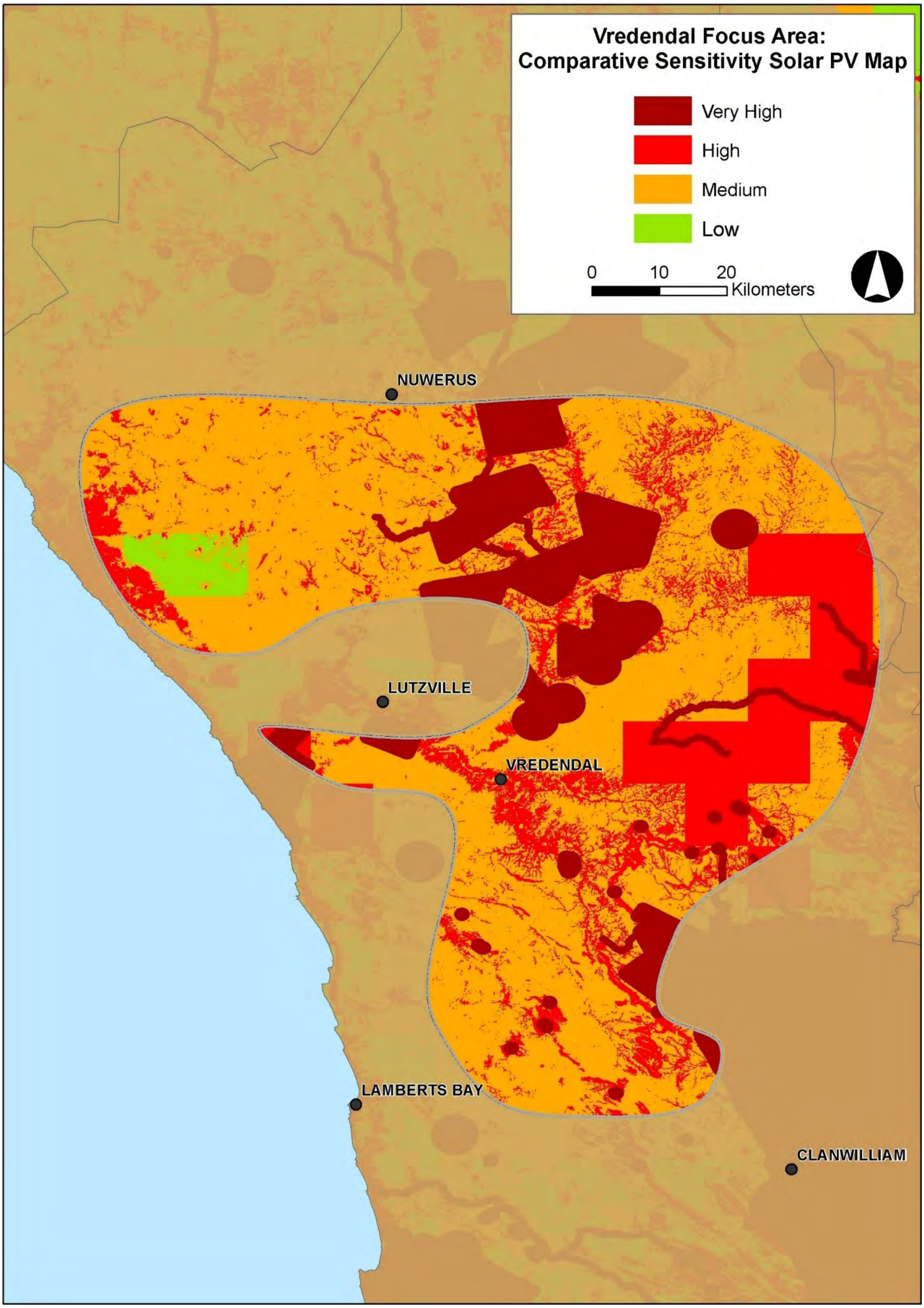
5.2.4 Welkom Focus Area 4 – Solar PV



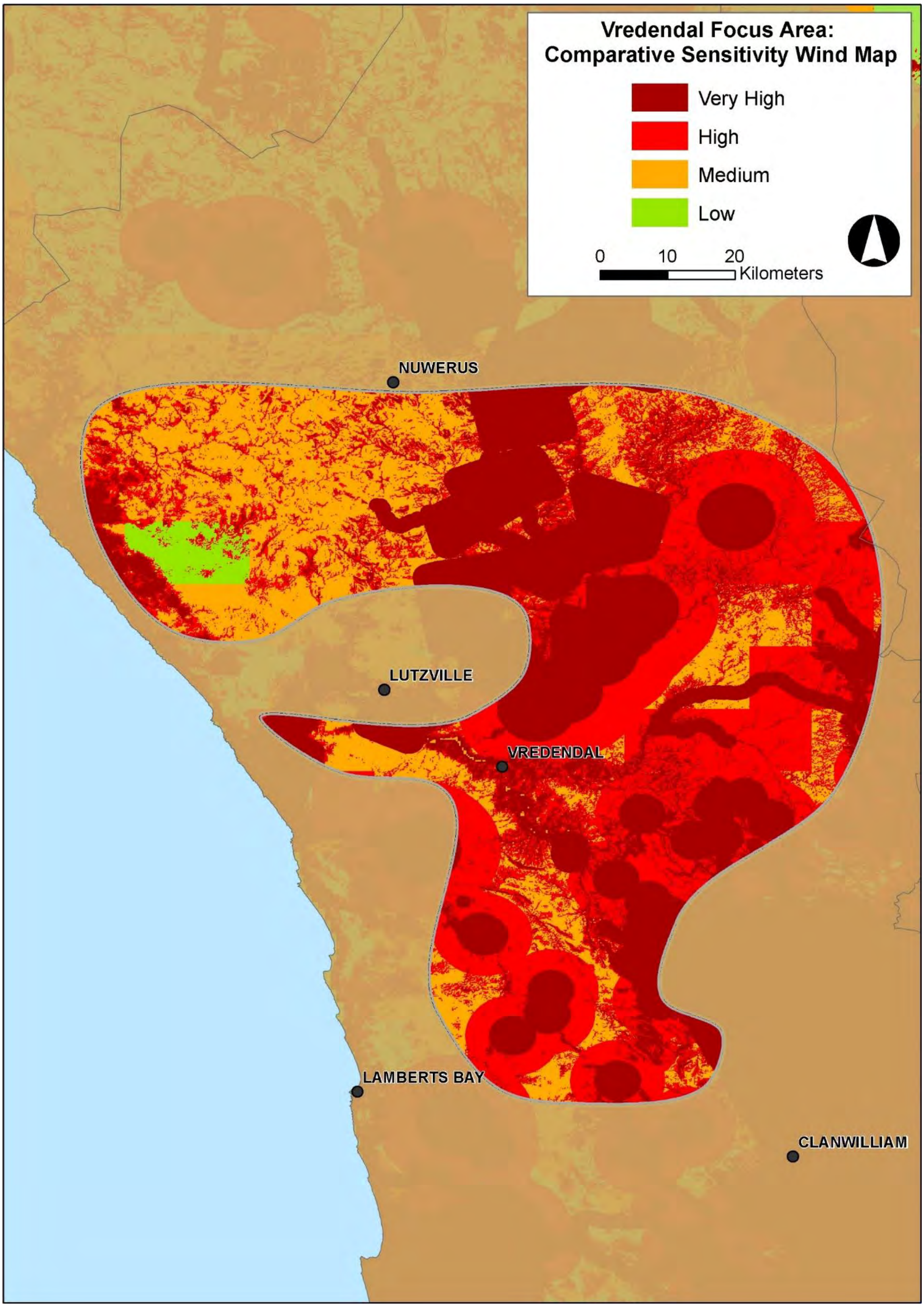
5.2.5 Murraysburg Focus Area 5 – Wind



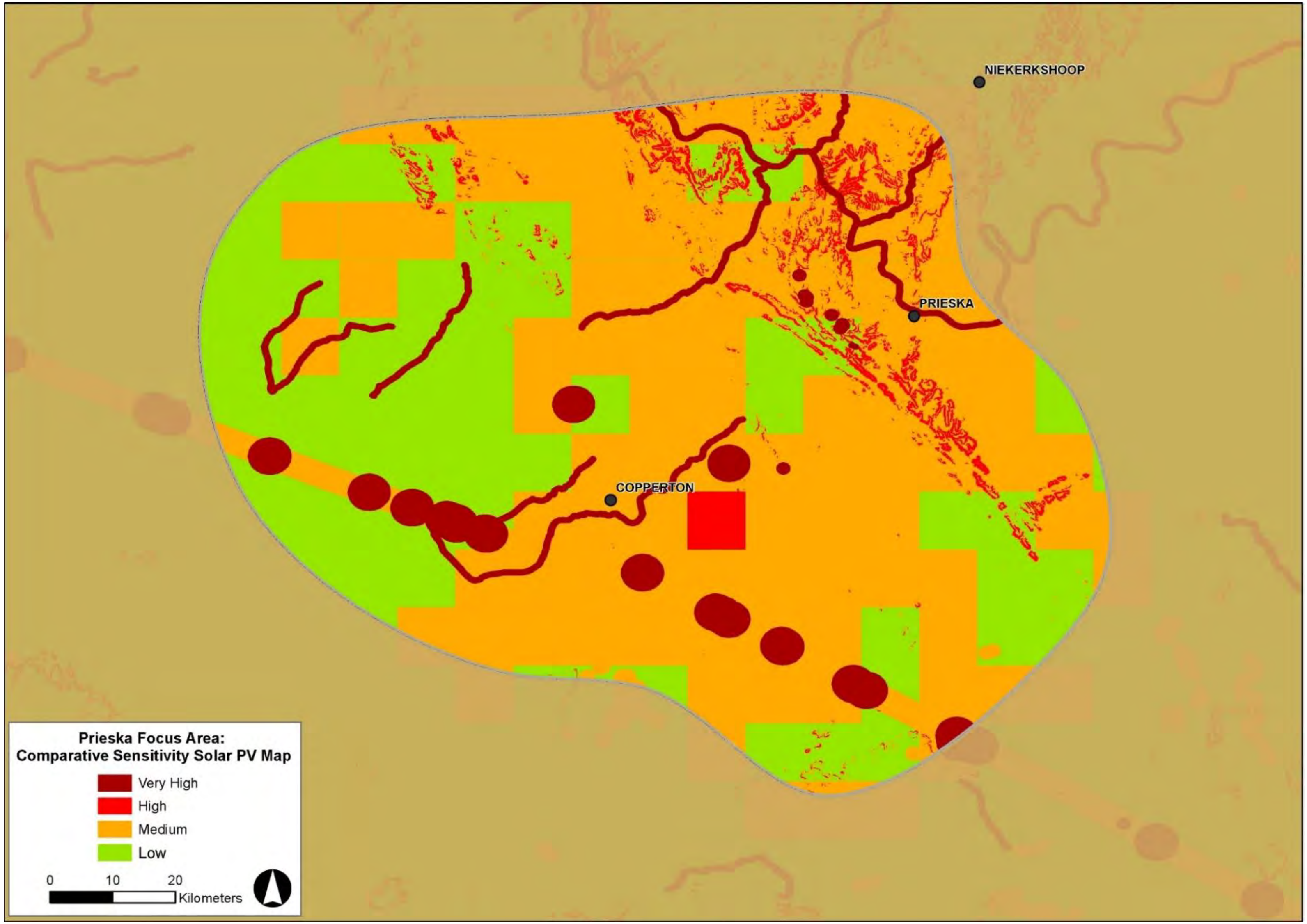
5.2.6 Vredendal Focus Area 6 – Solar PV



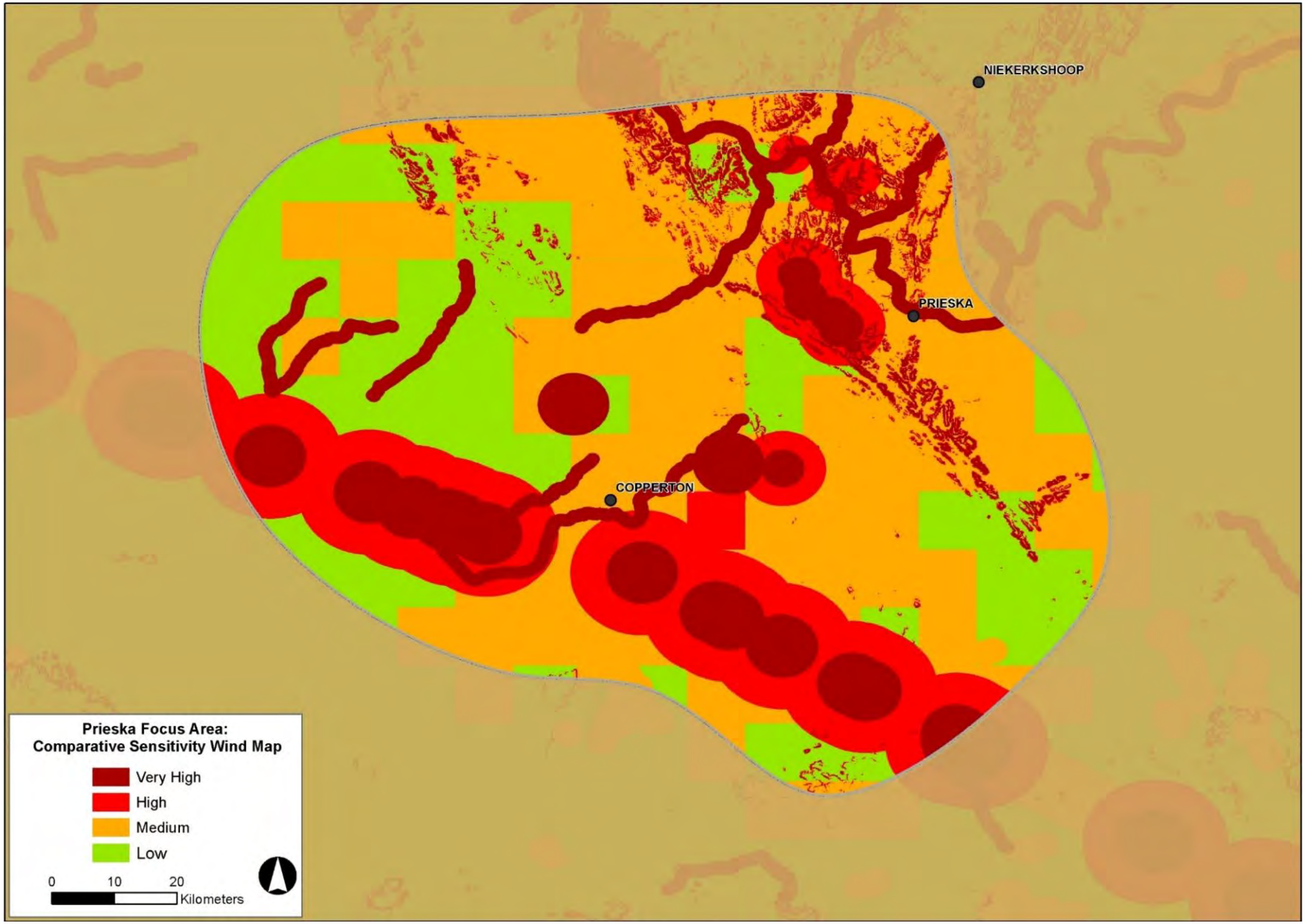
5.2.7 Vredendal Focus Area 6 – Wind



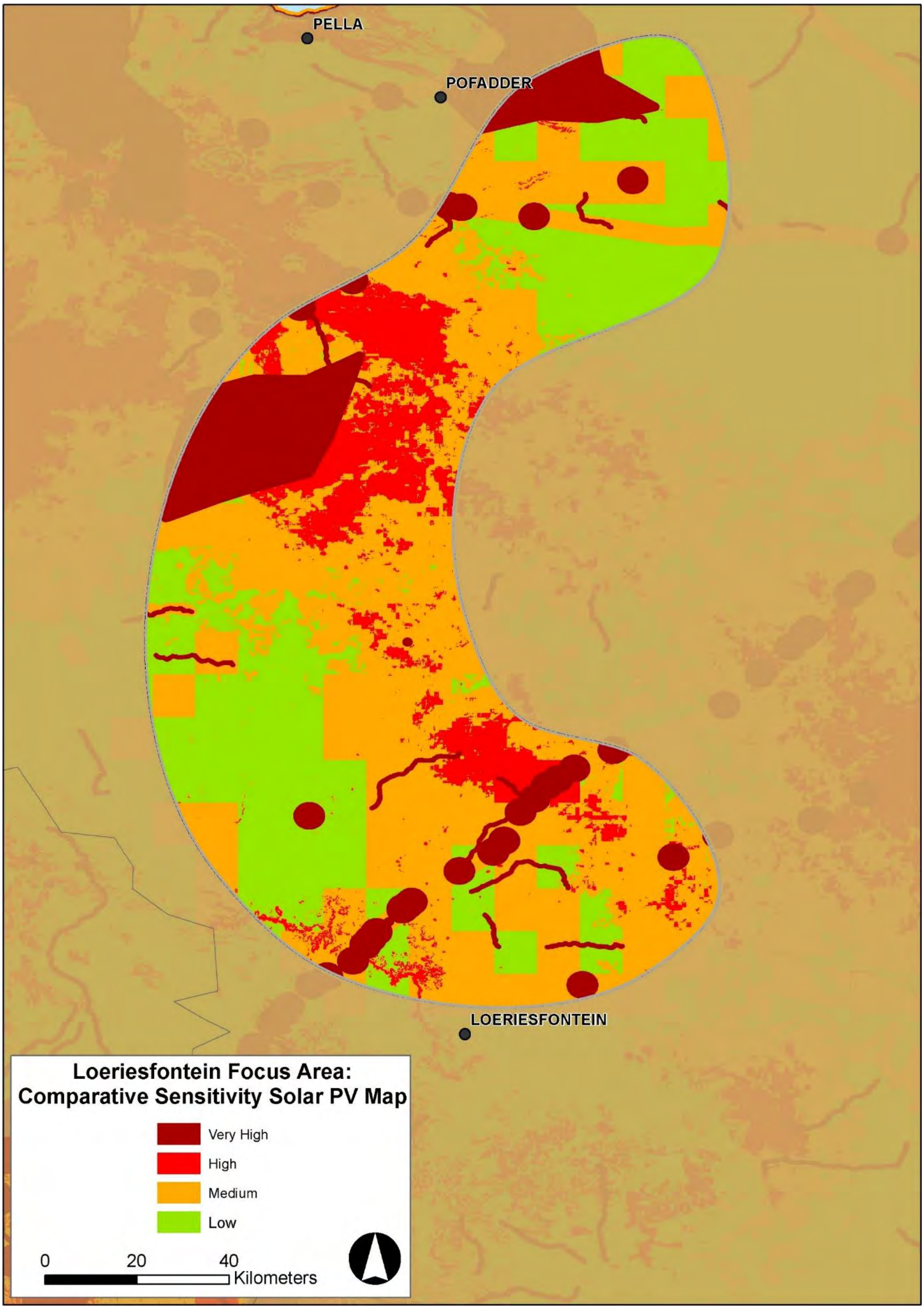
5.2.8Prieska Focus Area 7 – Solar PV



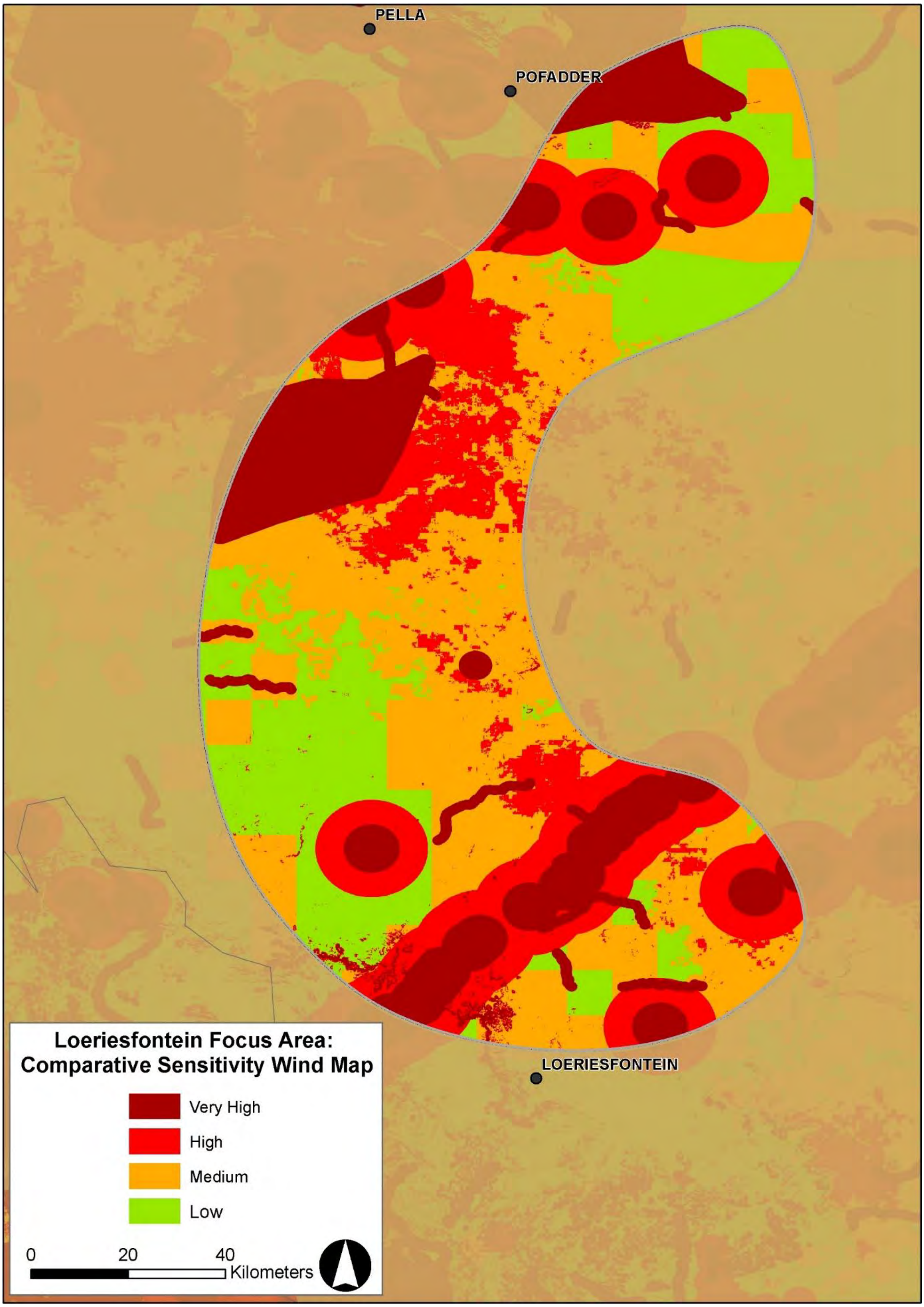
5.2.9Prieska Focus Area 7 – Wind



5.2.10 Loeriesfontein Focus Area 8 – Solar PV



5.2.11 Loeriesfontein Focus Area 8 - Wind



6. INTERPRETATION AND IMPLEMENTATION OF SENSITIVITY MAPS

6.1 Interpretation and implementation of the four-tier wind and solar maps and permit requirements for each focus area

Technology	Sensitivity Class	Interpretation	Implementation and additional assessments at project level	Permit requirements (where applicable)
Both	Dark red	Very High sensitivity areas known or strongly suspected to support important populations of threatened, impact susceptible species. Not suitable for development.	None recommended. Development in these areas is discouraged. The onus is on any would-be developer to provide sound, empirical evidence of sustainability in spite of the impact sensitivities identified.	Authorisation should be denied in terms of NEMA. BLSA should be requested to review any development proposal and to advise accordingly.
	Red	High sensitivity areas likely to support important populations of threatened, impact susceptible species. Not suitable for development unless sensitivities are fully investigated and predicted impacts can be sufficiently mitigated.	No streamlining possible - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology (Jenkins *et al.* 2015, BirdLife South Africa 2017). Particular attention should be paid to key sensitivities already identified; these may require additional research to ensure sustainability.	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.

Technology	Sensitivity Class	Interpretation	Implementation and additional assessments at project level	Permit requirements (where applicable)
	Orange	Medium sensitivity areas that could support important populations of threatened, impact susceptible species. Possibly suitable for development, but potential sensitivities must be fully investigated and effective mitigation options clearly identified.	No streamlining is possible in these areas in terms of current levels of knowledge - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology (Jenkins *et al.* 2015, BirdLife South Africa 2017). No realistic possibility of relaxing these requirements until more comprehensive field data can be obtained to refine and build confidence in the quality of the sensitivity mapping.	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.
	Green	Lower sensitivity areas that possibly don't support important populations of threatened, impact susceptible species. May be suitable for development, but present levels of knowledge preclude confident predictions on the sustainability of impacts.	Streamlining is unlikely in these areas in terms of current levels of knowledge - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology (Jenkins *et al.* 2015, BirdLife South Africa 2017). It may be possible to relax some of these requirements but only once more comprehensive field data are available to refine and build confidence in the quality of the sensitivity mapping.	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.

7. GENERAL COMMENTS AND DISCUSSION

7.1 Key impacts and mitigation

Site	Key Impacts	Site specific description	Mitigation
Features relevant to both technologies and more than one FA	**Slopes and Ridges:** Collision mortality (with wind turbines and/or new power lines) and/or displacement (from areas populated by turbines and/or covered by solar PV installations) of various cliff-nesting and soaring species, including various red-listed raptors and Black Stork.	-	Search areas for nest sites of cliff-nesting species and buffer these accordingly (see section 4). Monitor thoroughly to determine which ridgelines are frequented by threatened slope-soaring species and buffer accordingly.
	Power lines (grid connection for new RE developments): Disturbance or permanent displacement of sensitive or priority species, especially raptors and vultures, that use pylon infrastructure for nesting or roosting. These impact susceptible species play an integral part in the local ecology and could permanently be removed from the system, either through displacement or mortality with the operational RE facility.	-	All existing power infrastructure should be surveyed for possible nesting or roosting sites. Any newly identified sites should be buffered accordingly to ensure these areas are protected from possible disturbance (see section 4).
	Wetlands (>20 000 m^2): Disturbance or permanent displacement of wetland species from development footprint and surrounds, and possible destruction of unique habitat types. Collision mortality (with wind turbines and/or new power lines) of birds that use flight lines in and out of these large wetland areas, which attract and support both impact susceptible and priority species.	-	All major wetlands (especially those larger than 20 000 m^2) should be surveyed to determine the abundance and diversity of wetland and other birds present. Where these represent locally or regionally significance resource areas they should be buffered accordingly (see section 4).

Site	Key Impacts	Site specific description	Mitigation
	Cliff-nesting raptor nests: Collision mortality (with wind turbines and/or new power lines) and/or permanent displacement of montane, cliff-nesting raptors from development footprint and surrounds. A suite of cliff-nesting and slope-soaring raptors – including Cape Vulture, Verreaux's Eagle, Booted Eagle, Peregrine Falcon, Lanner Falcon - are thought to be highly susceptible to collision mortality with wind turbines, especially where these are placed on ridgelines, close to active nests, colonies or roosts, or on favoured flight-lines.	-	All known cliff-nesting raptor nests and modelled nesting habitats are buffered as Very High sensitivity zones (see section 4). The High sensitivity outer buffer should be regularly surveyed to determine whether or not particular landscape features are favoured by foraging birds. Detailed information on ranging behaviour could be derived from direct observation or by remote tracking of individual birds - only embark on tracking studies in collaboration with accredited ornithologists. Based on findings, all high traffic areas need to be effectively buffered from development.
	Crane nesting areas: Disturbance or displacement of Wattled, Grey-crowned and Blue Cranes from favoured breeding areas within or close to the development footprint by expansive wind or solar PV development	-	Keep RE development outside of the designated Very High sensitivity buffer areas (See section 4). Search the designated High sensitivity buffer areas for other nests during the breeding season – October-February and buffer Very High sensitivity accordingly.
	Migrating Kestrel roosts: Collision mortality (with wind turbines and/or new power lines) and/or permanent displacement from the development footprint or surrounds of Lesser Kestrels, Amur Falcons and Red-footed Falcons from summer roost sites.	-	Keep wind farm developments well outside the Very High sensitivity buffers imposed (See section 4). Survey the movements of birds within the surrounding High sensitivity buffer to ensure that there are no other, unforeseen points of aggregation that might heighten collision risk.
Emalahleni Focus Area 1 (Solar PV only)	Displacement of nesting Wattled and Blue Cranes (and possibly also Grey-crowned Crane	Permanent disturbance of cranes from favoured breeding areas by over-development of solar PV in key areas – probably particularly relevant in the east of the FA in areas of more pristine grassland and wetland habitats.	Keep RE development outside of the designated Very High sensitivity buffer areas. Search the designated High sensitivity buffer areas for other nests during the peak breeding seasons (which vary across species).

Site	Key Impacts	Site specific description	Mitigation
	Displacement of or loss of habitat for Rudd's Lark	Permanent disturbance of this threatened endemic, or destruction of important habitat, resulting from over-development - of solar PV in key areas – only relevant in the east of the FA in areas of more pristine grassland where this species occurs.	Keep RE development outside of the designated Very High sensitivity areas. Search the designated High sensitivity areas for signs of this species and respond accordingly. Surveys best done when the birds are breeding in mid-summer.
	Displacement of or loss of habitat for Yellow-breasted Pipit	Permanent disturbance of this threatened endemic, or destruction of important habitat, resulting from over-development - of solar PV in key areas – only relevant in the east of the FA in high-lying areas of more pristine grassland where this species occurs.	Keep RE development outside of the designated Very High sensitivity areas. Search the designated High sensitivity areas for signs of this species and respond accordingly. Surveys best done when the birds are breeding in mid-summer.
	Displacement of or loss of habitat for White-winged Flufftail	Permanent disturbance of this Critically Endangered species resulting from over-development of solar PV in key areas – only relevant in the east of the FA in the near vicinity of relatively pristine, well-vegetated wetlands.	Keep RE development outside of the designated Very High sensitivity areas. Search possibly suitable habitat for signs of this very cryptic species (only in summer when the species is present in our area) and respond accordingly.
	Displacement of or loss of habitat for African Grass Owl	Permanent disturbance of this threatened species resulting from over-development of solar PV in key areas.	Keep RE development outside of the designated Very High sensitivity buffer areas. Search possibly suitable habitat for signs of this cryptic species and respond accordingly
	Collision mortality of large terrestrial birds, raptors, storks and ibises with new power lines	Multiple casualties of Wattled, Grey-crowned and Blue Crane, Denham's Bustard and White-bellied Korhaan, Martial Eagle, Tawny Eagle, possibly Cape Vulture, Black Stork and Southern Bald Ibis, in collisions (and in some cases electrocutions) with power lines servicing new RE developments.	Thoroughly survey crane, bustard, large raptor, stork and ibis populations and habitat use around and within a proposed development area from as early in the development process as possible. Avoid routing power lines through key habitats or in proximity to nesting or roosting areas, ensure all live components of new lines are insulated and bird-friendly, and fit bird flight diverters along the entire length of all new power lines.

Site	Key Impacts	Site specific description	Mitigation
Potchefstroom Focus Area 2 (Solar PV only)	Collision mortality of Lesser and/or Greater Flamingos with PV solar arrays and/or associated power lines	If these birds are susceptible to mistaking solar arrays for waterbodies (Kagan *et al.* 2014) this could result in significant numbers of casualties	Keep development out of the designated Very High sensitivity areas around key wetlands and be sure to survey other wetlands that could at least occasionally support large numbers of flamingos.
	Collision mortality of vultures attending vulture restaurants with new power lines and/or electrocution of vultures on new power infrastructure	Cape, White-backed and Lappet-faced Vultures could be attracted artificial feeding sites located within the FA – these species are highly susceptible to power line collision when flying in to and away from restaurants, and to electrocution when roosting on nearby utility structures	Keep RE developments out of buffered Very High sensitivity areas around any known vulture feeding sites. Survey movements of vultures in surrounding high sensitivity buffer and if required avoid placing wind turbines in these areas. All new peripheral power infrastructure should be fully insulated, marked and bird friendly.
Postmasburg Focus Area 3 (Solar PV only)	Collision mortality of Lesser and/or Greater Flamingos with PV solar arrays and/or associated power lines	If these birds are susceptible to mistaking solar arrays for waterbodies (Kagan *et al.* 2014) this could result in significant numbers of casualties	Keep development out of the designated Very High sensitivity areas around key wetlands and be sure to survey other wetlands that could at least occasionally support large numbers of flamingos.
Welkom Focus Area 4 (Solar PV only)	Collision mortality of Lesser and/or Greater Flamingos with PV solar arrays and/or associated power lines	If these birds are susceptible to mistaking solar arrays for waterbodies (Kagan *et al.* 2014) this could result in significant numbers of casualties.	Keep development out of the designated Very High sensitivity areas around key wetlands and be sure to survey other wetlands that could at least occasionally support large numbers of flamingos.

Site	Key Impacts	Site specific description	Mitigation
Murraysburg Focus Area 5 (Wind only)	Collision mortality of Verreaux's Eagles with wind turbines and/or associated power lines	Multiple casualties of eagles annually; could be sufficient to de-stabilise the local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.
	Collision mortality of Martial Eagles with wind turbines and/or associated power lines, or displacement by disturbance within the development footprint and surrounds	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing power lines, major drainage lines (and possibly alien plantations) for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.

Site	Key Impacts	Site specific description	Mitigation
	Collision mortality of large terrestrial birds with wind turbines and/or associated power lines	Multiple casualties of Blue Crane, Kori and Ludwig's Bustard, Karoo and Southern Black Korhaan annually. Added to high power line collision rates, could be sufficient to de-stabilise local populations.	Thoroughly survey crane, bustard and korhaan numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.
Vredendal Focus Area 6 (Wind and Solar PV)	Collision mortality of Verreaux's Eagles with wind turbines and/or new power lines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.

Site	Key Impacts	Site specific description	Mitigation
	Collision mortality of Martial Eagles with wind turbines and/or new power lines, or displacement by disturbance within the development footprint and surrounds	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing power lines, major drainage lines (and possibly alien plantations) for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.
	Collision mortality of large terrestrial birds with wind turbines and/or new power lines	Multiple casualties of Blue Crane, Kori and Ludwig's Bustard, Karoo and Southern Black Korhaan annually. Added to high power line collision rates, could be sufficient to de-stabilise local populations.	Thoroughly survey crane, bustard and korhaan numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.
	Collision mortality of Black Harriers with wind turbines and/or new power lines, or habitat loss and/or displacement by disturbance within the development footprint and surrounds	Disturbance of or loss of habitat for this threatened endemic could significantly reduce success of breeding pairs or cause desertion of occupied habitat. Escalated collision mortality could de-stabilise important local populations. Particularly pertinent to major drainage lines through the Knersvlakte in the northern half of the FA where densities of breeding Black Harriers can be high in good rainfall years.	Keep development, and particularly wind farms, outside of the designated Very High sensitivity areas, and carefully survey High sensitivity (perceived lower density) areas for breeding pairs or suitable breeding habitat that might be used only in favourable years – responding accordingly.

Site	Key Impacts	Site specific description	Mitigation
Prieska Focus Area 7 (Wind and Solar PV)	Collision mortality of Verreaux's Eagles with wind turbines and/or new power lines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.
	Collision mortality of Large savanna raptors with wind turbines and/or new power lines, or displacement by disturbance within the development footprint and surrounds	Multiple casualties of Martial Eagles, Tawny Eagles, White-backed Vultures and/or Lappet-faced Vultures annually, or desertion of established nest sites; could be sufficient to cause localised extinction of these threatened birds	Keep wind and solar farms outside of the designated Very High sensitivity buffers around known nest or roost sites. Survey all nearby transmission lines (and possibly also stands of large trees) for new nest sites and buffer accordingly. Ideally, gather information on eagle foraging behaviour in relation to the proposed wind energy development – either by direct observation or by deploying tracking devices on adult birds. Only embark on tracking studies in collaboration with accredited ornithologists.

Site	Key Impacts	Site specific description	Mitigation
Loeriesfontein Focus Area 8 (Wind and Solar PV)	Collision mortality of Verreaux's Eagles with wind turbines and/or new power lines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.
	Collision mortality of Martial Eagles with wind turbines and/or new power lines, or displacement by disturbance within the development footprint and surrounds	Multiple casualties of eagles annually, and desertion of established nest sites; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms and solar farms outside of the designated Very High sensitivity buffers around known nest sites. Survey all nearby transmission lines (and possibly also stands of large trees) for new nest sites and buffer accordingly. Ideally, gather information on eagle foraging behaviour in relation to the proposed wind energy development – either by direct observation or by deploying tracking devices on adult birds. Only embark on tracking studies in collaboration with accredited ornithologists.

Site	Key Impacts	Site specific description	Mitigation
	Displacement of Red Lark from core or peripheral areas of its distribution, or collision mortality with wind turbines, solar PV panels and/or new power lines	Construction or completed footprint of developments could destroy prime habitat, or construction or operational activities may disturb or displace larks from critical areas, and/or multiple casualties annually in collisions; possibly sufficient to de-stabilise the population and even jeopardise the survival of the species.	Keep wind and solar farms outside of the designated Very High sensitivity core areas of the Red Lark range. Survey all High sensitivity peripheral areas of the range to determine presence/absence and relative abundance of larks and buffer accordingly.

7.2 General comments

Site	Overall Suitability	Comment
Emalahleni Focus Area 1 (Solar PV)	Possibly suitable for solar PV	Provided that (i) existing guidelines are adhered to, (ii) all proposed developments areas are carefully surveyed for cranes, African Grass Owl, Southern Bald Ibis and localised, red-listed endemics, (iii) all sites and habitats used by these birds are adequately buffered against disturbance and habitat loss impacts.
Potchefstroom Focus Area 2 (Solar PV)	Possibly suitable for solar PV	Provided that (i) existing guidelines are adhered to, and (ii) development is planned around the distribution of Very High and High sensitivity areas mapped by this study.
Postmasburg Focus Area 3 (Solar PV)	Probably suitable for solar PV	Provided that (i) existing guidelines are adhered to, and (ii) development is planned around the distribution of Very High and High sensitivity areas mapped by this study. *Note that current knowledge of the avifauna of this FA is limited.*
Welkom Focus Area 4 (Solar PV)	Probably suitable for solar PV	Provided that (i) existing guidelines are adhered to, and (ii) development is planned around the distribution of Very High and High sensitivity areas mapped by this study.
Murraysburg Focus Area 5 (Wind)	Possibly not suitable for wind energy development in terms of potential impacts on both cliff- and plains-nesting raptors and large terrestrial birds	Any wind energy development proposal will probably have to do more survey and monitoring work than the baseline required by current guidelines. There is considerable scope to improve the confidence around the sensitivity mapping for this FA by conducting targeted supplementary survey work, focused on locating, mapping and buffering large eagle nests.
Vredendal Focus Area 6 (Wind & Solar PV)	Possibly suitable for solar PV development. Possibly not suitable for wind energy development, given that the potential impacts on Black Harriers, cliff- and plains-nesting raptors, large terrestrial birds and wetland birds associated with estuaries of the Olifants and other rivers may be problematic.	Solar PV development: provided that existing guidelines are adhered to, and (ii) development is planned around the distribution of Very High and High sensitivity areas mapped by this study, particularly avoiding important habitats for Black Harrier. Wind farm development: proposed projects may have to do more survey and monitoring work than the baseline requirement. There may be scope to improve the confidence around the sensitivity mapping for this FA by conducting targeted, supplementary survey work, focused on locating, mapping and buffering large eagle nests, Black Harrier habitat and nesting areas and locally significant wetland areas.
Prieska Focus Area 7 (Wind & Solar PV)	Probably suitable for solar PV although habitat loss and disturbance impacts on red-listed, endemic passerines may be problematic. Possibly suitable for wind energy development although potential impacts of the latter on cliff- and plains-nesting raptors, large terrestrial birds and red-listed, endemic passerines may be problematic.	Wind farm development: proposed projects may have to do more survey and monitoring work than the baseline requirement. There may be scope to improve the confidence around the sensitivity mapping for this FA by conducting targeted, supplementary survey work, focused on locating, mapping and buffering large eagle nests and vulture roosting sites, and locating hot-spot areas for threatened, endemic passerines. Note that current knowledge of the avifauna of this FA is limited.
Loeriesfontein Focus	Possibly suitable for solar PV	Wind farm development: proposed projects may have to do

Site	Overall Suitability	Comment
Area 8 (Wind & Solar PV)	although habitat loss and disturbance impacts on red-listed, endemic passerines may be problematic. Possibly not suitable for wind energy development given potential collision, displacement and habitat loss impacts on cliff- and plains-nesting raptors, large terrestrial birds and red-listed, endemic passerines may be problematic.	more survey and monitoring work than the baseline requirement. There may be scope to improve the confidence around the sensitivity mapping for this FA by conducting targeted, supplementary survey work, focused on locating, mapping and buffering large eagle nests and vulture roosting sites, and locating hot-spot areas for threatened, endemic passerines. Both technologies should be discouraged from exploring development opportunities within the distribution of Red Lark, at least until our understanding of the population size, distribution and habitat requirements of this species are vastly improved. *Note that current knowledge of the avifauna of this FA is very limited.*

7.3 Cumulative impacts

In thinking strategically about the environmental impacts of large-scale industrial development it is obviously critical to consider the accumulated effects of many projects built in the same general area (Masden *et al.* 2010, Ralston-Paton *et al.* 2017, Visser *et al.* 2019). It is generally recognised that project-specific impacts of multiple developments may be more than simply additive when operating together (Masden *et al.* 2010). However, exactly how to quantify or otherwise assess the magnitude of cumulative impacts, and how to avoid or mitigate their effects on natural environments, remains poorly understood (Masden *et al.* 2010).

In this instance, assessing cumulative impacts is essentially about determining how much wind and/or solar PV development each FA can reasonably sustain. The sensitivity mapping presented in this study goes some way to addressing this issue by integrating existing spatial data for key biodiversity areas and important nesting and resource areas for a shortlist of rare, threatened, endemic and/or impact susceptible birds. Hence, variation in sustainable levels of development across an area-specific suite of priority species is accounted for and expressed in the resulting maps, hopefully providing a high-level indication of the quantity of development appropriate for each FA. Note, however, that this outcome is highly dependent on the quality of the data contributing to the maps and the limitations built into the existing mapping process – further emphasising the need to supplementary fieldwork, to ground-truth some of the predictive elements of the maps and improve the coverage of targeted data collection completed with each FA.

Also note that even with the benefit of the best quality data, the magnified impacts of many RE projects developed within any of the FAs could still exceed the boundaries of mapped impact sensitivity, ultimately resulting in significant losses of irreplaceable biodiversity. In the absence of any accurate way to forecast and allow for cumulative impacts, a suitably precautionary and conservative approach to decision making requires that wind and solar PV developments should only be located outside of Very High sensitivity areas (and preferably outside of High sensitivity areas too), and that the number of authorised projects should (at least to some extent) be a function of the quantity of lower sensitivity habitat present within each FA (e.g. Table 9).

Another consideration is to ensure that all the pre- and post-construction monitoring data collected as part of the EIAs for all developments authorised within each FA – and particularly for the earlier projects – is centrally collated and analysed. This will progressively improve field-based knowledge of the avifauna of each REDZ, help to refine sensitivity mapping, and enable independent measurement of the combined residual impacts of wind energy and solar PV facilities actually operating in the area. This knowledge can then be used to more reliably predict cumulative impacts and inform upcoming authorisations.

8. CONCLUSIONS AND FURTHER RECOMMENDATIONS

The following conclusions can be reached in assessing the outcomes of this study:

1) RE development is encouraged as a potentially sustainable option in terms of likely bird impacts in at least 6-7 of the eight proposed FAs, although there are significant problems with large-scale wind energy development in at least three of these areas (Murraysburg FA5, Vredendal FA6 and Loeriesfontein FA8).

2) Solar PV is far less constrained by avian sensitivity than wind, and is a realistic option in seven of the eight FAs (Table 9), provided that cumulative impacts are controlled, and PV arrays do not impinge on key habitats for red-listed, range-restricted endemic passerines or significant waterbodies that support large populations of threatened wetland birds.

3) The best areas for solar PV development appear to be the Postmasburg (FA3), Welkom (FA4) and Prieska (FA7) FAs, while the least problematic area for wind energy development appears to be the Prieska FA (FA7).

4) Given the lack of recent, reliable and extensive field data for the majority of the FAs assessed, the confidence around most of these findings is low and there is limited scope at present to relax the existing baseline monitoring requirements listed in the best practice guidelines documents (Jenkins *et al.* 2015, BirdLife South Africa 2017).

5) One of the central issues that prompted the need for additional survey and monitoring to inform responsible authorisation of RE developments in this country, and especially of wind farms, is our poor knowledge and understanding of the daily, nomadic or seasonal movements of birds, and the extent to which these movements expose them to collision risk. No information of this type was used in the compilation of these maps (because so little is available). For the most part, this is not an issue that can be adequately addressed in a SEA-type study and must be deferred to project-specific field studies.

6) Some of the areas identified as Very High sensitivity in each FA are situated adjacent to the current FA boundary. It might be easier from a legislative and administrative perspective to simply excise these areas from their respective FAs by adjusting the FA boundaries, than to retain them within the FA.

7) The addition of recent, extensive and reliable field data for the Springbok FA in the compilation of the Phase 1 SEA study (Avisense Consulting 2014) greatly increased the amount of information contributing to the assessment of this area at relatively little additional time or expense, and vastly improved the accuracy of the maps produced and our ability to identify genuinely low sensitivity areas for development within the FA. As a result, a strong recommendation of this report is that more groundwork be done in a follow-up to this study, aimed at refining the maps presented here for at least some of the remaining FAs.

8) Even though the present report does not offer any definite opportunities to streamline the development authorisation process, the findings still have considerable worth for both DEA and the industry. By highlighting and mapping the avian sensitivities within each FA at this scoping level, the SEA offers developers early clarity on the bird-related obstacles they are likely to encounter at any given location within each of the FAs. Hence there is greater certainty in pursuing development options, and less likelihood of unexpected and costly delays. The value of this indirect streamlining function should not be underestimated.

Table 9. Proportions of Focus Areas occupied by each development sensitivity class, for each technology, with an indication of the likelihood of being able to relax some of the baseline monitoring work currently required by the respective guidelines documents.

Focus Area	Technology	% area of different sensitivities				Streamlining of guidelines requirements?
		Very High	High	Medium	Lower	
Emalahleni 1	Solar PV	17.8	26.1	56.0	0.0	Possibly not
Potchefstroom 2	Solar PV	4.9	32.5	62.6	0.0	Possibly not
Postmasburg 3	Solar PV	2.7	2.8	84.6	10.0	Possibly
Welkom 4	Solar PV	2.5	13.3	84.2	0.0	Possibly
Murraysburg 5	Wind	31.0	24.3	41.1	3.6	Definitely not
Vredendal 6	Wind	39.5	34.6	24.2	1.7	Definitely not
	Solar PV	14.8	23.2	60.3	1.8	Possibly not
Prieska 7	Wind	18.4	17.0	40.4	24.2	Possibly not
	Solar PV	6.7	3.8	56.8	32.6	Possibly
Loeriesfontein 8	Wind	21.4	23.6	34.6	20.4	Probably not
	Solar PV	13.3	11.5	47.1	28.1	Possibly not

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PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A.3

Heritage Scoping Assessment Report

Heritage Scoping Assessment Report

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[1] HCAC (Heritage Contracts and Archaeological Consulting).

CONTENTS

TABLES

FIGURES

ABBREVIATIONS & ACRONYMS

AIA	Archaeological Impact Assessment
BP	Before Present
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
ESA	Early Stone Age
GIS	Geographic Information System
HCAC	Heritage Contracts and Archaeological Consulting CC
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
KZNHA	Kwa Zulu Natal Heritage Act
ICOMOS	International Council on Monuments and Sites
LSA	Later Stone Age
Ma	Millions of years old
MPRDA	Minerals and Petroleum Resources Development Act
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
NID	Notice of Intent to Develop (Applicable to all Section 38 (1) Developments)
PIA	Palaeontological Impact Assessment
PGWC	Provincial Government Western Cape
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
PV	Photo Voltaic
RE	Renewable Energy
REDZs	Renewable Energy Development Zones
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAPAD	South African Protected Areas Database
SANParks	South African National Parks
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization
VIA	Visual Impact Assessment

1. SUMMARY

The Department of Environmental Affairs (DEA) appointed the Council for Scientific and Industrial Research (CSIR) to undertake a Strategic Environmental Assessment (SEA) to identify geographical areas best suited for the roll-out of wind and solar PV energy projects, referred to as Renewable Energy Development Zones (REDZs). It is envisaged that wind and solar PV development will be incentivised and streamlined in the REDZs as the SEA process provides a platform for co-ordination between the various authorities responsible for issuing authorisations, permits or consents. Based on development potentials, major environmental constraints and industry inputs, eight focus areas are proposed (Figure 1).

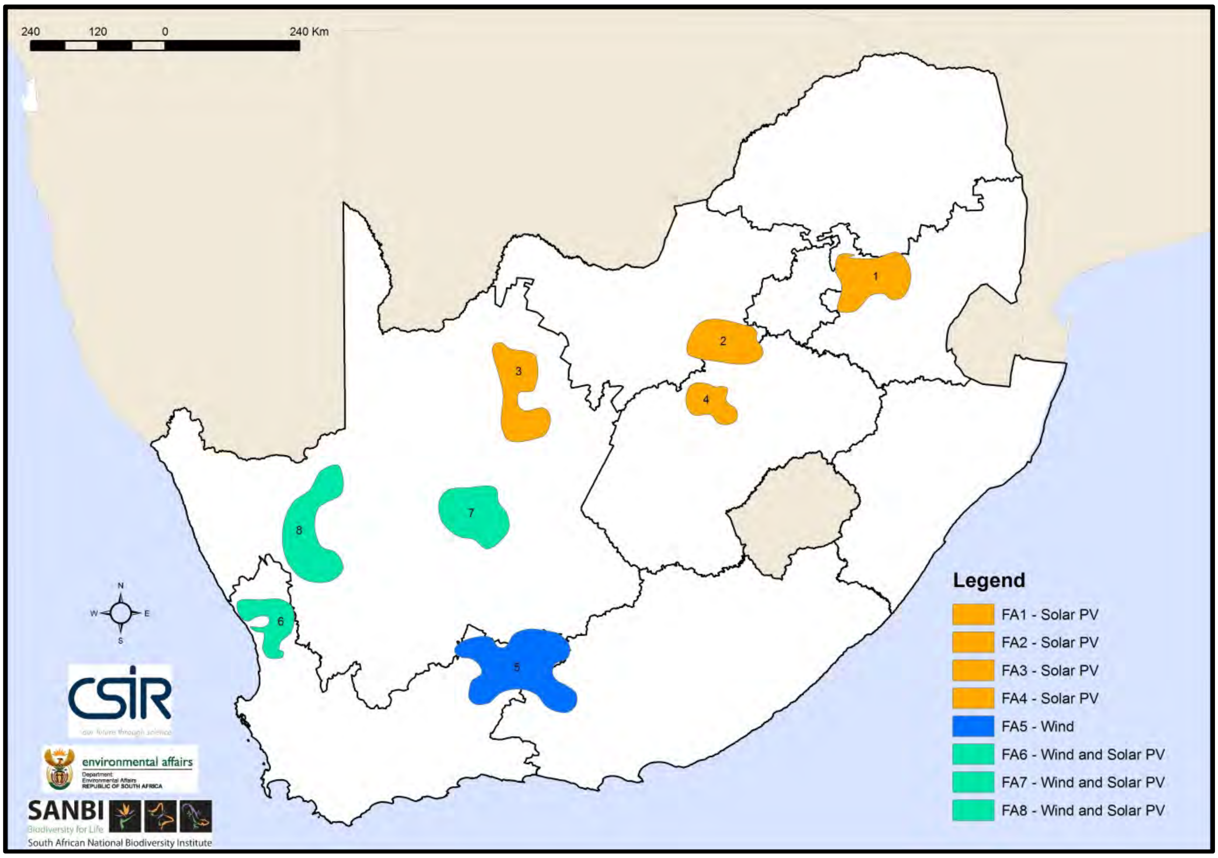

Figure 1: Wind and Solar PV focus areas

Heritage Contracts and Archaeological Consulting (HCAC) was appointed by the CSIR to prepare a Strategic Issue Chapter on the sensitivities associated with heritage in the draft focus areas, delineated as part of Phase 2 of the Wind and Solar PV SEA. This assessment consisted of the review of the existing environmental wall to wall mapping outputs (Section 3.2) produced by the CSIR and the South African National Biodiversity Institute (SANBI) with respect to features linked to heritage for the eight focus areas identified through the current and previous SEA processes for wind and solar energy. The assessment includes mapping of absolute features (Section 4.2.2.1), as well as the refinement of buffer zones surrounding these features (Section 3.1) and the relative sensitivity mapping of the features following a four-tier sensitivity class approach (Section 4.3).

Heritage resources mapped for this study include recorded tangible heritage resources (structures older than 60 years, archaeological and burial sites) as per the data sources provided by the CSIR and SANBI supplemented by the listed UNESCO World Heritage sites and the cemetery database of the genealogical society of South Africa (Table 4) as well as paleontological sensitivity as defined by the Phase 1 SEA. The heritage mapping and assessment is based on two main considerations: firstly, the potential for palaeontological finds associated with underlying geology (i.e. rock units); and secondly the occurrence of recorded archaeological and historical features.

The integrated heritage sensitivity maps provide a background to the possible heritage sensitivities in each of the focus areas, which can inform further planning and implementation. The sensitivity mapping was then linked to development protocols (Section 7) with minimum requirements for heritage studies needed for the approval of a Renewable Energy (RE) facility by the responsible heritage resources authority for each specific focus area.

Based on the results of the assessment the sensitivity of each of the focus areas is summarised in Table 1 (known heritage resources in each Focus area) and Table 2 with sensitivity rated as very high, high, medium and low sensitivity. The grading used in Table 2 is specified in the National Heritage Resources Act (Act 25 of 1999) and associated guidelines, with a brief description of the grades provided in Table 3.

Table 1: Summary of recorded heritage resources within the focus areas

Focus Area	High PS*	Medium PS*	Grade I	Grade II	Grade IIIA	Grade IIIB	Grade IIIC	Recorded Burial Sites
1 Mpumalanga Middelburg Emalahleni Area	x	X		7	12	14	12	8
2. North West Klerksdorp, Viljoenskroon and Potchefstroom Area	x	X		15				12
3. Northern Cape Danielskuil, Postmasburg, Lime Acres and Hotazel area	x		1 site (recorded as 11 sites on SAHRIS all relating to Kathu Pan)	4				3
4. Free State Henneman, Virginia, Wesselsbron and Allanridge area	x	X		4	1		1	3
5. Eastern and Western Cape Aberdeen Beaufort West Area		X		10	2		1	7
6. Western Cape Vredendal area		X		1				13
7. Northern Cape Prieska Copperton Area	x	X		1	2	3		6
8. Northern Cape Riemvasmaak Conservancy and Loeriesfontein area	x	X						0

** Palaeontological Sensitivity – PS*

Table 2: Summary of heritage sensitivity of each focus area

Focus Area	Summary of heritage sensitivity
1 Mpumalanga Middelburg Emalahleni Area	Sections of the focus area are of medium and high palaeontological sensitivity. Heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
2. North West Klerksdorp, Viljoenskroon and Potchefstroom Area	Sections of the focus area are of medium and high palaeontological sensitivity. Heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
3. Northern Cape Danielskuil, Postmasburg, Lime Acres and Hotazel area	Small sections in the focus area are of high palaeontological sensitivity. Heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
4. Free State Henneman, Virginia, Wesselsbron and Allanridge area	Sections of the focus area are of medium and high palaeontological sensitivity. Heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided with the required protocols are in place as listed in Section 7.
5. Eastern and Western Cape Aberdeen Beaufort West Area	Small sections in the focus area are of medium palaeontological sensitivity. A small number of heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
6. Western Cape Vredendal area	Small sections in the focus area are of medium palaeontological sensitivity. A small number of heritage sites with high sensitivity are localised which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
7. Northern Cape Prieska Copperton Area	Sections of the focus area are of medium and high palaeontological sensitivity. There are no heritage sites with high sensitivity which makes large areas suitable for RE facilities, provided the required protocols are in place as listed in Section 7.
8. Northern Cape Riemvasmaak Conservancy and Loeriesfontein area	Sections of the focus area are of medium and high palaeontological sensitivity (mostly limited to the southern extent). These are not exclusion zones and are suitable for RE facilities, provided the required protocols are in place as listed in Section 7 of the report. No heritage sites of high significance are on record.

2. INTRODUCTION

South Africa has a long and complex pre-colonial history spanning from the Early to Later Stone Age (with a sequence of more than 2 million years, (Lombard *et al* 2012)) followed by the Iron Age (200 - 1820 AD (Huffman 2007)) to the historical period when written documents became available. The final layer of significant heritage that could be affected by RE facilities comprises the layered cultural landscape that reflects the interplay between people and the landscape through time. Any development, particularly in rural areas that have not been subject to intensive, recent human activity, poses a possible risk to heritage resources that may exist there. These resources and sites (historical, archaeological and palaeontological heritage) are unique and non-renewable as defined in section 3 of the National Heritage Resources Act (Act No 25 of 1999) (NHRA) and as such any impact on such resources must be seen as significant. Heritage resources are given "general protection" from damage, destruction or alteration without a permit in terms of, sections 34, 35, 36 of the NHRA, Act No 25 of 1999.

The NHRA (sections 34, 35 and 36) and the KwaZulu-Natal Heritage Act (No 10 of 1997) (KZNHA) protects all heritage resources, including places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic, technological value or significance from damage, destruction or alteration. To this end, Heritage Impact Assessments (HIAs) are required by law as defined by section 38 (1, 2 and 8) of the NHRA and section 27 of the KZNHA. The HIA's should make provision for the protection of all heritage components including: archaeology, shipwrecks and underwater heritage, battlefields, graves, structures over 60 years, living heritage, the collection of oral histories, historical settlements, landscapes, geological sites, and palaeontological sites and objects.

In South Africa, the South African Heritage Resources Agency (SAHRA), and the nine Provincial Heritage Resources Authorities (PHRAs) are responsible for managing the impacts to heritage resources posed by all kinds of developments, RE facilities included. Several RE facilities are on record at SAHRA's South African Heritage Resources Information System (SAHRIS), listed in various provinces throughout South Africa. Due to the extent of these developments all have been subjected to either Heritage Impact Assessments (HIA's), Archaeological Impact Assessments (AIA's) or Palaeontological Impact Assessments (PIA's).

Globally, in as much as heritage legislation and heritage resources are context specific, the development of RE facilities are subject to legislation. As such, several international studies and assessments recognised the expansion of RE facilities as a potential threat to cultural and heritage resources including scenic and cultural landscapes (Broström & Svahnström 2011, Chias & Abad 2014).

3. SCOPE OF THIS STRATEGIC ISSUE

3.1 Scope of the study

The scope of this study is focused on mapping of known heritage resources (absolute features) and heritage sensitive areas (rock units that are potentially of palaeontological sensitivity) within the eight focus areas. The mapping data is based on the existing environmental wall to wall mapping outputs produced by the CSIR and SANBI with respect to features linked to heritage. Secondly, the chapter includes a high-level assessment (scoping level) of the eight focus areas to summarise the heritage character of these areas. Based on the distribution of absolute heritage features and the subsequent four-tier sensitivity mapping (according to the rating scale provided for the study) of the eight focus areas, this chapter assists with determining the specific sensitivities and possible impacts on heritage resources within these areas. This assessment will enable users of the DEA screening tool to determine the type of assessments required as a minimum in each of the focus areas.

3.1.1 Methodology

The methodology developed for this study consists of the mapping of the GIS based four-tiered consolidated sensitivity maps of all absolute sensitivity features, showing the location and spatial extent for each sensitivity feature and associated buffering. This mapping was derived from the following main components which are explained below:

a) *Review of the wall to wall environmental sensitivity data produced by SANBI;*
b) *Review and confirmation of the features and the four-tier sensitivity mapping (i.e. Very High, High, Medium or Low);*
c) *Data analysis and mapping to develop a set of absolute maps;*
d) *Identification of specific impact sensitivities for each focus area; and*
e) *Development of guidelines for the focus areas.*

a) Review of the wall to wall environmental sensitivity data produced by SANBI.

The existing data provided by SANBI (available as at January 2018) was based on data captured into a Geographic Information System (GIS) providing a spatial representation of the position of known heritage resources throughout South Africa based on data sources, as expanded upon in Section 3.2.

b) Review and confirmation of heritage features and the four-tier sensitivity mapping (i.e. Very High, High, Medium or Low).

The analysis of palaeontological sensitivity within the various Focus Areas presented here is based largely on the 1: 1 000 000 scale geological maps (Fourie *et al* 2014). The finer-scale 1: 250 000 maps are available on SAHRIS linked to a palaeontological sensitivity map for South Africa and although these two systems are largely congruent (Fourie *et al* 2014) it should also be consulted. It should be noted that the dataset provided is not completely comprehensive and the data captured is not always accurate.

The various heritage site classifications (i.e. archaeological sites, palaeontological sites, built environment sites, burial grounds and monuments, underwater heritage sites, etc) were not used to further separate the categories of heritage, as the variable involved with the sites are too large to utilise at the current high-level mapping exercise.

By implementing the requirements for the grading of heritage resources as outlined in Section 7 of the NHRA and its Regulations, absolute features were given a sensitivity rating based on the national grading system. This rating system was then linked to the four tier sensitivity rating system as required for the SEA study (Table 3).

Table 3: National Grading system linked to the four-tier sensitivity rating

Field Rating	Grade	Heritage Significance	Mapping Colour	Recommended Mitigation
National and International Significance	Grade 1	Outstanding Universal Value	Dark red - Very High Sensitivity	Conservation; national site nomination
Provincial Significance	Grade 2	Outstanding Universal Value	Dark red - Very High Sensitivity	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Red - High Sensitivity	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Red - High Sensitivity	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	Grade 3C	High/medium significance	Orange - Medium Sensitivity	Mitigation before destruction
Generally Protected B (GP. B)	Grade 3C	Medium significance	Orange - Medium Sensitivity	Recording before destruction
Generally Protected C (GP.C)	Grade 3C (Artefacts)	Low significance	Green - Low Sensitivity	Destruction

c) Data analysis and mapping to develop a set of absolute maps

The data provided to the author was represented in two GIS sets:

- *Point – Structures, cemeteries, archaeological sites, etc*
- *Polygon – Areas such as World Heritage Sites (WHS).*

After mapping of the data sets, absolute features were then buffered utilising the ArcMap geoprocessing buffer application. Guidelines for buffer distances were provided by SAHRA and are summarised in Table 4. The four-tier sensitivity mapping does not constitute a legal exclusion zone but only serves as a guideline with regards to sensitivity zones surrounding heritage resources.

Table 4: Recommended buffer zones provided by SAHRA for both wind and solar PV developments

Site Type	Buffer Zone
Grade 1	*5 km from either the official point or official boundary of the site*
Grade 2	*2 km from either the official point or official boundary of the site*
Grade 3A	*150 m from the provided point*
Grade 3B	*100 m from the provided point*
Grade 3C	*50 m from the provided point*
Ungraded/no field rating provided	*100 m from the provided point*

d) Identification of specific impact sensitivities for each focus area

Identification of possible impacts associated with RE facilities focused on the large body of South African literature that included HIAs, AIAs and PIAs.

e) Development of guidelines for the focus areas

Cognisant of the requirements of Section 38 of the NHRA, and the Regulations as promulgated under the National Environmental Management Act (NEMA, No. 17 of 1998), a set of development guidelines (protocols) were formed and linked to the sensitivities as identified in this study.

3.2 Data Sources

The scope of the data gathered for this strategic level scoping assessment focused on the existing environmental wall to wall mapping outputs produced and transferable to spatially representable data that was provided by the CSIR and SANBI. The primary data sources utilized for this study are listed in Table 5. This data was supplemented by consultation of the updated SAHRIS (2018) database.

Table 5: Data Sources used for the project

Data Source	Source and Date	Description of Data
Council for Geoscience	1984 Council for Geoscience, Pretoria, 1:1 000 000 Geological Maps	Palaeontological heritage resources
South African Protected Areas Database (SAPAD)	Q2, 2017, South African National Parks (SANParks) and Provincial.	World Heritage Sites (Core)
UNESCO	2018 UNESCO Website and SAHRIS	World Heritage Sites and Sites on the Tentative List
SAHRA	2018 SAHRIS updated information	Data is in the form of HIAs, AIAs and PIAs, as well as declared and graded sites.

3.3 Defining Heritage resources

Heritage management is governed by the National Heritage Resources Act (Act 25 of 1999, NHRA) and includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes. Heritage resources are defined in Section 2 of the NHRA as “any place or object of cultural significance”, where cultural significance can be understood as meaning “aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance”. Heritage resources together constitute the National Estate, as defined in Section 3 of the NHRA, and each constituent resource enjoys recognition and protection under the Act.

Heritage resources together constitute the National Estate, and each resource enjoys recognition and protection under the Act. The types of heritage resources included in the National Estate as provided in Section 3(2) of the NHRA include:

a) *places, buildings, structures and equipment of cultural significance;*
b) *places to which oral traditions are attached or which are associated with living*
c) *heritage;*
d) *historical settlements and townscapes;*
e) *landscapes and natural features of cultural significance;*
f) *geological sites of scientific or cultural importance [these are excluded from the*
g) *present study as there is as yet no comprehensive national or provincial*
h) *database of significant geological sites available];*
i) *archaeological and palaeontological sites;*
j) *graves and burial grounds, including—*
   i. *ancestral graves;*
   ii. *royal graves and graves of traditional leaders;*
   iii. *graves of victims of conflict;*
   iv. *graves of individuals designated by the Minister by notice in the Gazette;*
   v. *historical graves and cemeteries; and*
k) *vi. other human remains which are not covered in terms of the Human Tissue Act (No. 65 of 1983);*
l) *h) sites of significance relating to the history of slavery in South Africa;*
m) *movable objects [excluded from this study because by their nature they are not*
n) *tied to any particular place on the landscape]*

Section 34 of the NHRA deals with structures that are older than 60 years. Section 35(4) of the NHRA deals with archaeology, palaeontology and meteorites. Section 36 of the NHRA, deal with human remains older than 60 years. Unidentified/unknown graves are also handled as older than 60 years until proven otherwise. Section 37 deals with Public monuments and memorials.

3.4 Assumptions and Limitations

This assessment is based on the distribution of known heritage resources, largely as captured and mapped on SAHRIS and supplemented by 1: 1 000 000 scale geological maps as provided by the CSIR and SANBI. Although this information is quite extensive the following limitations apply:

Table 6: Limitations applicable to this assessment

Limitation	Application to this study	Way Forward
High level of assessment	It should be noted that on a high level all resources cannot be accurately recorded.	Heritage resources should be assessed at ground level and due to the sub surface nature of heritage resources monitoring of projects will also be required.
Not all information is captured on SAHRIS	Many previous heritage and palaeontological studies were conducted and submitted in hard copy and are not available electronically	Hard copies of available information will have to be studied prior to development.
Accuracy of Information	Many heritage resources appear to be inaccurately mapped or graded	Information will have to be ground truthed on a project by project basis.
The absence in some areas of previous commercial or research heritage work	This study only included known primary and secondary heritage resources and although large areas are not indicated as of heritage sensitivity, this is not necessarily due to a lack of resources but rather a lack of coverage.	Field surveys to be conducted during heritage studies as required for proposed wind and solar PV projects.
Local and provincial heritage registers and inventories are not captured or available on SAHRIS	National Museum data sets of heritage resources are not always electronically available.	Consultation with local museums as part of field surveys.
UNESCO Boundaries are poorly defined	Not all UNESCO site boundaries are available on the dataset	Site boundaries will have to be considered prior to project specific assessment.
Palaeontological information is on 1: 1 million scale maps	Many rock formations have small outcrop areas that may not be reflected in the 1: 1 million scale maps	Site specific palaeontological sensitivities will have to be assessed in conjunction with the SAHRIS Palaeontological Sensitivity map.
Cultural Landscapes	Cultural landscapes did not form part of the dataset provided and could not be assessed, however no formally declared Cultural Landscapes form part of the focus areas.	Site specific cultural landscape assessments should be conducted where necessary as part of HIA's.
The assessment lacks dedicated, specialist attention in certain fields	Cultural landscape, palaeontology and built environment specialists were not included as part of the heritage team for this assessment	Specialist studies should be included in assessments conducted for individual projects where applicable.
Places associated with living heritage	Living heritage is difficult to address without extensive public participation	Public participation should be conducted prior to development.
Lack of field work	This assessment was conducted as a high-level desk-top assessment and unidentified sites could occur in the focus areas due to lack of research in certain areas.	RE facilities must be subjected to a field survey prior to development.
Genealogical society database	This electronic database of burial sites across the country was included in this report	The Genealogical Society database is continually updated and should be consulted for each project.

3.5 Relevant Regulations and Legislation

Table 7: Relevant local legislation

Instrument	Objective
Provincial regulations	
PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA, 2003	Regulating process of permitting for heritage resources and consultation regarding protected areas.
KZN Heritage Act No. 4 Of 2008	Provide for the conservation, protection and administration of both the physical and the living or intangible heritage resources of the Province of KwaZulu-Natal.
National Instruments	
National Heritage Resources Act 25 of 1999	The NHRA is the overarching legislation that protects and regulates the management of heritage resources in South Africa. It provides for the identification, conservation, protection and promotion of heritage resources for present and future generations.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The NEMA, as amended, was set in place in accordance with Section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making on issues affecting the environment.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PPA)	The NEM: PPA provides for South Africa's system of protected areas. It establishes the mechanisms for the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes. It makes further provisions for intergovernmental co-operation and public consultation in matters concerning protected areas to promote the continued existence, governance and functions of the National Parks.

Section 38 of the NHRA (Act 25 of 1999) stipulates the process for assessing the impacts of developments on heritage resources. In terms of section 38(1), at the initial stages of a development where no NEMA process is followed, the relevant heritage authority must be notified of the proposed development. The heritage authority should then respond within 14 days indicating whether or not heritage resources are likely to be impacted by the development, and indicate if a Heritage Impact Assessment in terms of section 38(3) is required. Section 38(3) of the NHRA details the information that must be included in a Heritage Impact Assessment (HIA).

In terms of Section 38(8) of the NHRA (for any proposed development that requires an Impact Assessment in terms of the National Environmental Management Act (NEMA)) the consenting authority must ensure that the evaluation of impacts to heritage resources is completed, as part of the impact assessment. The assessment must fulfil the requirements of the relevant heritage resources authority in terms of section 38(3) of the NHRA and any comments and recommendations of the relevant heritage resources authority with regard to such development must have been considered prior to the granting of the consent.

All archaeological and palaeontological specialist work that forms part of the requirements stipulated in section 38(3) of the NHRA should conform to international best practice as well as comply with SAHRA minimum standards for the archaeological and palaeontological components of impact assessment reports (2007) and the minimum standards for Phase 2 palaeontological studies (2013).

As described in the SAHRA minimum standards, the process of assessment for the archaeological (AIA) or palaeontological (PIA) specialist components of heritage impact assessments usually involve:

1. Initial pre-assessment (scoping) phase, where the specialist establishes the scope of the project and terms of reference for the developer.
2. Phase 1 Impact Assessment/Specialist Report:
    a. Identifies heritage resources;
    b. Assesses their significance;
    c. Comments on the impact of the development
    d. Makes recommendations for their mitigation or conservation,
    e. OR: A Letter of Recommendation for Exemption (if there is no likelihood that any sites will be impacted).
3. Phase 2 Mitigation/Rescue, which involves planning the protection of significant heritage resources via excavation/collection at sites that may be lost.
4. Phase 3 Heritage Site Management Plan (for heritage conservation), may be required in rare cases where the site is so important that development will not be allowed. Developers may also choose to, or be encouraged to, enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

The SAHRA minimum standards also specify three points during development at which SAHRA or the relevant heritage resources authority may be approached for permission to disturb a site during the impact assessment process. Those three permitting requirements are:

1. 'Shovel-Test Permits': in particular circumstances ‘shovel-test’ permits may be issued prior to or immediately after a Phase 1 survey (e.g. for testing the extent of coastal middens or collecting restricted ceramic samples for identification from Iron Age sites).
2. 'Mitigation Permits': these are generally issued for excavation or collection of samples and assess sites that will be impacted by the development. These are issued to the specialist before the Phase 2 study, and after assessment of the Phase 1 report.
3. 'Destruction Permits/Permission' and/or 'Interpretation Permits': these are generally issued to the developer after assessment of the Phase 2 report (but are usually filled in by the archaeologist). ‘Interpretation Permits’ refer to situations where the addition of boardwalks or notice boards may impact on the site and the permitting process allows for the proposed actions to be discussed and possibly modified to better protect the site(s).

3.6 Key International Regulation and legislation

Cognisance was taken of the following key instruments.

Table 8: Key international instruments

Instrument	Objective
International Instrument	
Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972	Signatories to this Convention recognize the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage.
The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013	The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places).
World Heritage Convention Act, 1999 (Act No. 49 of 1999) (WHCA)	The WHCA makes provision for the inclusion of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Convention concerning the Protection of the World Cultural and Natural Heritage (*i.e. World Heritage Convention [WHC]*) of 1972, into South African law.

4. KEY HERITAGE ATTRIBUTES AND SENSITIVITIES OF THE STUDY AREAS

Section 4 provides a general background to the heritage character of the heritage resources within each of the focus areas. This background description is summarised in Table 9.

4.1 Focus Area Description

Table 9: Brief description of Focus Areas 1 to 8

Site	Brief description
1 Mpumalanga Middelburg Emalahleni Area	Focus area 1 comprises approximately 1 009 886 hectares in the Middelburg Emalahleni Area, Mpumalanga. The focus area stretches from Belfast in the east to Bronkhorstspruit in the west with the northern extent bordered by Loskop Dam and southern extent by the town of Ogies. The area is mostly highveld and is characterised by coal mining. **Heritage** Very few Early Stone Age (ESA) sites are on record for Mpumalanga. An example where ESA tools have been discovered located outside of the study area is at Maleoskop (Bergh 1999) on the farm Rietkloof, which is one of only a handful of such sites in Mpumalanga. Another example also outside of the study area is at Bushman Rock Shelter (Mason 1969, Wadley 1987), a well-known site in the Ohrigstad district. This cave was excavated twice in the 1960s by Louw and later by Eloff. The Middle Stone Age (MSA) layers show that the cave was repeatedly frequented over a long period. Lower layers have been dated to over 40 000 Before Present (BP), while the top layers date to approximately 27 000 BP (Esterhuysen and Smith in Delius, 2007). MSA material is found widely across South Africa and some MSA manifestations can be expected in the study area. Sites dating to the Later Stone Age (LSA) are found in numerous rock shelters throughout Eastern Mpumalanga, where some of their rock art is still visible. A number of these shelters have been documented in and around the focus area, these include areas such as Witbank, Ermelo, Barberton, Nelspruit, White River, Lydenburg and Ohrigstad (Schoonraad in Barnard, 1975; Bornman, 1995 and Delius, 2007). Several Iron Age sites dating to the Early, Middle and Late Iron Age are found in the study area and the following ceramic *facies* are represented: • Marateng AD 1650 – 1840 (Collett 1982) • Doornkop AD 750 – 1000 (Whitelaw 1996, Huffman 2007) • Klingbeil AD 1000 – 1200 (Evers 1980, Huffman 2007) The study area is well known for the extensive Late Iron Age stone walled settlement's that are found along the Mpumalanga escarpment (Collett 1982; Marker & Evers 1976). This type of walling is referred to as Badfontein walling (Huffman 2007) emphasizing the centre/side axis of the Central Cattle Pattern associated with the Koni in this area (Rasmussen 1978). Rock engravings in the same area also depict this settlement pattern (Maggs & Ward 1995; Van Hoepen 1939).

Site	Brief description
	Sites dating to the historic period occur sporadically in the study area. These are mostly farming related, although some mining sites occur as well (e.g. the old Albion Colliery, dating to the 1940's). In the Waterval Boven and Waterval Onder areas sites relating to the early railway history of South Africa occur (De Jong *et al* 1988) with the five Arch bridge, close to Waterval Boven, being the most well-known. During the Anglo-Boer War, a number of battles took place in the region, for example the battle that took place on the farm Wilmansrust, in June 1901. During this clash, more than 50 British troops were killed. The Witkloof Memorial also attests to the conflict that took place in the area and specifically the Machadodorp area played an important role during the Anglo Boer War until 1902 (Jooste 1936). The south-eastern Highveld is characterised by vernacular architecture in which sand stone and ferricrete was used to build farmsteads and dwellings in urban as well as in rural areas (Pistorius 2006). Heritage resources (45 sites) on record (based on the data obtained from SAHRIS) in the study area include buildings, railway infrastructure, stone walling, archaeological sites and burial sites **Palaeontology** A wide range of rock units are represented in focus area 1 rated of medium and high palaeontological Sensitivity.
2. North West Klerksdorp, Viljoenskroon and Potchefstroom Area	Focus Area 2 stretches from Parys in the east to just west of Klerksdorp with Viljoenskroon in the south and Potchefstroom in the northern extent and comprises around 851 010 hectares. The unique surrounding in which the town of Parys is situated, had its origin roughly around 2 000 million years ago when a giant meteorite struck the earth just south east of Vredefort in the Free State Province (UNESCO). The impact structure that was subsequently formed has come to be known as the Vredefort Dome (a World Heritage Site of National Significance), the oldest and largest meteorite impact site on earth, measuring about 200km in diameter. This is a Grade 1 site. **Heritage** The Vaal Gravels are known to contain Early and Middle Stone Age Artefacts and some Rock Engraving sites are on record around the greater study area. The rock engraving site of Leeuwkuil is described by Hollmann (1999) as being located on a small island in the Vaal River. Engravings are concentrated on the south-eastern part of the peninsula. The images are dominated by Eland and other antelope, which appeared to be in the San hunter-gatherer engraving tradition (Hollmann, 1999). Pistorius (2007) discusses the Redan rock engraving site which contains up to 244 rock engravings. These engravings depict animals, geometric designs as well as San weapons (Du Piesani 2014). The well-known rock art site of Bosworth that also included Later Stone Age artifacts (Mason 1962) is located to the north of Klerksdorp. In addition to these Stone Age sites the study area contains several sites dating to the Iron Age and the following ceramic *facies* are represented in the study area: Mzonjani Facies - AD 450 – 750 (Huffman 2007) Ntsuantsianatsi - AD 1450 – 1650 (Taylor 1979, Mason 1968) Olifantspoort - AD 1500 – 1700 (Mason 1986 and Huffman 2007) Uitkomst - AD 1650 – 1820 (Huffman 2007)

Site	Brief description
	Thabeng - AD 1700 – 1840 (Mason 1986 and Huffman 2007) Buispoort- AD 1700 – 1840 (Huffman 2007) Several Later Iron Age stone walled sites categorised as Type N and Klipriviersberg walling (Taylor 1979) dating to between 1500 and 1700 AD are also on record for the study area with Molokwane settlements stretching across the hilly areas of Gauteng west to Zeerust (Boeyens 2000; Huffman 1986; Mason 1986; Pistorius 1992; Taylor 1979). They date from the late 18th century to the beginning of the Historic Period (Huffman 2007). In addition, Iron Age sites such as Palmietfontein (White 1977), Platberg (Wells 1933) and Buisfontein (Thabeng) (Maggs 1976) have also been recorded in the area. During the Second Boer War (1899-1902), there were many battles in the Klerksdorp area and the area also housed a large concentration camp. Famous battles in the Klerksdorp area is the Battle of Ysterspruit and Rooiwal. Just under a thousand graves of the victims of the concentration camps, namely Boer women and children, can still be visited today in the old cemetery just outside of Klerksdorp. Klerksdorp was connected by rail to Krugersdorp on 3 August 1897 and to Kimberley in 1906. In terms of the built environment, historic farmsteads associated with the settlement of Voortrekkers and structures older than 60 years can be expected. Graves and cemeteries are widely distributed across the landscape and can be expected anywhere. A number of historical graveyards are known from the area some of which have been declared National and Provincial Heritage Sites (e.g. Ventersdorp and Potchefstroom cemeteries). Family cemeteries can be expected close to farmsteads with informal cemeteries widespread in informal settlements. Unmarked graves are associated where Iron Age Settlements occur. **Paleontology** A wide range of rock units are represented in focus area 2 rated of medium and high palaeontological Sensitivity.
3. Northern Cape Danielskuil, Postmasburg, Lime Acres and Hotazel area	The study area comprises 1 075 628 hectares with Danielskuil in the east stretching to the west of Postmasburg. It ends south of Lime Acres and to the north of Hotazel. **Heritage** The larger study area has a wealth of pre-colonial archaeological sites (Beaumont & Morris 1990; Morris & Beaumont 2004). Famous sites in the region include the world renowned Wonderwerk Cave to the north of the study area. Closer to Kuruman two shelters on the northern and southern faces of GaMohaan (in the Kuruman Hills north west of the town) contain Later Stone Age remains and rock paintings. Rock art is known to occur at Danielskuil to the north and on Carter Block itself (Morris 2008). Middle Stone Age material occur widely in the area. Archaeological surveys have shown rocky outcrops and hills, drainage lines, riverbanks and confluences to be prime localities for archaeological finds and specifically Stone Age sites, as these areas where utilized for settlement of base camps close to water and hunting ranges. Studies in close proximity to the study area collaborates this e.g. Henderson *2005,* Webley 2010, Fourie 2011.

<table>
<tr><th>Site</th><th>Brief description</th></tr>
<tr><td></td><td>Iron Age expansion southwards past Kuruman into the Ghaap plato and towards Postmasburg is dated to the 1600’s (Humphreys, 1976 and Thackeray, 1983). Definite dates for Tswana presence in the Postmasburg area are around 1805 when Lichtenstein visited the area and noted the mining activities of the Tswana (probably the Thlaping) tribes in the area. The area of Danielskuil was named by the Thlaro as Thlaka la tlou (reeds of the elephant) and with the Thlaping they settled the area from Campbell in the east to Postmasburg and towards the Langeberg close to Olifantshoek in the north west before 1770 (Snyman, 1988). The Korana expansion after 1770 started to drive the Thlaro and Thlaping further north towards Kuruman (Shillington, 1985).

Heritage resources (16 sites) on record on SAHRIS in the study area include the well-known Kathu Pan (a declared Grade 1 site, as a result of the occurrence of palaeontological features and early stone age artefacts) as well as cemeteries, structures (including an Anglo Boer War Blockhouse at Danielskuil and the Kuruman Moffat Mission Station dating to the 1820’s).

Postmasburg was named after Reverend J Postma in 1892. An old stone Reformed Church dating back to 1908 can still be found in the area. The Reverend Dirk Postma's statue can also be found in the town (http://www.southafrica.org.za).

The Army Battle School of the South African National Defence Force is situated at Lohatla outside Postmasburg since the early 1980’s. A gun known as 'Howitzer Gun' is located at the civic centre and honours the men of Potmasburg who died during the Second World War. (http://www.southafrica.org.za)

Palaeontology
A wide range of rock units are represented in focus area 3 rated of high palaeontological Sensitivity.</td></tr>
<tr><td>4. Free State

Henneman, Virginia, Wesselsbron and Allanridge area</td><td>Focus area 4 comprises around 463 531 hectares and includes Henneman to the east and to the south Virginia. It encompasses Wesselsbron to the west and to the north Allanridge, the biggest town in the study area is Welkom.

<u>Heritage</u>
The Bushmen were the earliest inhabitants of the Northern Free State. These people were aboriginal foragers, as well as hunters, and roamed the area for hundreds of years. Bantu-speaking tribes later moved into the area and the combined stress of white and black migration led to the expulsion of the Bushmen from this area over time (Coplan 2008: 118, 130-131).

Isolated MSA artefacts especially around pans can be expected but it is not anticipated that these finds will have conservation value.

No sites dating to the Early or Middle Iron Age have been recorded or are expected for the study area. Iron Age remains mostly consist of ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986). Similarly, Makgwareng ceramics belonging to the Blackburn Branch of the Urewe tradition were recorded (Dreyer 1992 and Maggs 1976).

Since the time that the early pioneers, or Voortrekkers, crossed the Orange River, the Free State developed steadily to the stage where it became an important contributor to South Africa’s food supplies. Some of the commodities that are produced here is maize, wheat, oil-bearing seeds, dairy products and meat. The Free State has however only more recently become important for its mining operations.</td></tr>
</table>

Site	Brief description
	The northern Free State is located within the area where some of the main operations of the Boer General, Christiaan De Wet, took place between 1899 and May 1900 when the war ended. De Wet, among the other Boer generals, realized that they could not win the war by conventional means, and spread out into small hit-and-run groups that inflicted serious casualties on the British armies. This is known as Guerrilla warfare. According to the source of De Bruin, the railway station of Hennenman was occupied by British troops on 11 May 1900. 6 Sites are on record on SAHRIS for Focus Area 4 and these include artefacts and structures as well as cemeteries. <u>Palaeontology</u> A wide range of rock units are represented in focus area 4 rated to be of medium and high palaeontological Sensitivity.
5. Eastern and Western Cape Aberdeen Beaufort West Area	Focus Area 5 comprises around 1 973 466 hectares with Aberdeen in the east and Beaufort West in the west. Middle Stone Age artefacts occur widely through South Africa as well as the Eastern Cape in the interior and the coast. Most notably, the type-site for the Howiesons Poort stone tool industry, Howiesons Poort rock shelter is situated close to Grahamstown. Surface scatters of Middle Stone Age stone artefacts are widely documented across the Eastern Cape landscape and have been reported from around the Graaff-Reinet area (Binneman *et al*. 2011b), and close to Aberdeen (Binneman 2009a, b). MSA surface scatters occur widely across the area (Binneman *et al* 2010; van Rhyneveld 2012) while Opperman (1989) excavated a shelter dating to this period. Therefor it is expected to find MSA scatters across the study area with the possibility of significant sites with deposit in shelters. The Later Stone Age archaeology of the area is rich and varied. Various studies recorded LSA material in shelters (Opperman 1982) and rock art within the study area (UP Space). Wind facility surveyed by Binneman et al (2010) recorded LSA artefact mostly as surface scatters with increased density around rocky outcrops and koppies. LSA material is therefore expected as surface scatters with the possibility of significant sites with deposit in shelters. No Sites dating to the Middle or Late Iron Age have been recorded or are expected for the study area. The study area is located on the periphery of known Iron Age distribution (Mitchel & Whitelaw 2005; Huffman 2007). Booth (2011) indicates that Aberdeen was formed in 1856 and has been declared an architectural conservation Town with numerous historical structures dating to the 1850's in Town. With the Magistrates Court and Post Office being a declared Provincial site. The area also played a role during the Anglo Boer War with Smuts and his forces operating in the area in 1901. 13 Sites area on record on SAHRIS including buildings and stone walled sites. Palaeontology Rock units are represented in focus area 5 rated of medium palaeontological Sensitivity.

Site	Brief description
6. Western Cape Vredendal area	Focus area 6 comprises 613 175 hectares and includes the greater Vredendal area. Many examples of artefacts dating to the ESA, MSA and LSA exposed by erosion have been recorded from the area (e.g. Kaplan, 2010; Orton 2010, 2011, 2012a). River floodplains have greater levels of erosion and artefacts are often well-concentrated in such areas. Along the Hol River, close to its confluence with the Olifants River, many flaked artefacts and a ground stone point were recorded by Orton and Hart (2011). The vicinity of the Varsche River has been very well studied and many archaeological sites occur in the area. There are also several limestone rock shelters (Orton et al. 2011a, 2011b; Orton 2012c; Steele et al. 2012, 2016) with cultural material. The Knersvlakte was avoided during historical times. Occupation of the region proceeded from the Olifants River on the southern edge of the Knersvlakte into the Hantam area to the east and northeast and the Kamiesberg Mountains of central Namaqualand to the north. Because of the difficulties of farming in the Knersvlakte historical farmsteads are scarce. Fransen (2004) considers there to be just one historical building of interest in the northern part of Vredendal. The original farmhouse probably pre-dated 1795 but was apparently demolished in the late 20th century (Orton 2017). 1 Heritage site is on record at SAHRIS comprising a Grade II site (Structure). **Palaeontology** A wide range of rock units are represented in focus area 6 rated of medium and high palaeontological Sensitivity.
7. Northern Cape Prieska Copperton Area	Focus area 7 comprises 1 032 658 hectares including the towns of Prieska, Alkantpan and Copperton. Beaumont et al. (1995: 240) observed that “thousands of square kilometres of Bushmanland are covered by a low-density lithic scatter”. These artefacts are generally very well weathered and mostly pertain to the ESA and MSA. Occasional LSA artefacts are also noted. What is noteworthy of the archaeological record of the area is the presence of pans which frequently display associated archaeological material. Of interest, is the work of Kiberd (2001, 2005, 2006) who excavated Bundu Pan, some 25 to 30 km northwest of Copperton. The site yielded ESA, MSA and LSA horizons and the artefacts were accompanied by warthog and equid teeth to name a few (Beaumont et al. 1995). To the northwest, west and southwest of Copperton several LSA sites have been investigated (Beaumont et al 1995; Smith 1995; Parsons 2003, 2004, 2007, 2008). Work on these sites led to a distinction between hunter-gatherer and herder sites, based on stone artefact assemblages (Beaumont et al. 1995). All these LSA sites have very few, if any, organic items on them. The only organic material found on sites like these is fragments of ostrich eggshell probably belonging to broken water containers. Such flasks have been widely recorded across the Northern Cape (Morris 1994). Due to the arid nature of the area historical occupation was scarce. In September 1822, W. J. Burchell passed through Prieska, as well as the area to the south and southwest thereof. Some 50km southwest of Prieska, he found a large muddy dam, which was situated in a very extensive hollow flat. This would become a lake in the rainy season. There was apparently still some clean water to be found. The area around this was hard and dry, and plentifully strewed with stones and low shrubs. Burchell passed through Prieska to the Orange River in the same month. He noted that none of the bushes exceeded a foot in height. Nearer to the Orange River, the travelling party found a group of Khoikhoi camped in a grove. Copperton was established in 1972.

Site	Brief description
	The study area includes 6 Heritage sites recorded on the SAHRIS database. **Palaeontology** A wide range of rock units are represented in focus area 7 rated of medium and high palaeontological Sensitivity.
8. Northern Cape Riemvasmaak Conservancy and Loeriesfontein area	Focus area 8 comprises of 1 322 063 hectares located to the South of the Riemvasmaak Conservancy and to the north of Loeriesfontein. The archaeology of the Northern Cape is rich and varied covering long spans of human history. Studies by Morris (2007) have indicated minimal finds of archaeological sites in the study area. Morris (2010) further notes that previous studies have indicated that substantial MSA scatters is fairly uncommon in the Bushmanland/Namaqualand areas while herder sites are more limited to sheltered and dune areas close to water sources such as pans and rivers. It is clear that the distribution of sites may be highly structured relative to resources, principally water (e.g. Beaumont et al. 1995) and on the crests of small hills mostly dating to the LSA. No heritage sites are on record on SAHRIS for this area. **Palaeontology** A wide range of rock units are represented in focus area 8 rated of medium and high palaeontological Sensitivity.

4.2 Feature Sensitivity Mapping

4.2.1 Identification of feature sensitivity criteria

Table 9 provides the sensitivity rating and buffer distances developed for this study.

Table 10: Sensitivity rating and buffers

Sensitivity Feature Class	Data Source and Date	Features	CSIR Sensitivity Rating	Buffer Distance	Review of sensitivity rating	Relevant Focus Areas	Methodology for sensitivity verification
UNESCO sites (Fulfilling Cultural Criteria)	**UNESCO website / SAHRA**	World Heritage Sites (Core)	Very high sensitivity	5 km	Very high sensitivity	2	The information from SAHRIS was used as dataset and the known World Heritage sites were added to the information. Included

Sensitivity Feature Class	Data Source and Date	Features	CSIR Sensitivity Rating	Buffer Distance	Review of sensitivity rating	Relevant Focus Areas	Methodology for sensitivity verification
							sites such as the Vredefort Dome Cultural Landscape was not on this dataset.
		Buffer around World Heritage Sites	High sensitivity	5 km	High Sensitivity	2	The information from SAHRIS was used as dataset and the known World Heritage sites were added to the information. Included sites such as the Vredefort Dome Cultural Landscape was not on this dataset.
		UNESCO tentative sites	High sensitivity	5 km	Very high sensitivity	2	The information from SAHRIS was used as dataset and the known World Heritage sites were added to the information. Included sites such as the Vredefort Dome Cultural Landscape was not on this dataset.
Heritage	South African Heritage Resources Agency (SAHRA)	Grade I sites	Very high sensitivity	5 km	Very high sensitivity	3	Information as per the SAHRIS dataset was used.
		Grade II sites	Very high sensitivity	2 km	Very high sensitivity	1, 2, 3, 4,5, 6, 7	Information as per the SAHRIS dataset was used.
		Grade IIIa sites	High sensitivity	150m	High Sensitivity	1,4,5,7	Information as per the SAHRIS dataset was used.
		Grade IIIb sites	High sensitivity	100 m	High Sensitivity	1,7	Information as per the SAHRIS dataset was used.
		Grade IIIc sites	High sensitivity	50 m	Medium Sensitivity	1,3,4,5,7	Information as per the SAHRIS dataset was used.

Sensitivity Feature Class	Data Source and Date	Features	CSIR Sensitivity Rating	Buffer Distance	Review of sensitivity rating	Relevant Focus Areas	Methodology for sensitivity verification
Palaeontological heritage resources	Council for Geosciences 2014	• Adelaide • Asbestos Hills • Boegoeberg Dam • Bothaville • Brulsand • Campbell Rand • Clarens • Drakensberg • Dwyka • Ecca • Elliot • Enon • Ghaap • Kameeldoorns • Koegas • Kuibis • Matsap • Molteno • Prince Albert • Rietgat • Schmidtsdrif • Schwarzrand • Stalhoek • Sultanaoord • Tarkastad • Vryburg • Whitehill • Witteberg	High sensitivity	100 m	High sensitivity	1,2,3,4,7,8	Not verified
		• Achab • Allanridge • Bidouw • Bredasdorp • Ceres • Concordia Granite • Dwyka	Medium sensitivity	50 m	Medium Significance	1,2,4, 5, 6,7,8.	Not verified

Sensitivity Feature Class	Data Source and Date	Features	CSIR Sensitivity Rating	Buffer Distance	Review of sensitivity rating	Relevant Focus Areas	Methodology for sensitivity verification
		• Fort Brown • Geselskapbank • Gladkop • Grahamstown • Hartebeest Pan Granite • Hoogoor • Kalahari • Kamieskroon Gneiss • Karoo Dolerite • Khurisberg • Konkyp Gneiss • Kookfontein • Korridor • Mesklip Gneiss • Modderfontein Granite/Gneiss • Naab • Nababeep Gneiss • Nakanas • Nardouw • Nuwefontein Granite • Rietberg Granite • Skoorsteenberg • Stinkfontein • Styger Kraal Syenite • Table Mountain • Tierberg • Volksrust • Waterford					

4.2.2 Absolute Feature maps

Heritage features were mapped based on the dataset obtained from the CSIR and SANBI. The absolute heritage features include sites on the provided datasets and include natural features, archaeological sites as well as structures and burial sites.

The sites are mapped according to site types, i.e. whether the sites are proposed for solar only (Focus areas 1 to 4), wind only (Focus area 5), or wind and solar (Focus areas 6 to 8).

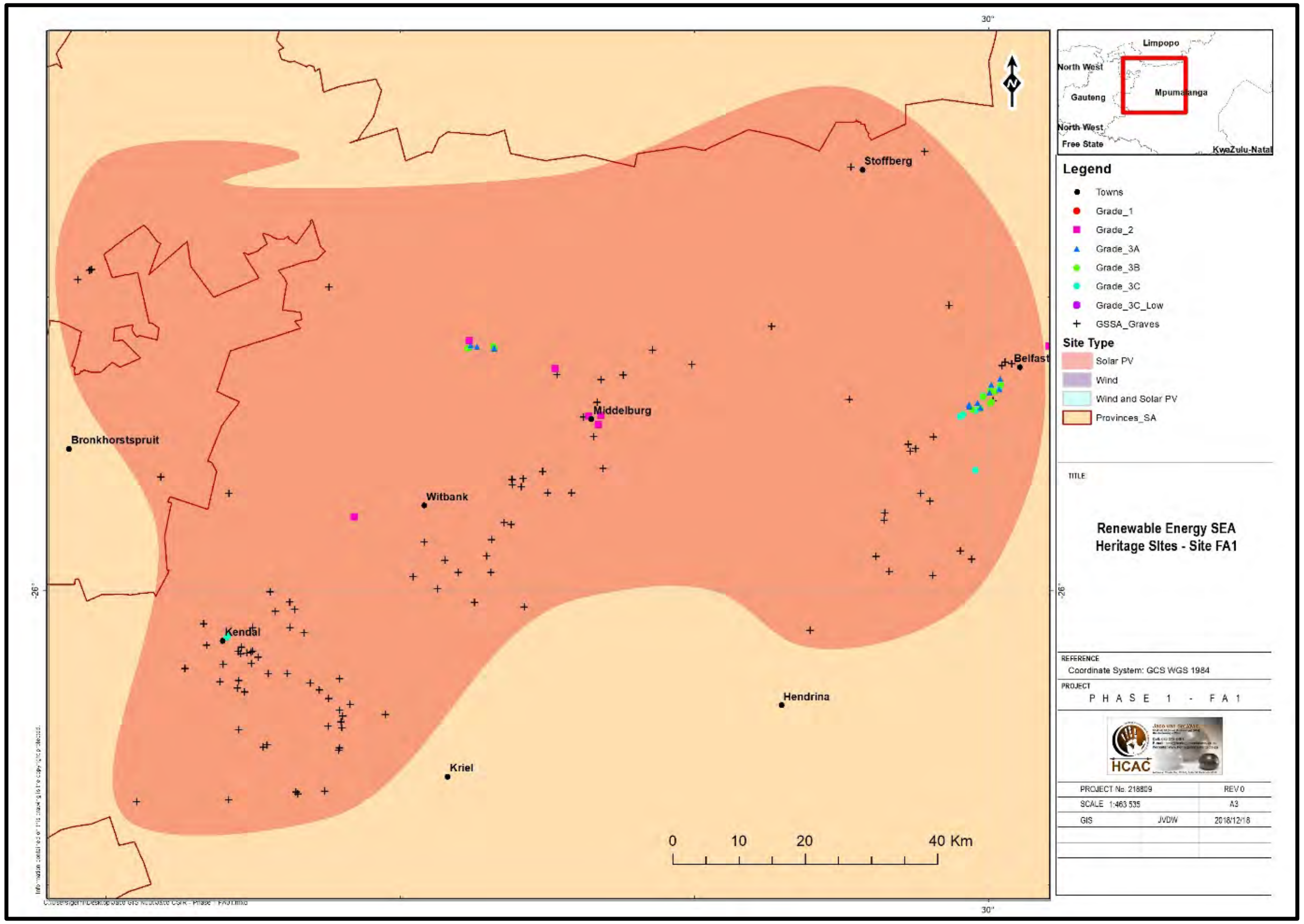

Figure 2. Focus Area 1 showing the heritage features mapped onto the solar PV site type

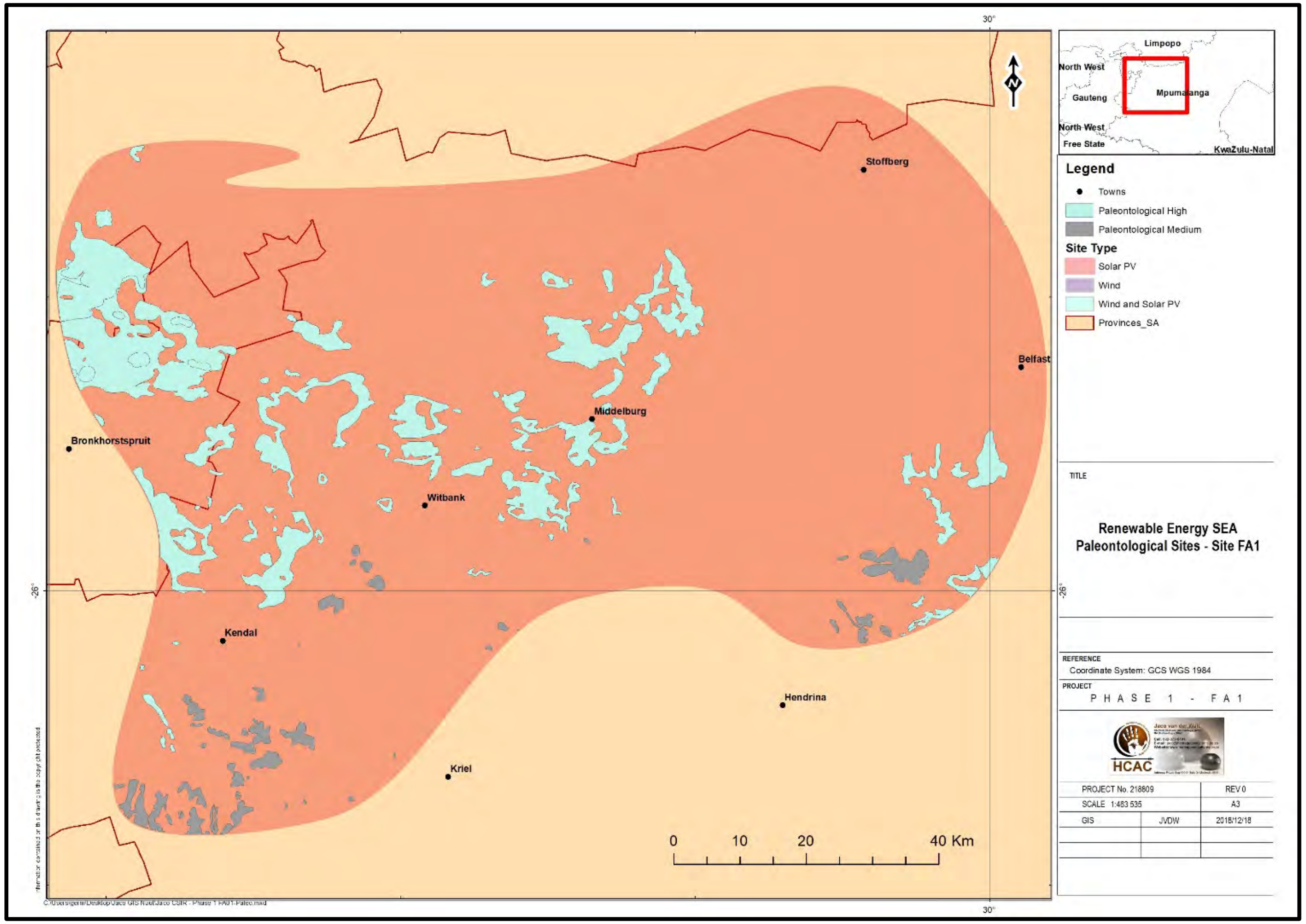

Figure 3. Focus Area 1 Palaeontological sensitivity.

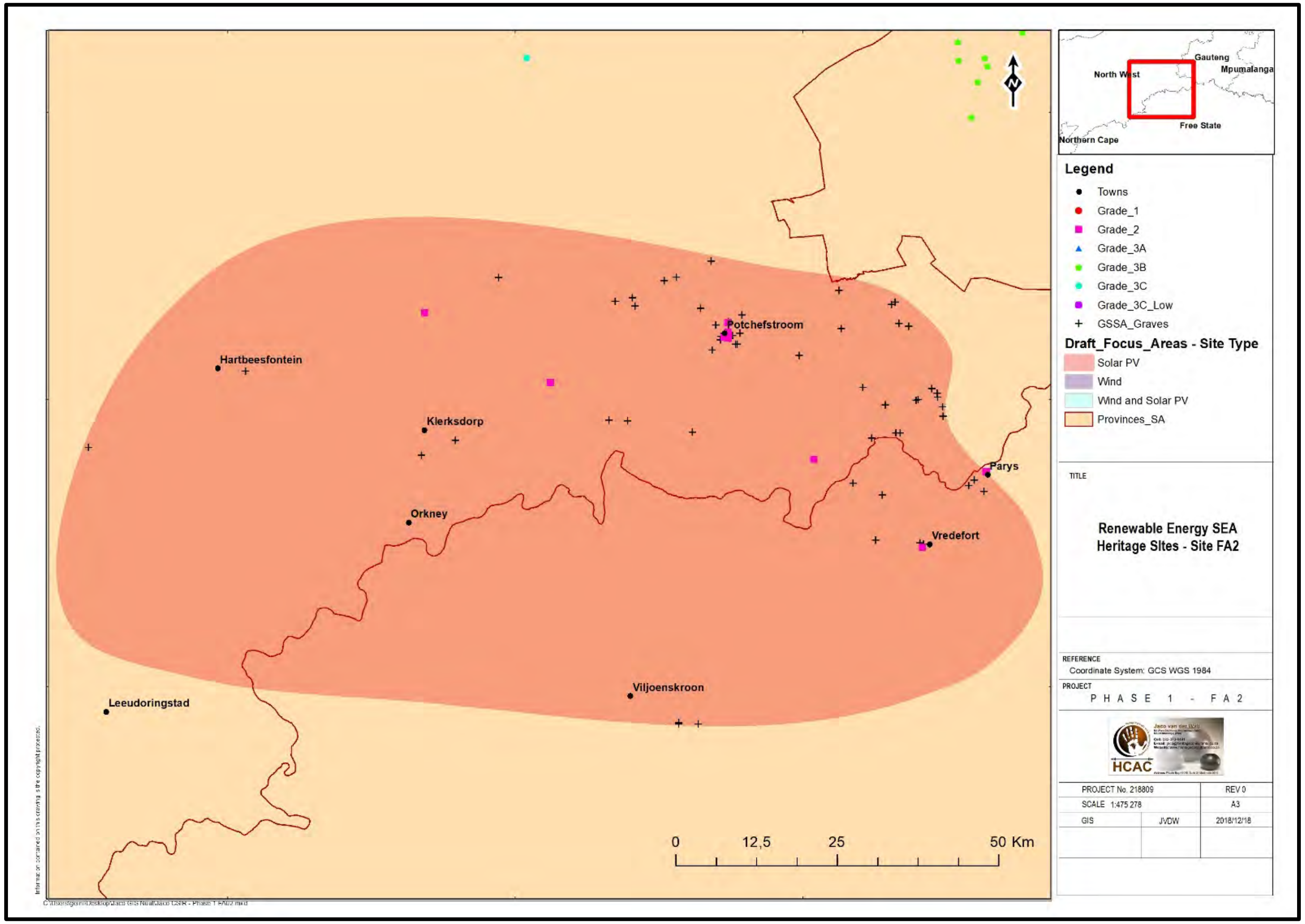

Figure 4. Focus Area 2 showing the heritage features and palaeontological units mapped onto the solar PV site type

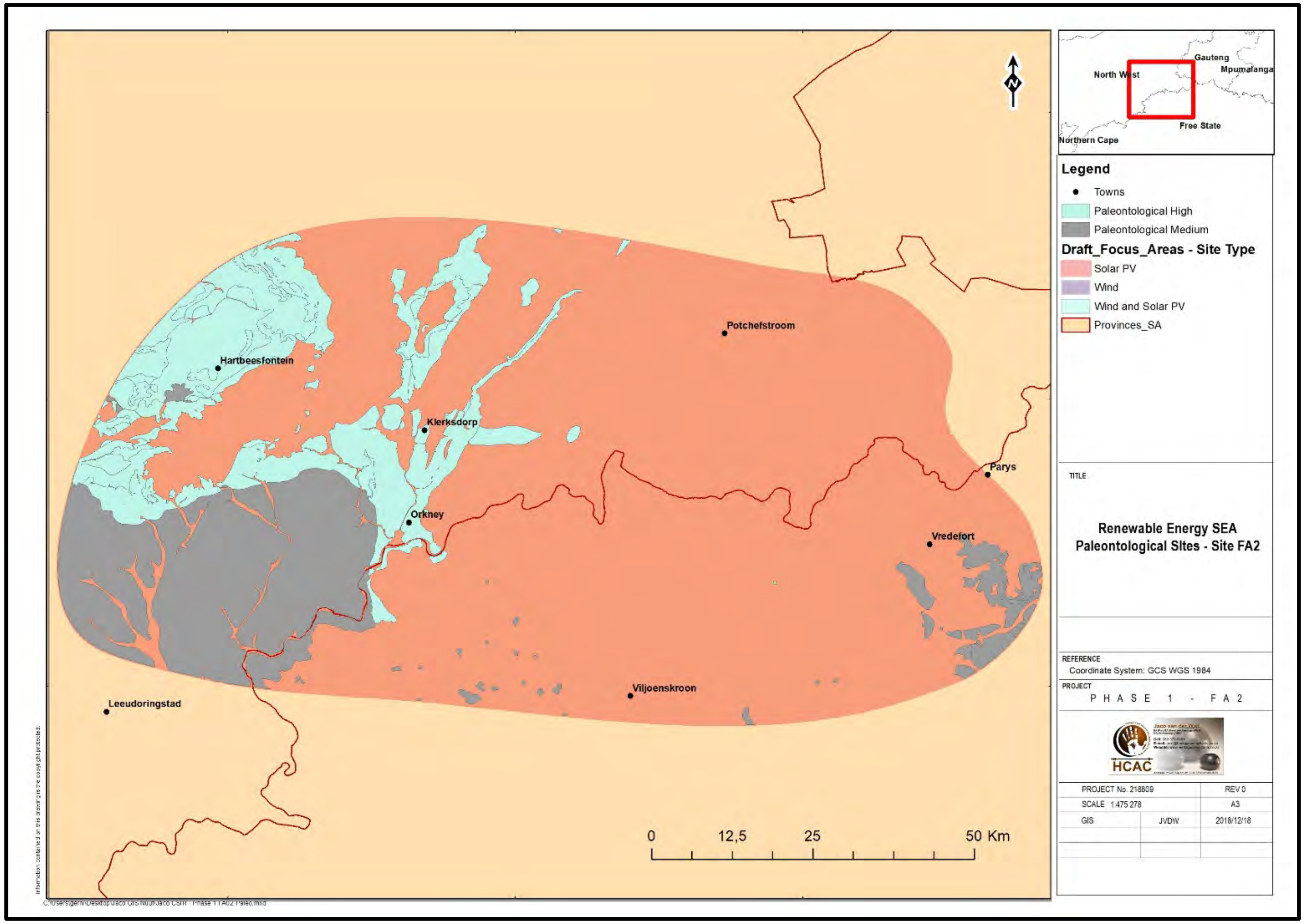

Figure 5. Focus Area 2 Palaeontological sensitivity

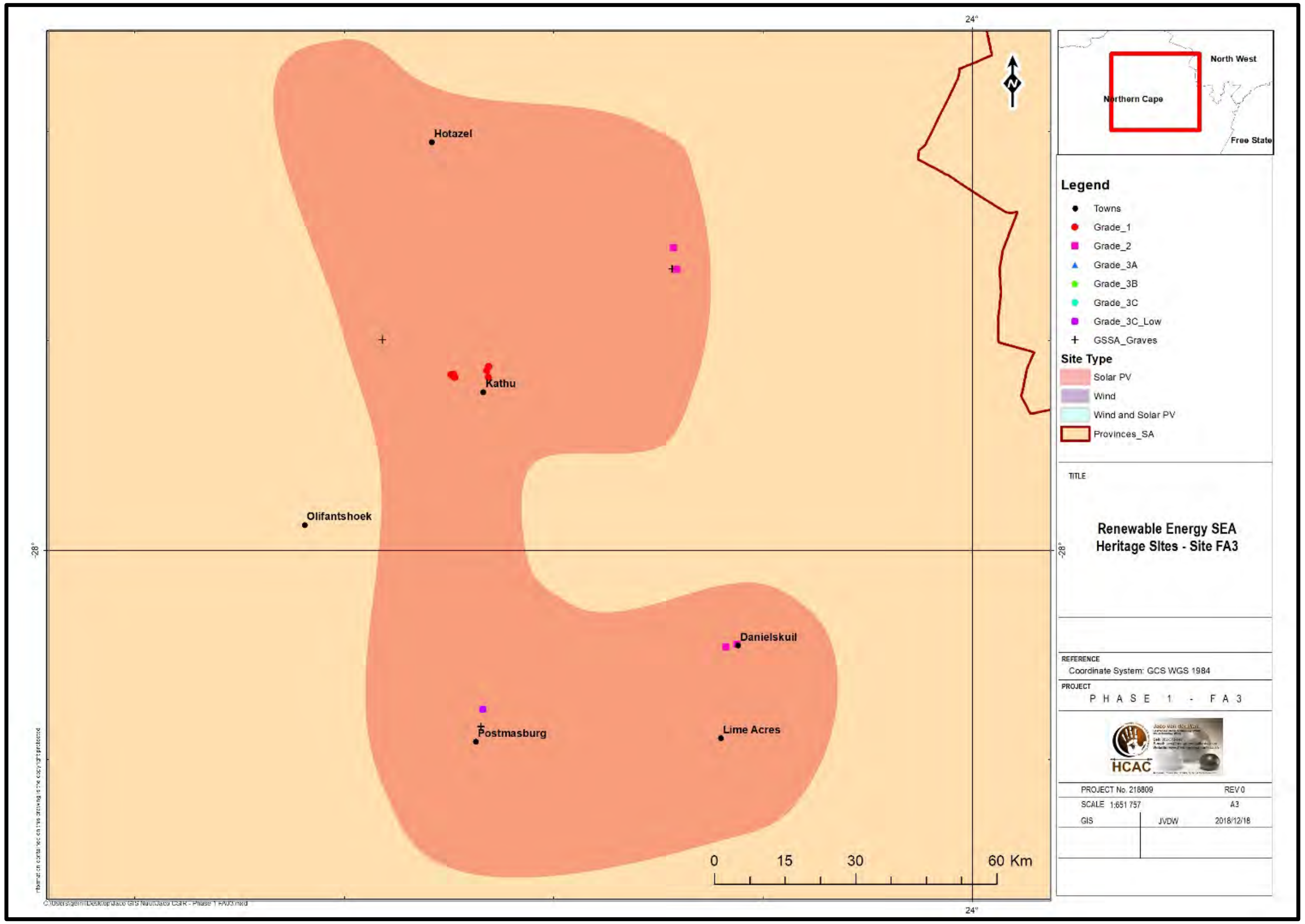

Figure 6. Focus Area 3 showing the heritage features (Kathu Pan is indicated in red) mapped onto the solar PV site type

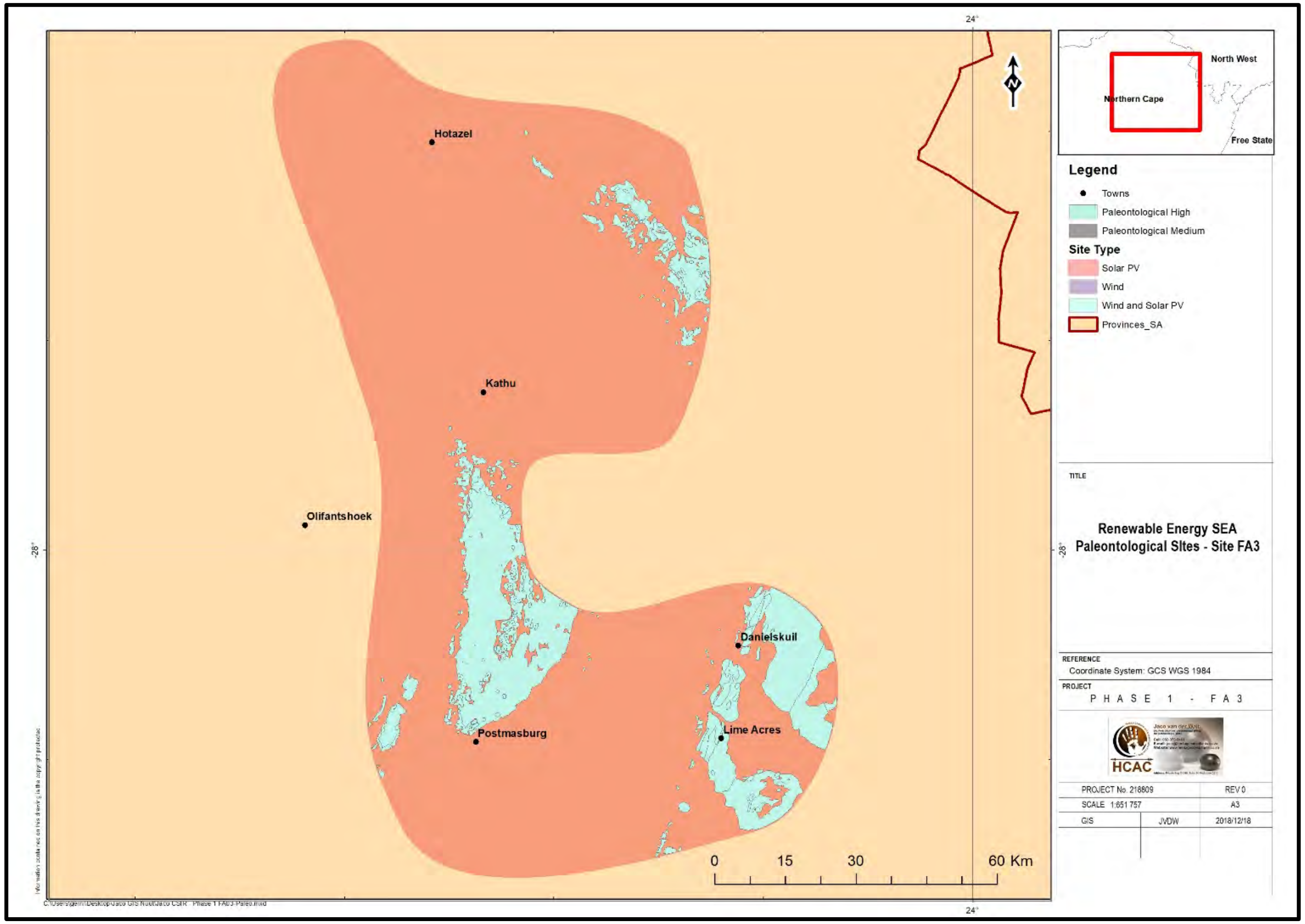

Figure 7. Focus Area 3 Palaeontological sensitivity

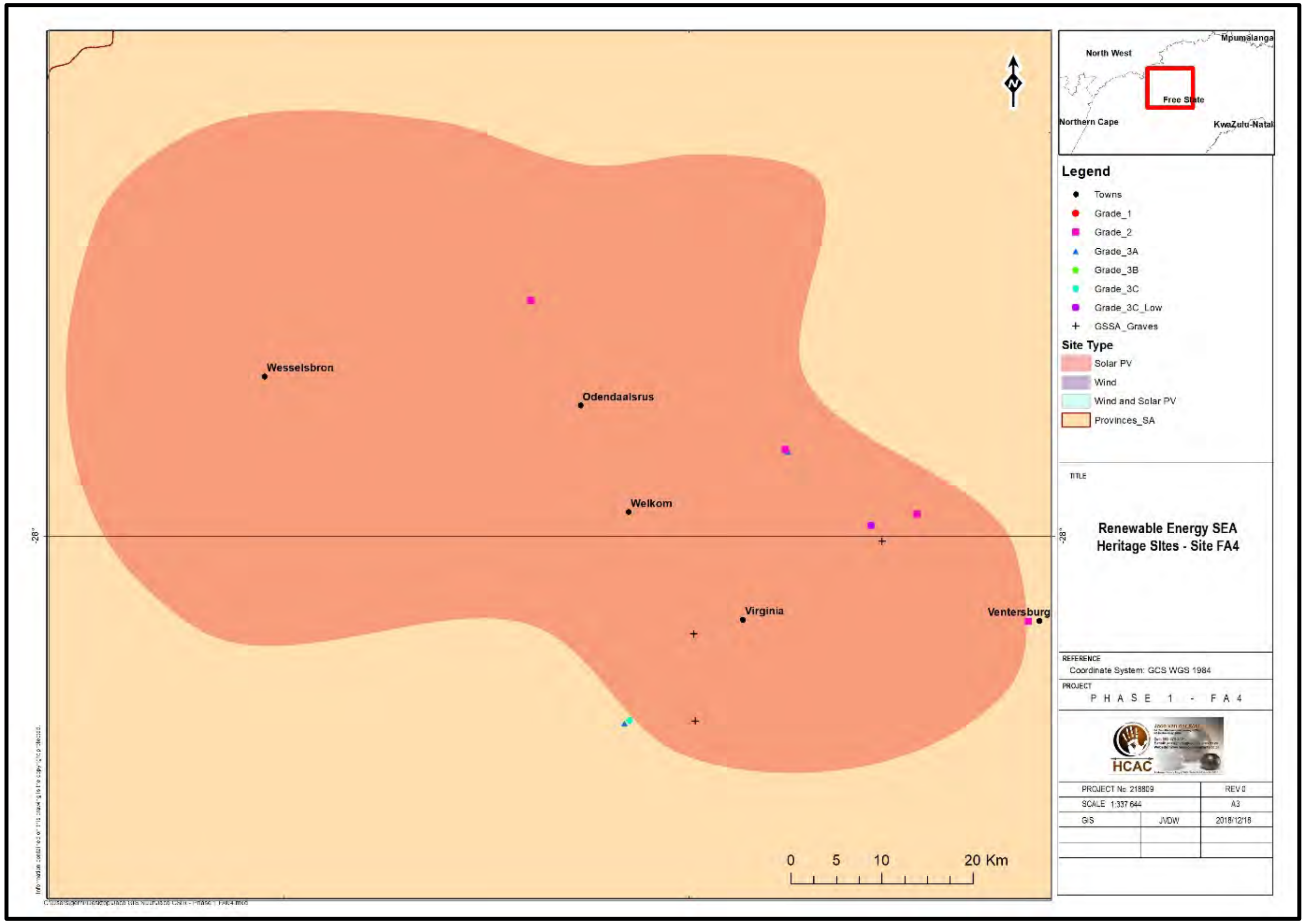

Figure 8. Focus area 4 showing the heritage features mapped onto the solar PV site type

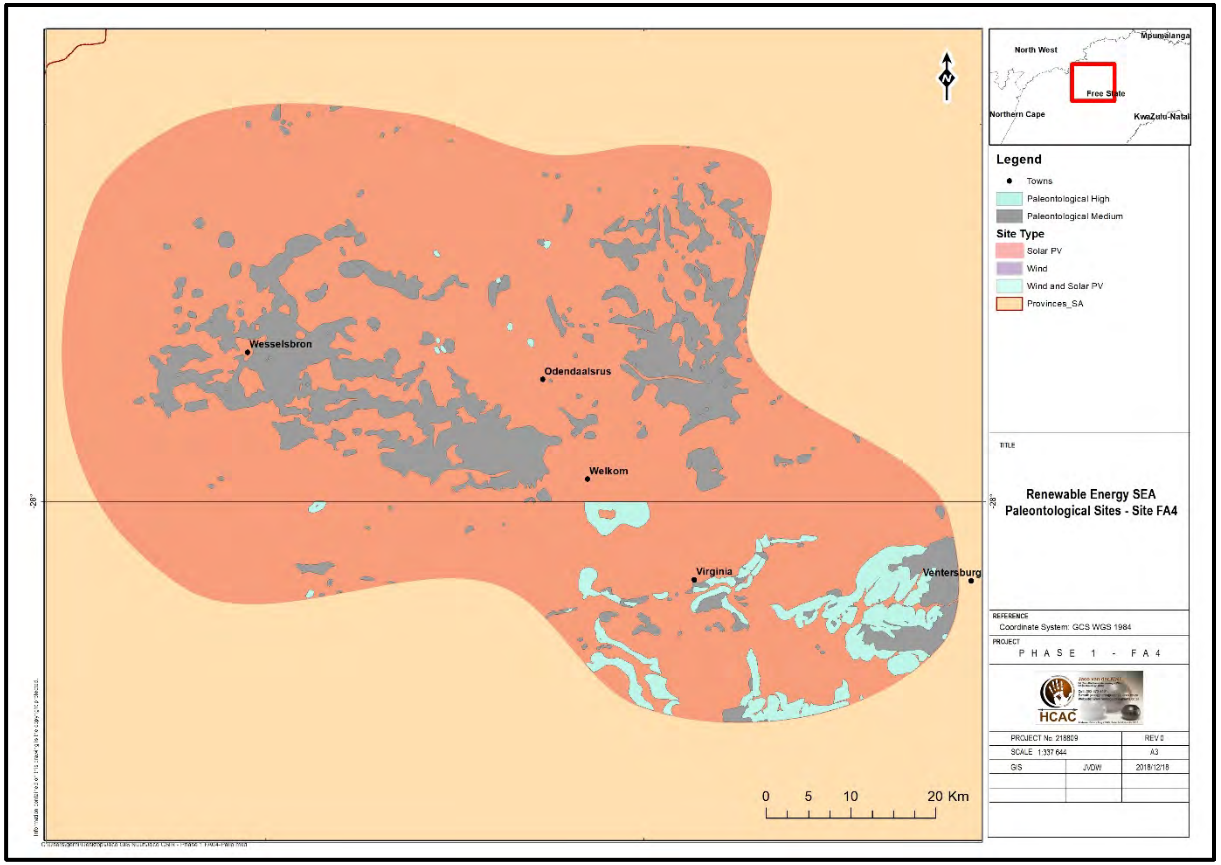

Figure 9. Palaeontological sensitivity mapped onto Focus Area 4

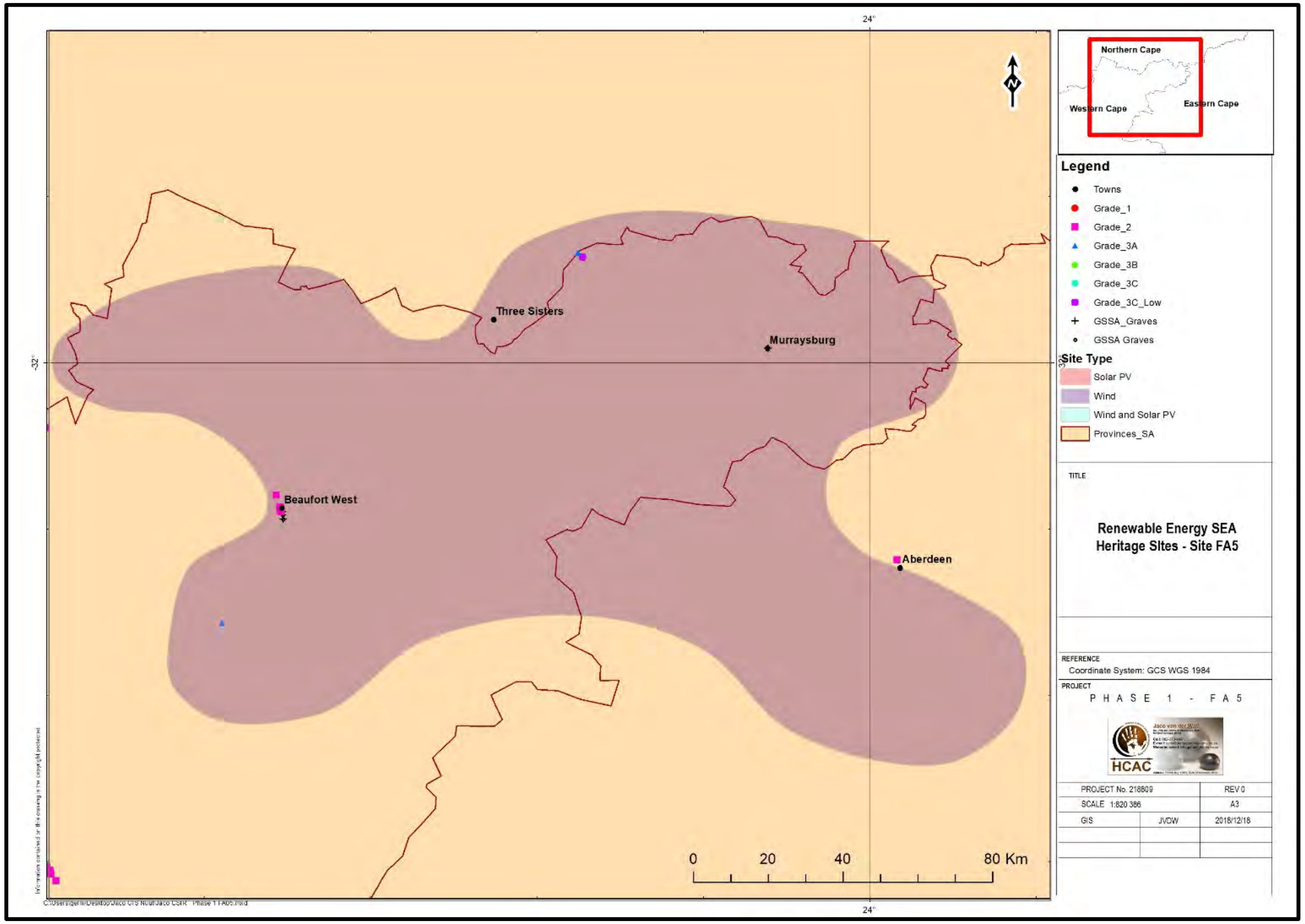

Figure 10. Focus Area 5 showing the heritage features mapped onto the wind site type

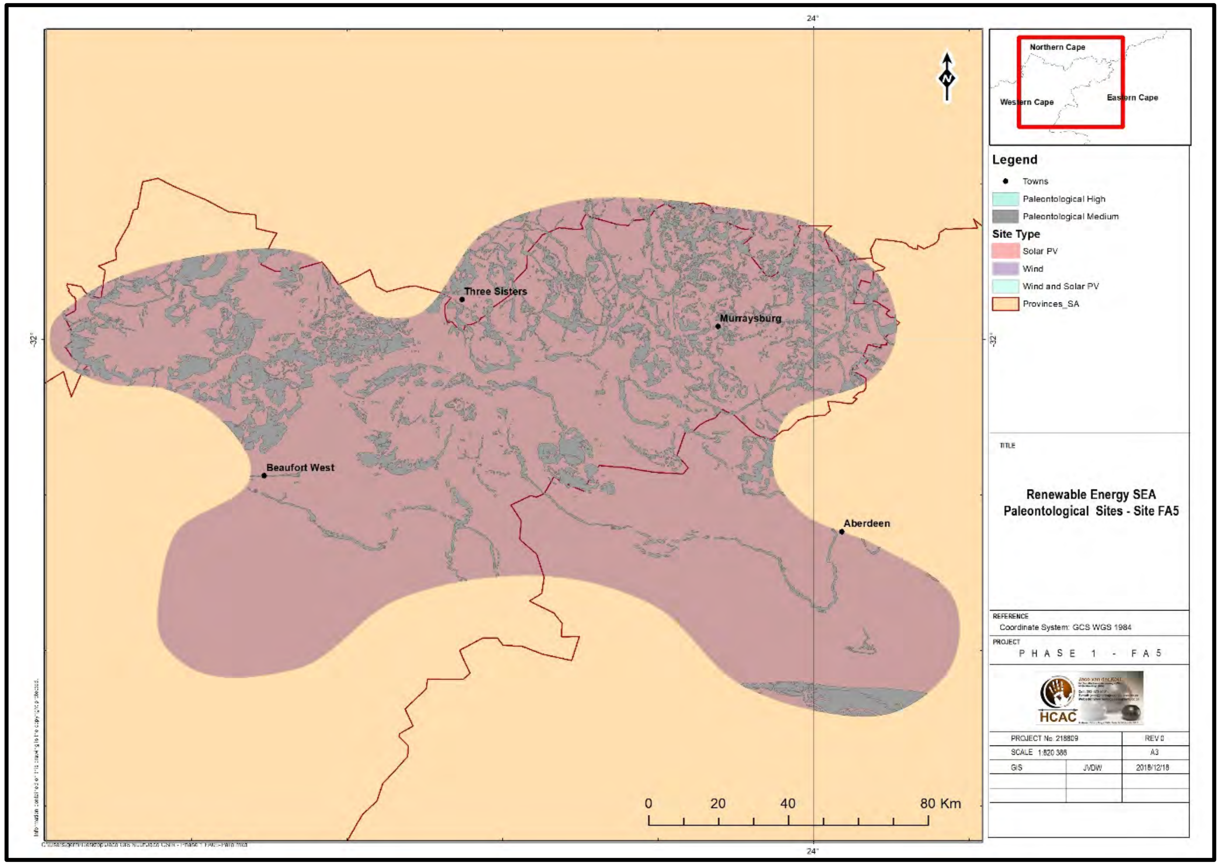

Figure 11. Palaeontological Sensitivity mapped onto Focus Area 5

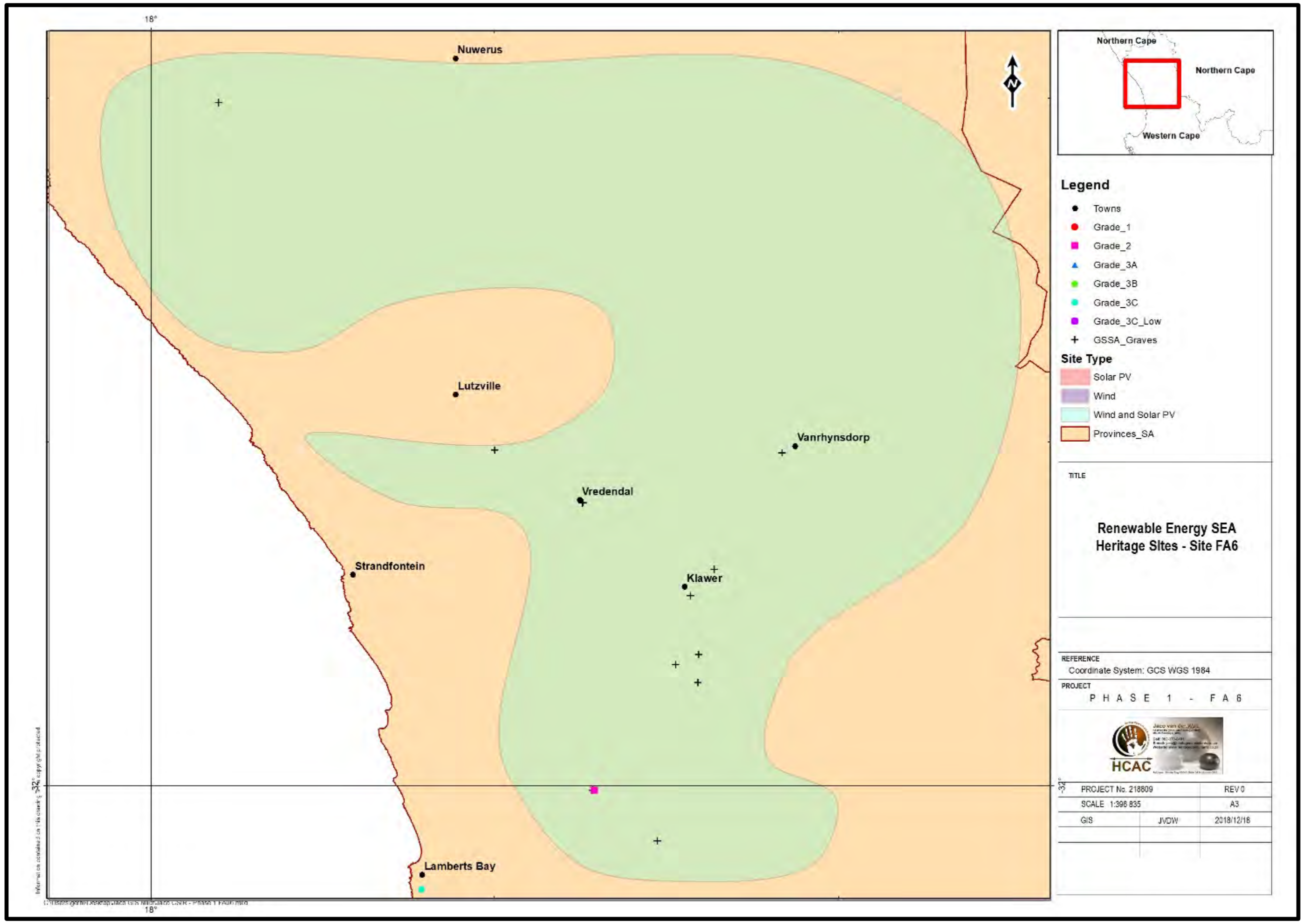

Figure 12. Focus Area 6 showing the heritage features mapped onto the wind and solar PV site type

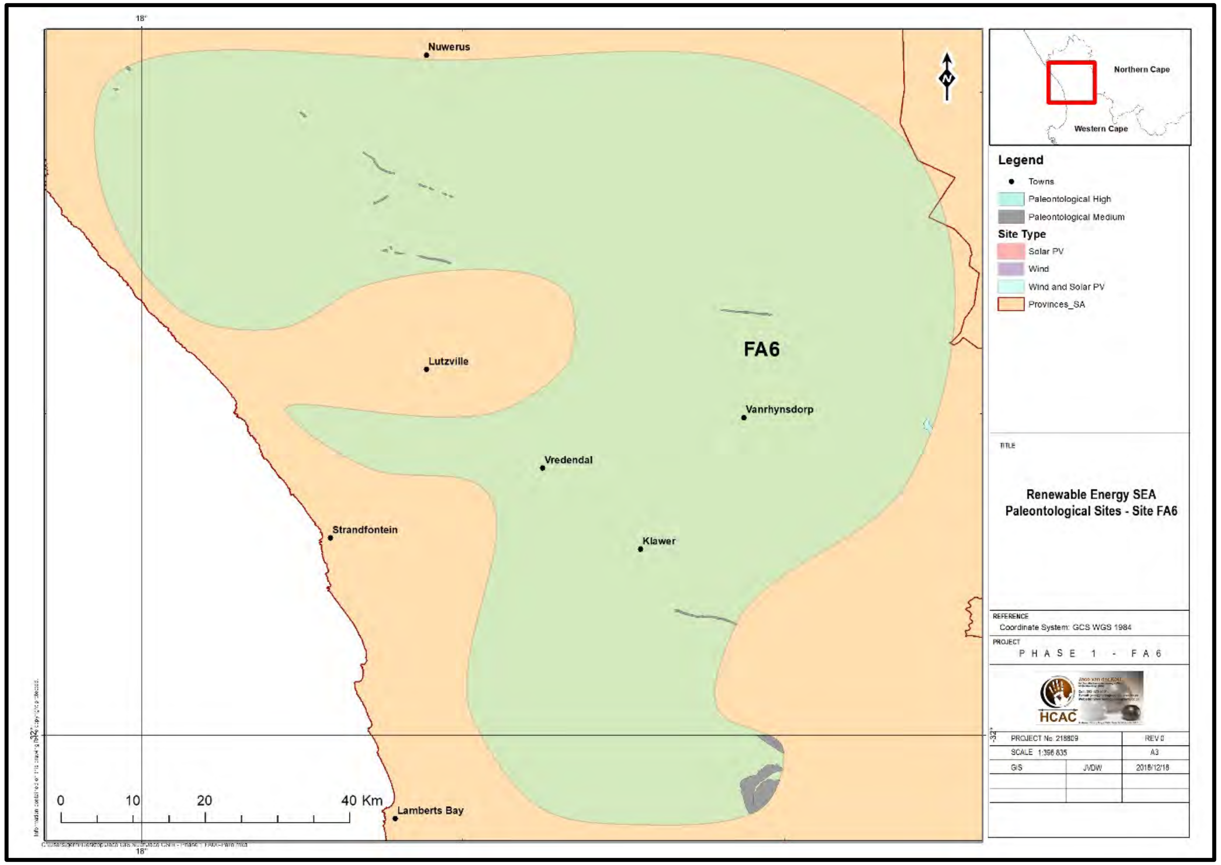

Figure 13. Paleontological sensitivity of Focus Area 6.

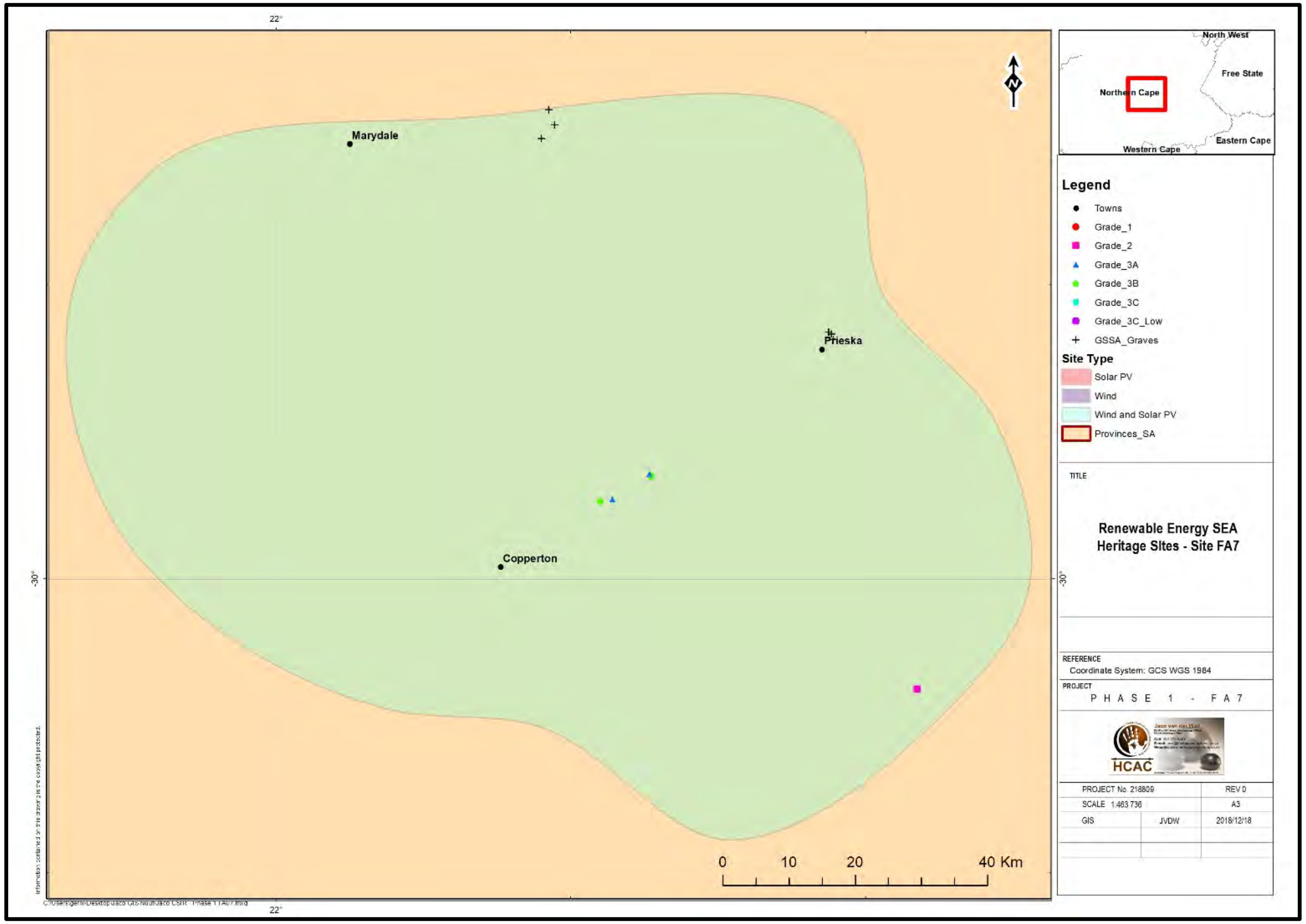

Figure 14. Focus Area 7 showing the heritage features mapped onto the wind and solar PV site type

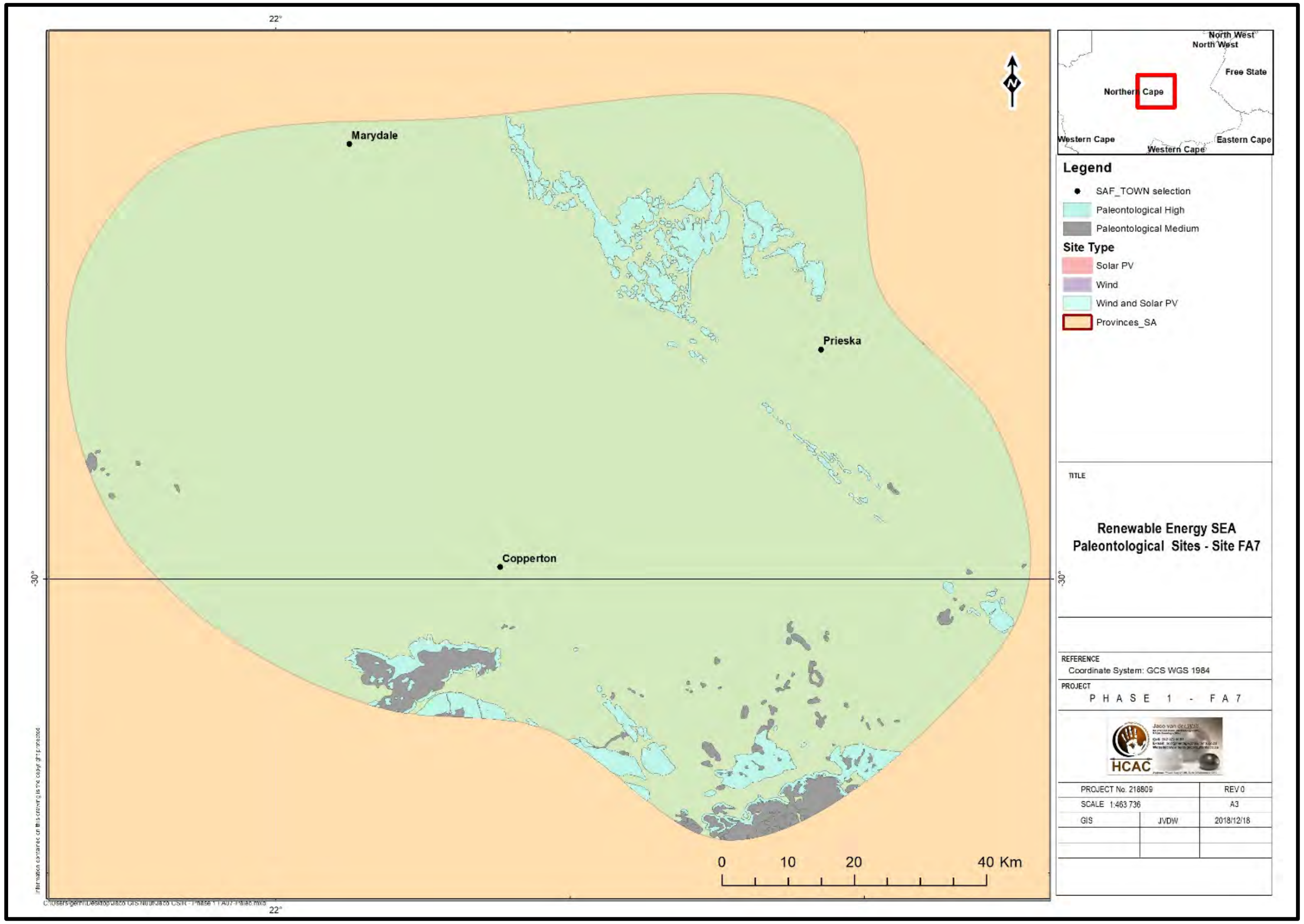

Figure 15. Palaeontological sensitivity of Focus area 7

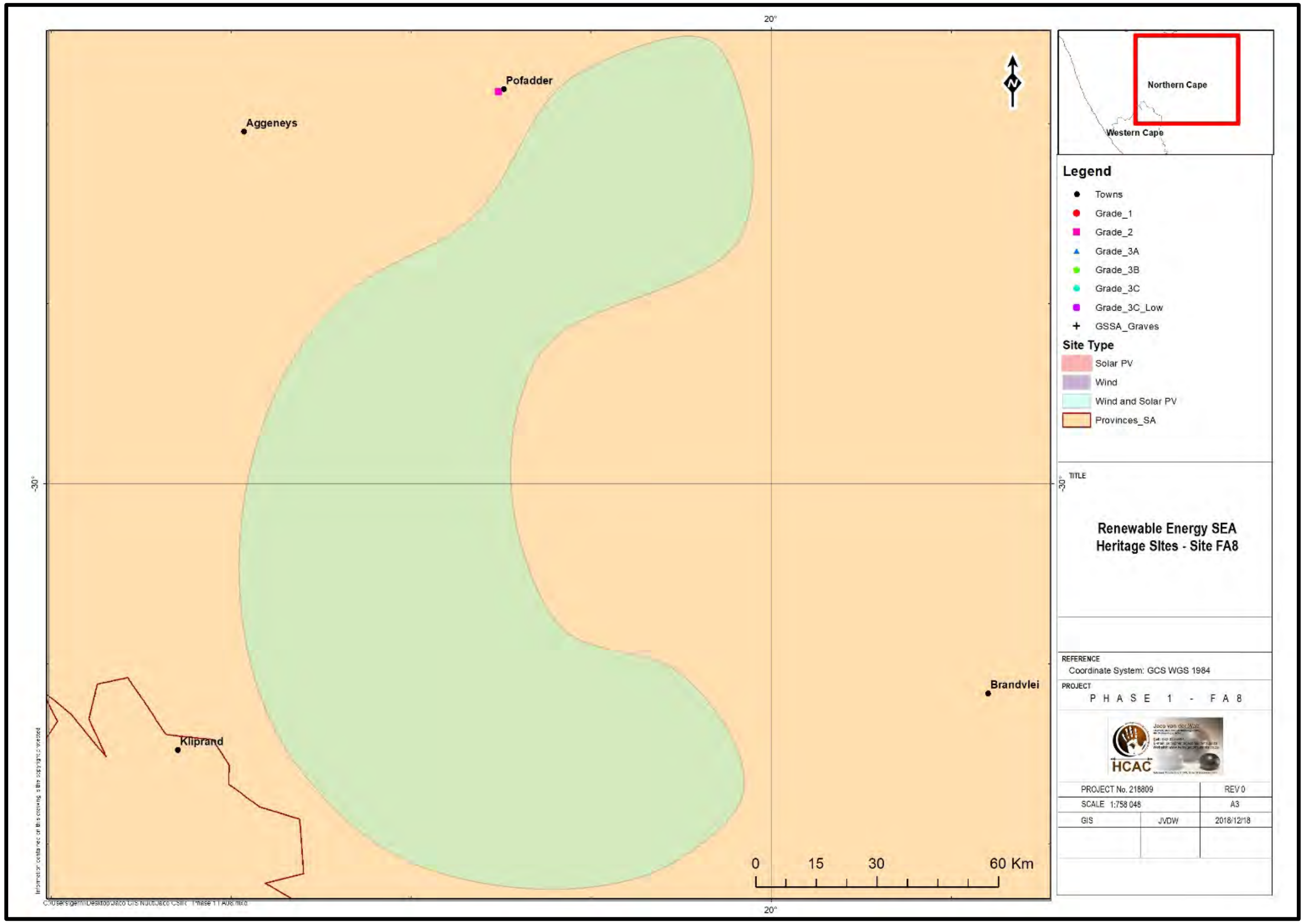

Figure 16. Focus Area 8 showing the heritage features mapped onto the wind and solar PV site type

4.3 Four- Tier Sensitivity Mapping

The following maps indicate the relative sensitivities for (1) rock units of potential palaeontological sensitivity, (2) SAHRA graded heritage resources (excluding palaeontology), and (3) combined heritage sensitivity.

The heritage sensitivity maps were developed to incorporate both the palaeontological and heritage sensitivity maps. For all areas the higher sensitivity rating of the two components was taken as the combined sensitivity.

The relative sensitivity mapping will follow a four tier sensitivity classes approach with:

- Dark Red (RGB 168, 0, 0): Very High Sensitivity
- Red (RGB 255, 0, 0): High Sensitivity
- Orange (RGB 255, 170, 0): Medium Sensitivity
- Green (RGB 85, 255, 0): Low Sensitivity

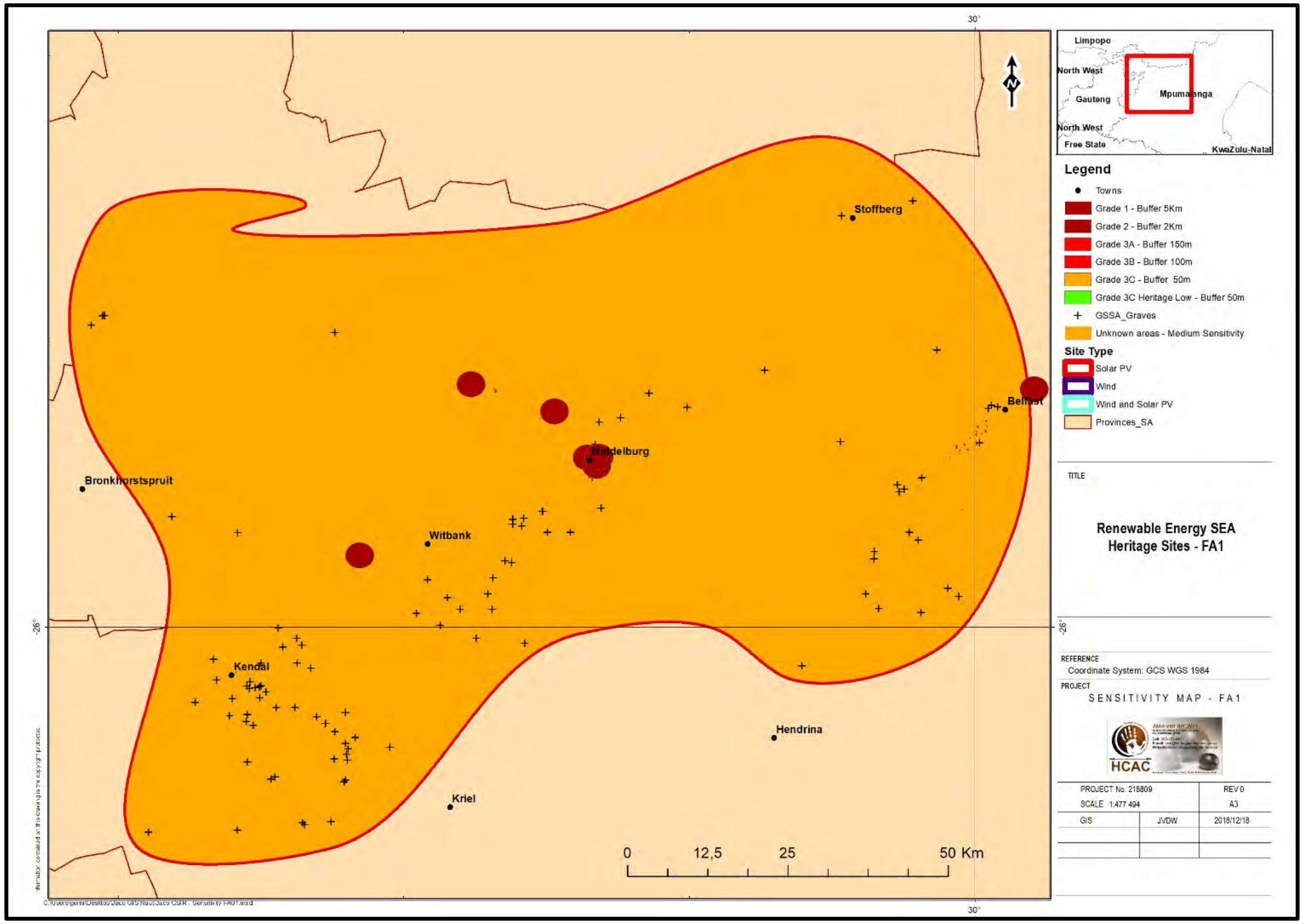

Figure 17. Heritage sensitivity map for Focus Area 1 mapped onto the Solar PV site type

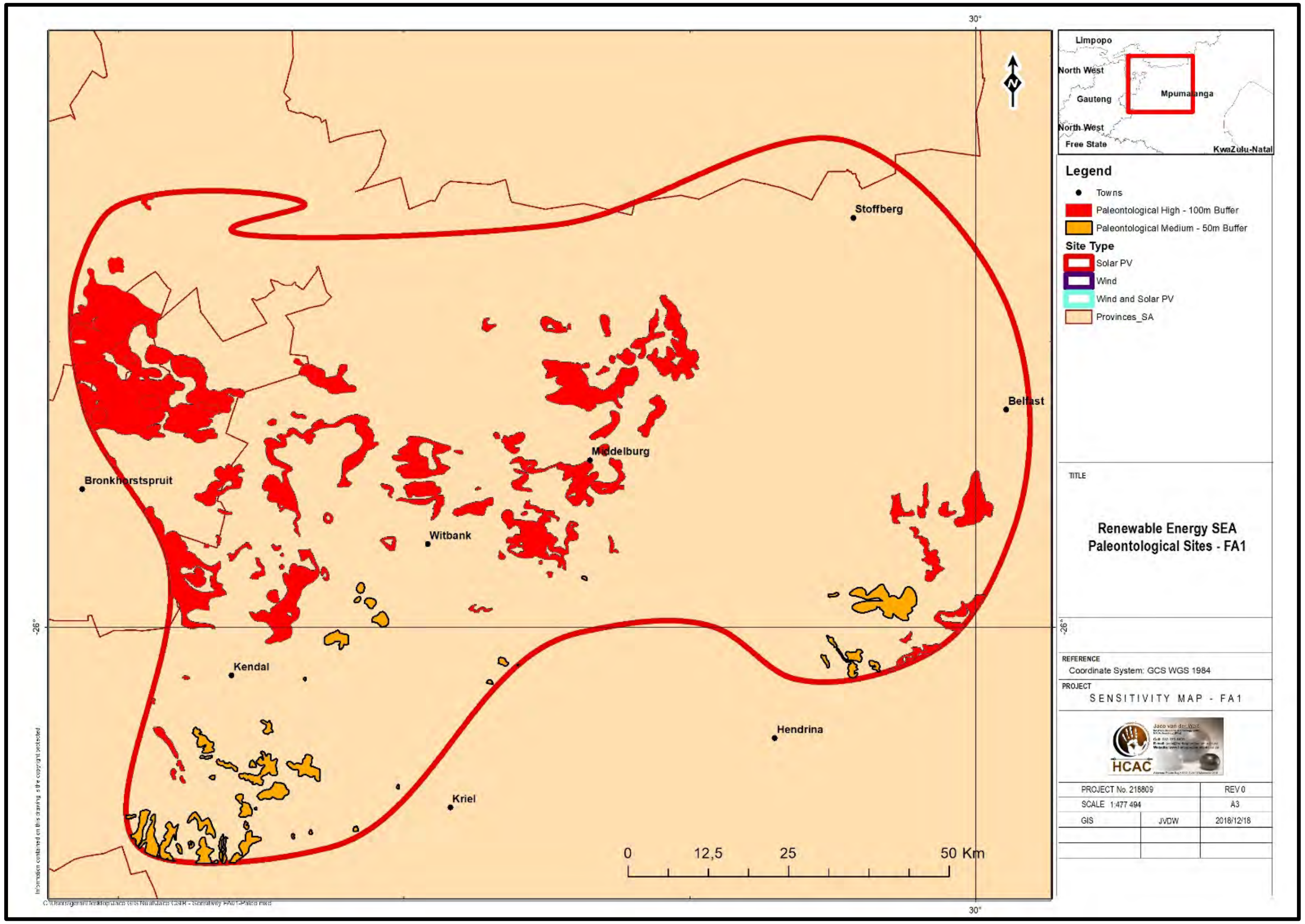

Figure 18. Palaeontological sensitivity map for Focus Area 1.

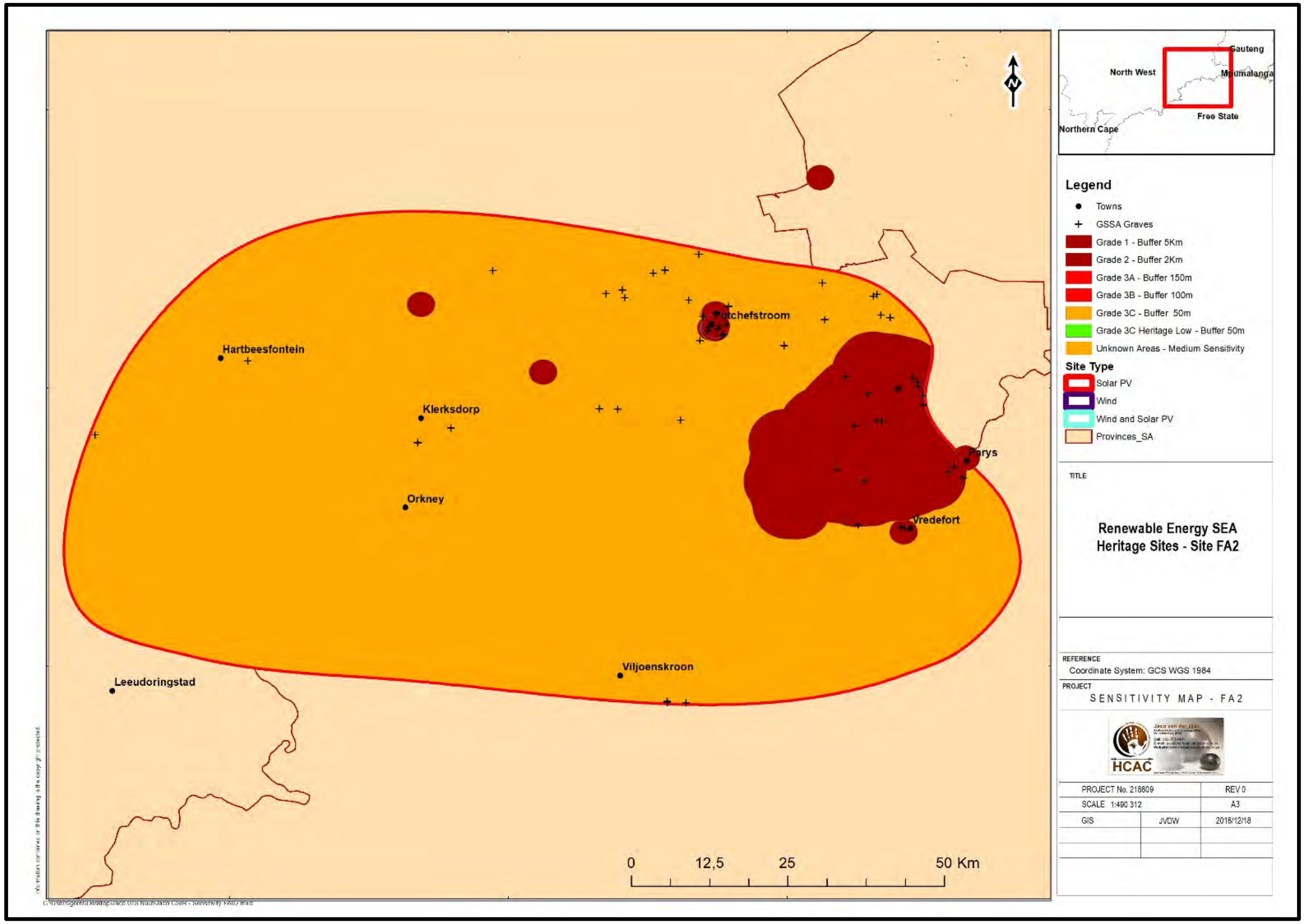

Figure 19. Heritage sensitivity map for Focus Area 2 mapped onto the Solar PV site type

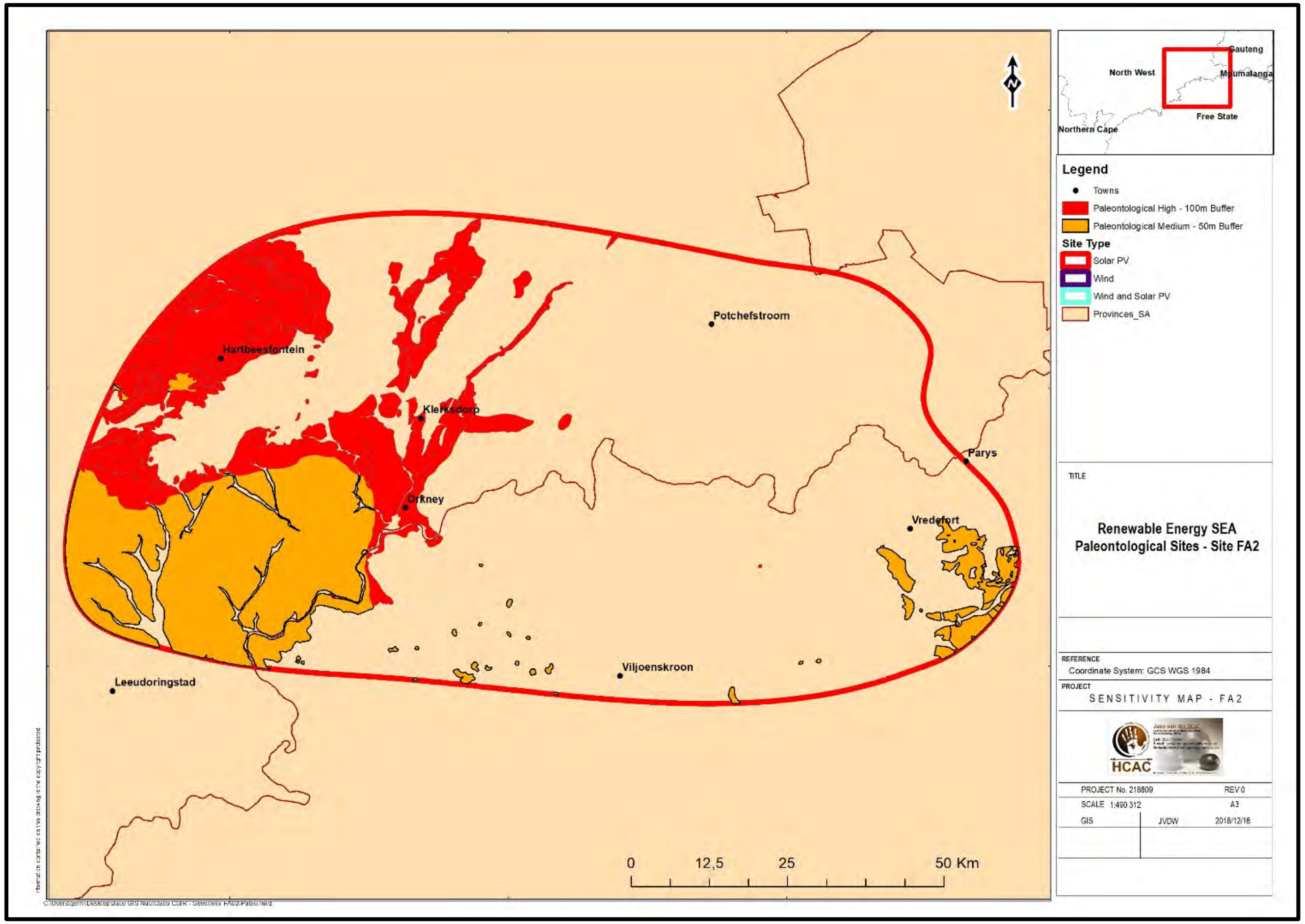

Figure 20. Palaeontological sensitivity map of Focus Area 2.

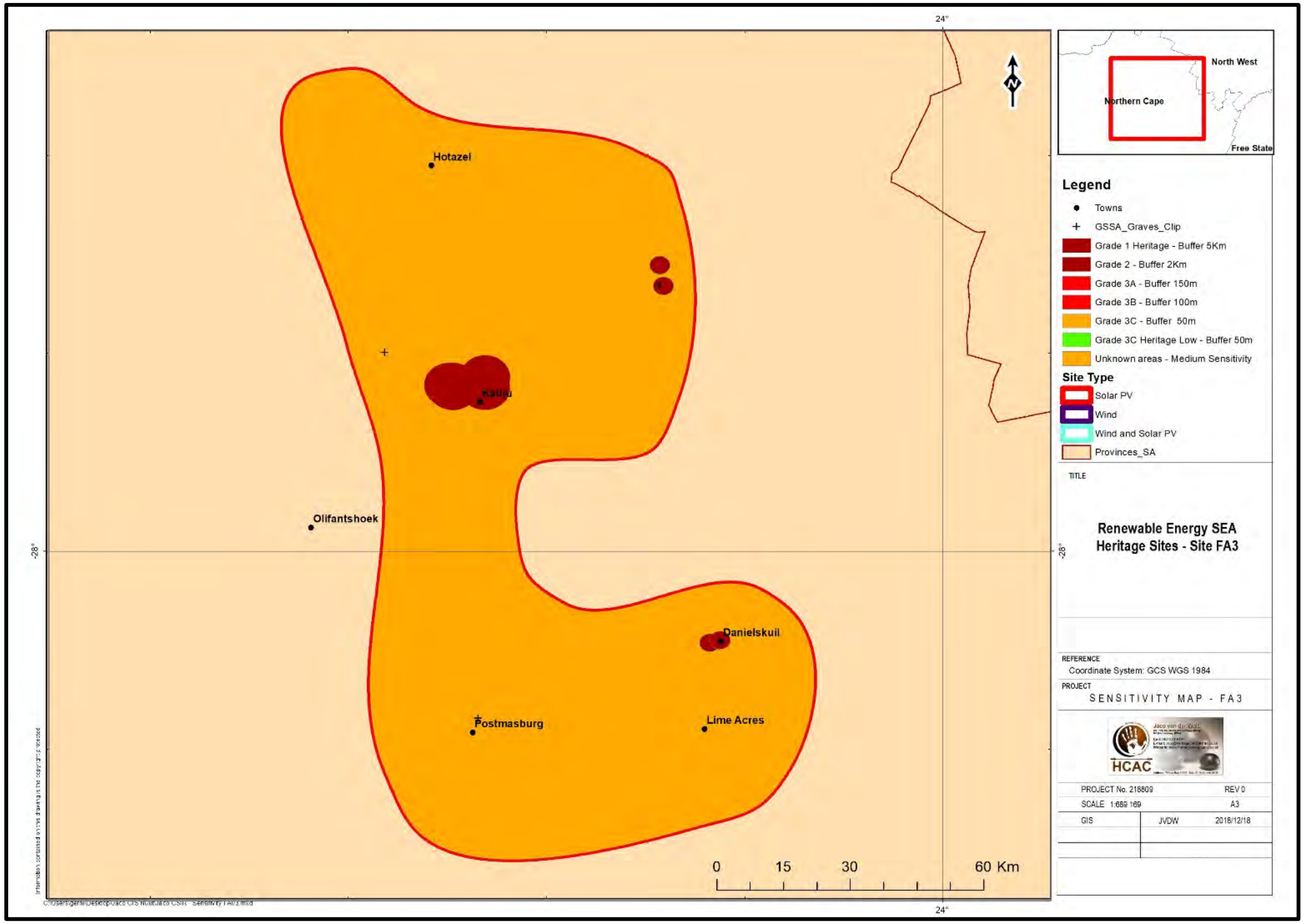

Figure 21. Heritage sensitivity map for Focus Area 3 mapped onto the Solar PV site type

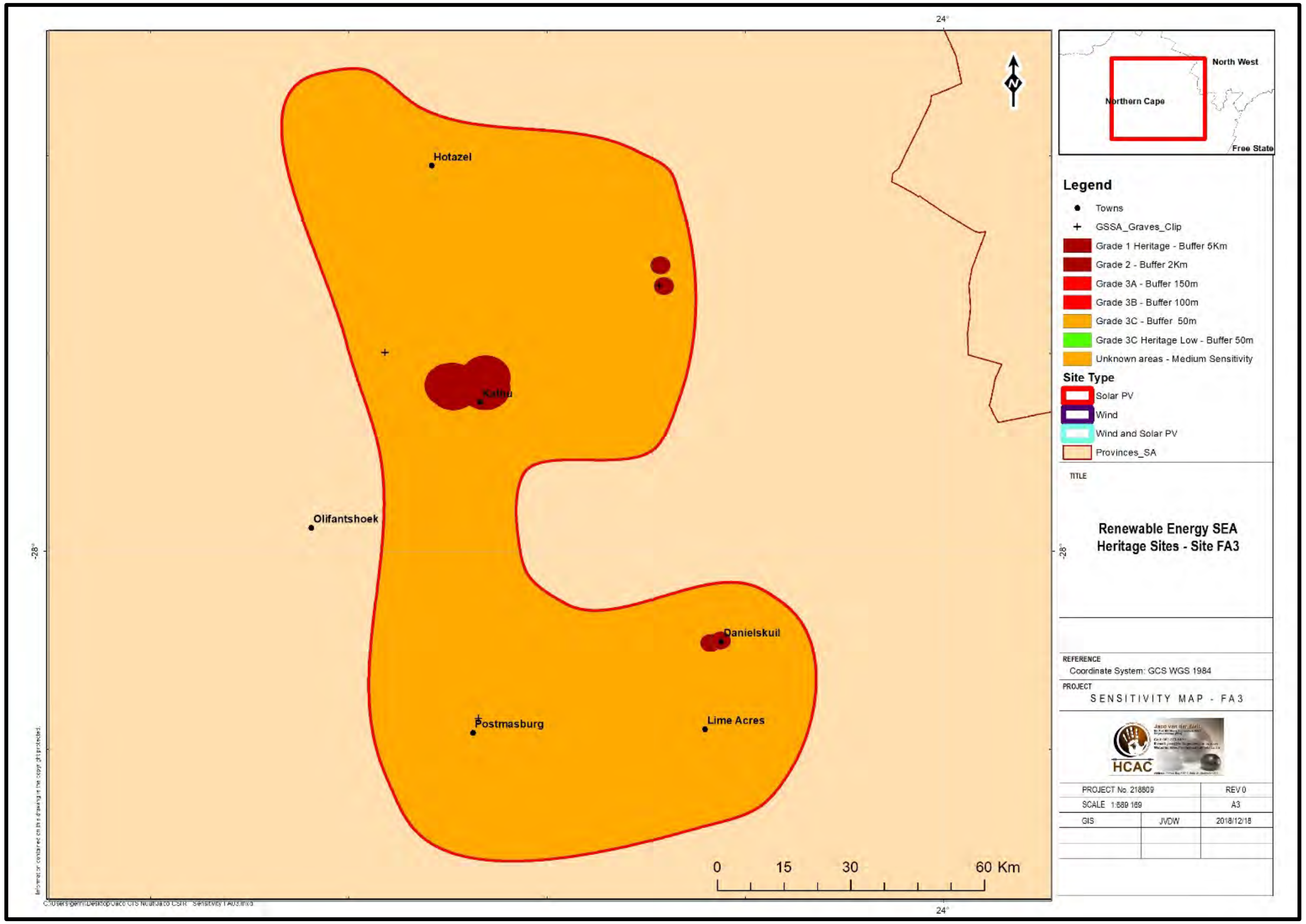

Figure 22. Palaeontological sensitivity for Focus area 3.

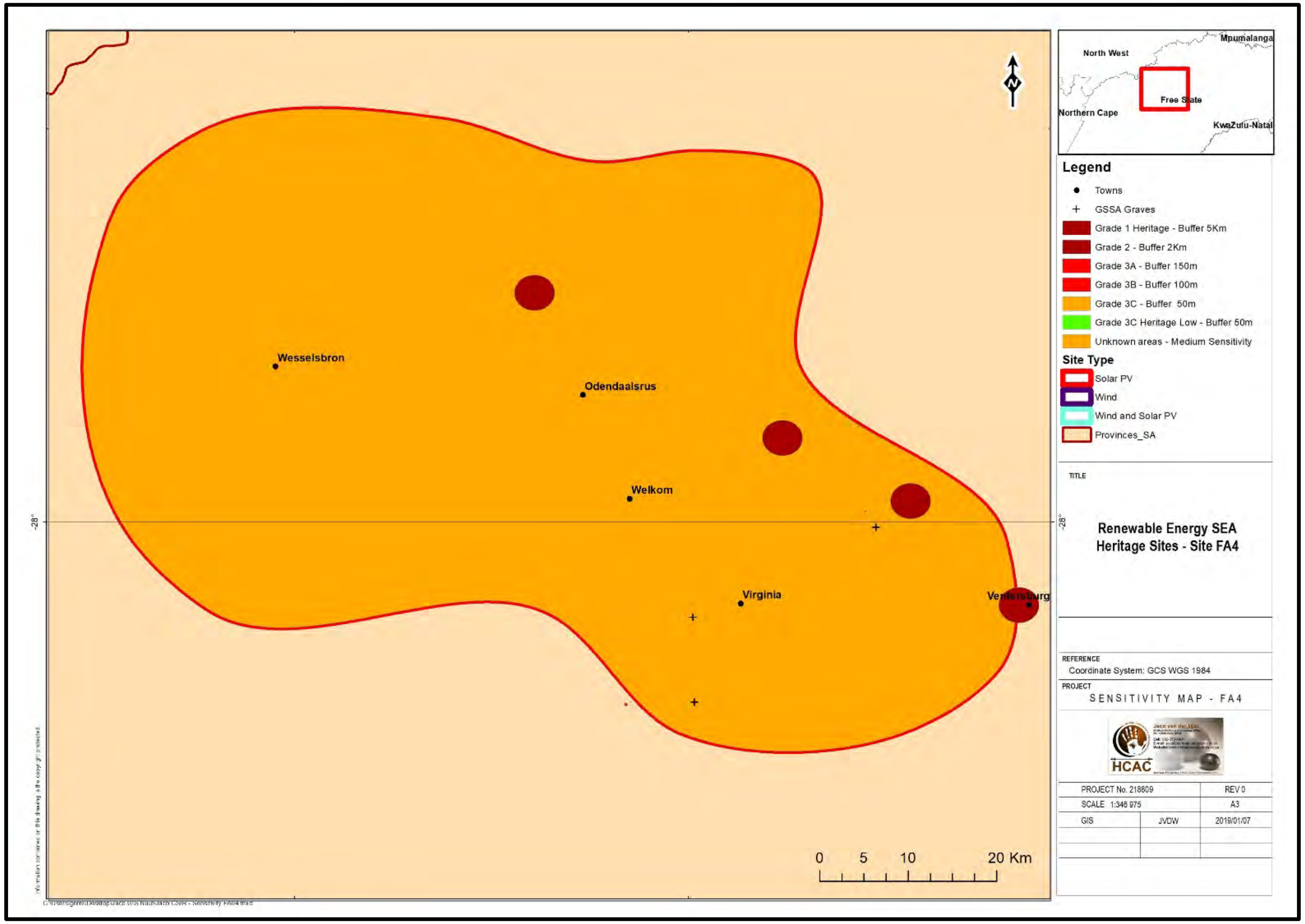

Figure 23. Heritage resources in Focus Area 4

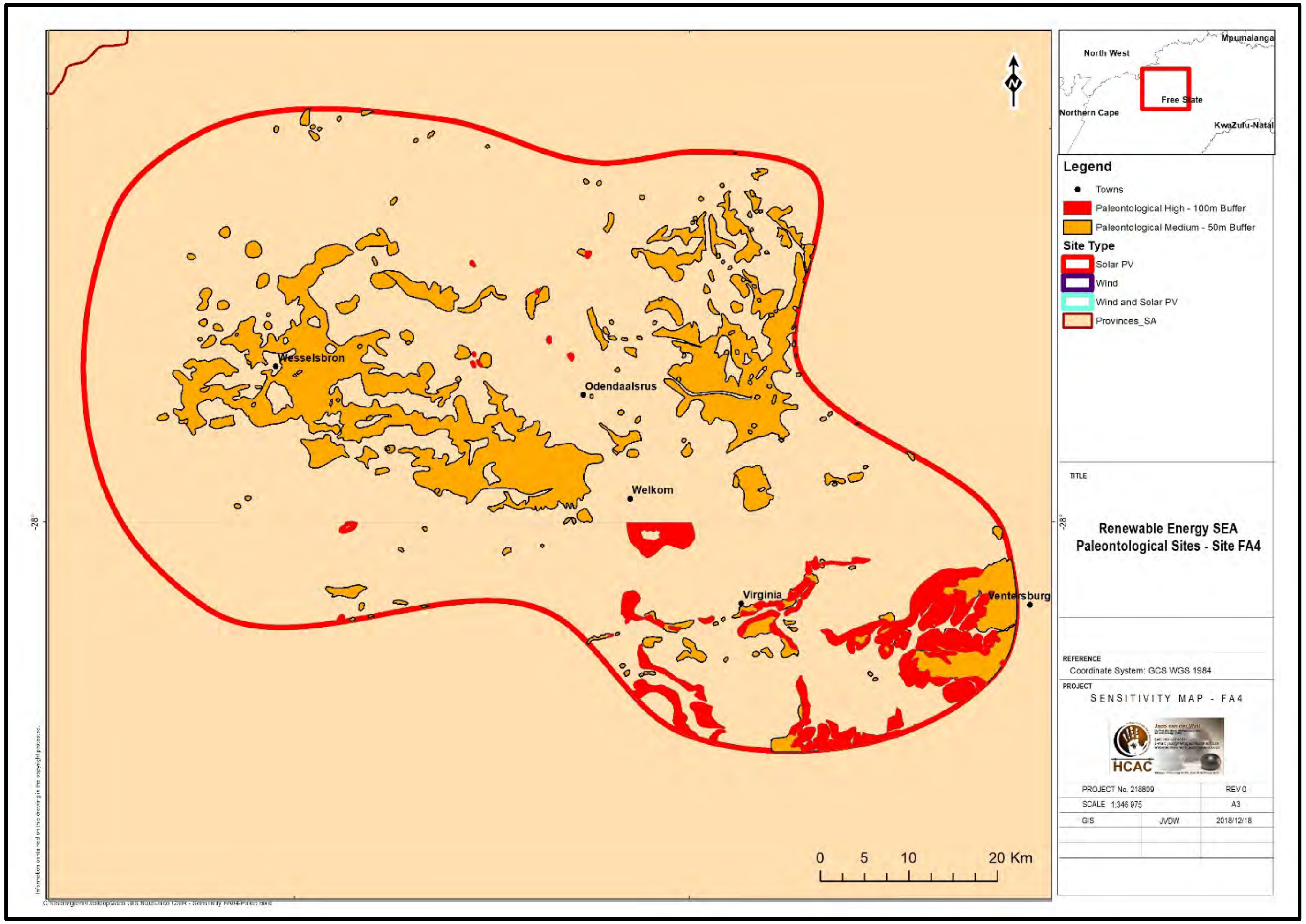

Figure 24. Palaeontological sensitivity map for Focus area 4

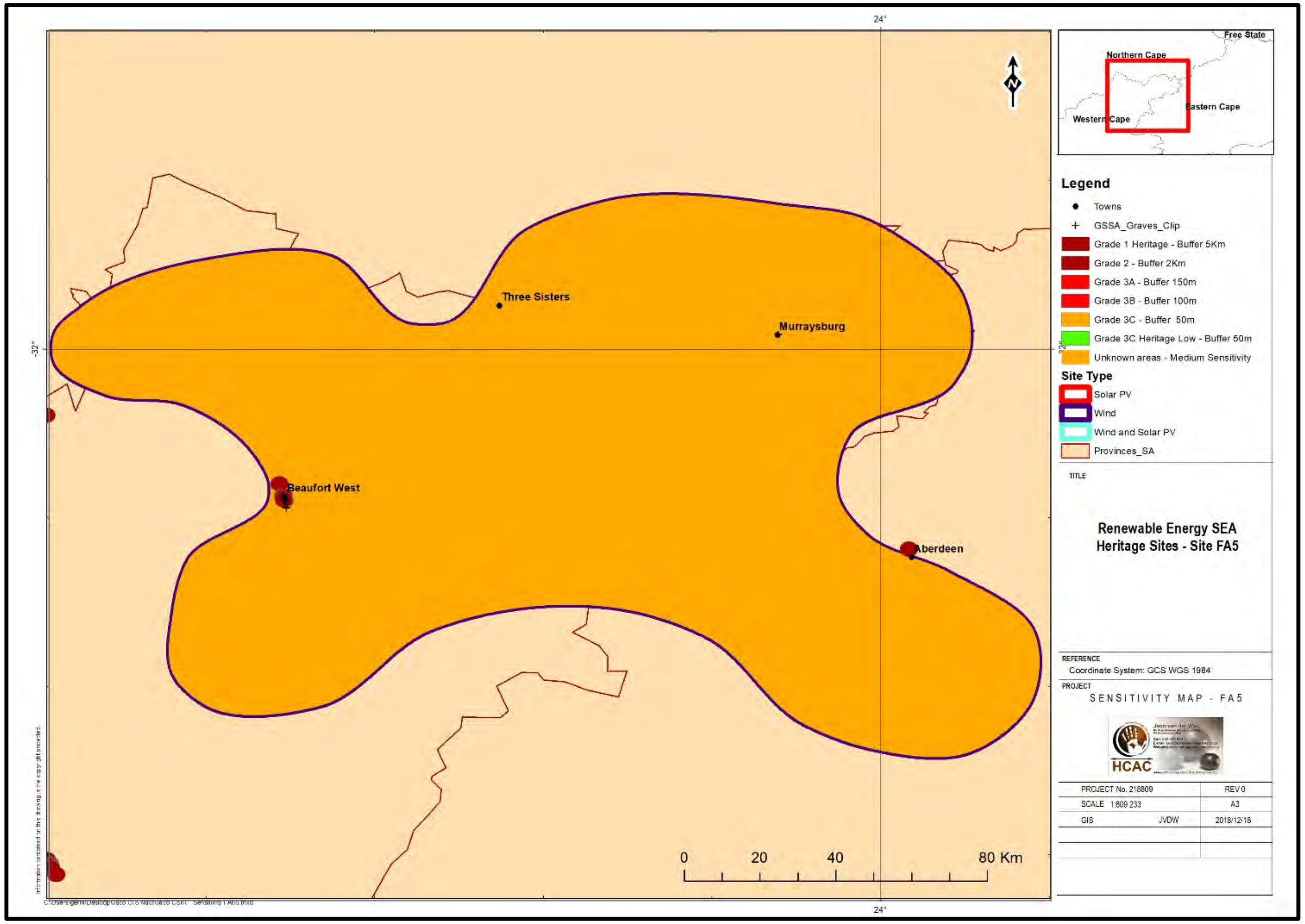

Figure 25. Heritage sensitivity map for Focus Area 5 mapped onto the Wind site type

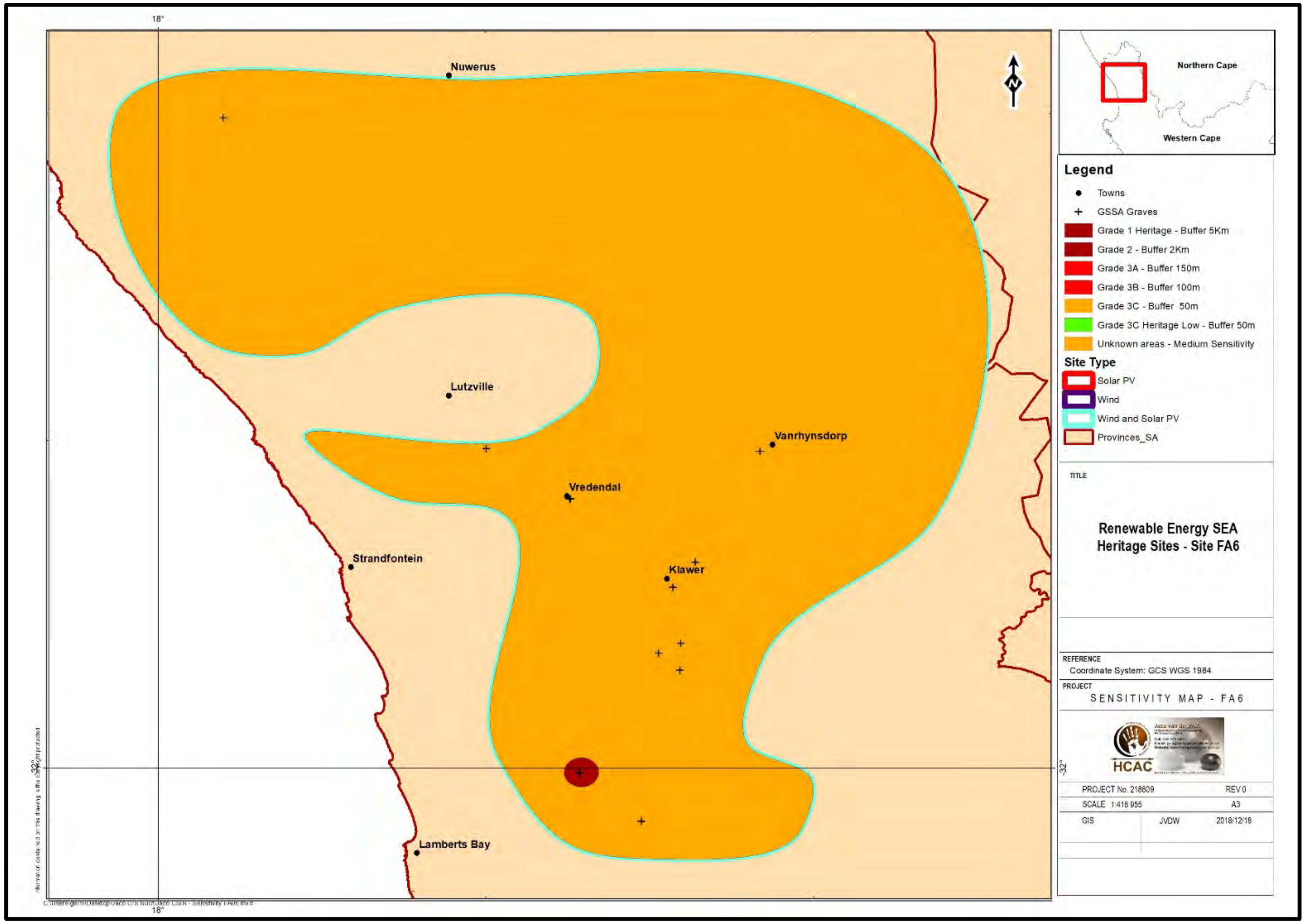

Figure 26. Heritage sensitivity map for Focus Area 6 mapped onto the Wind & Solar PV site type

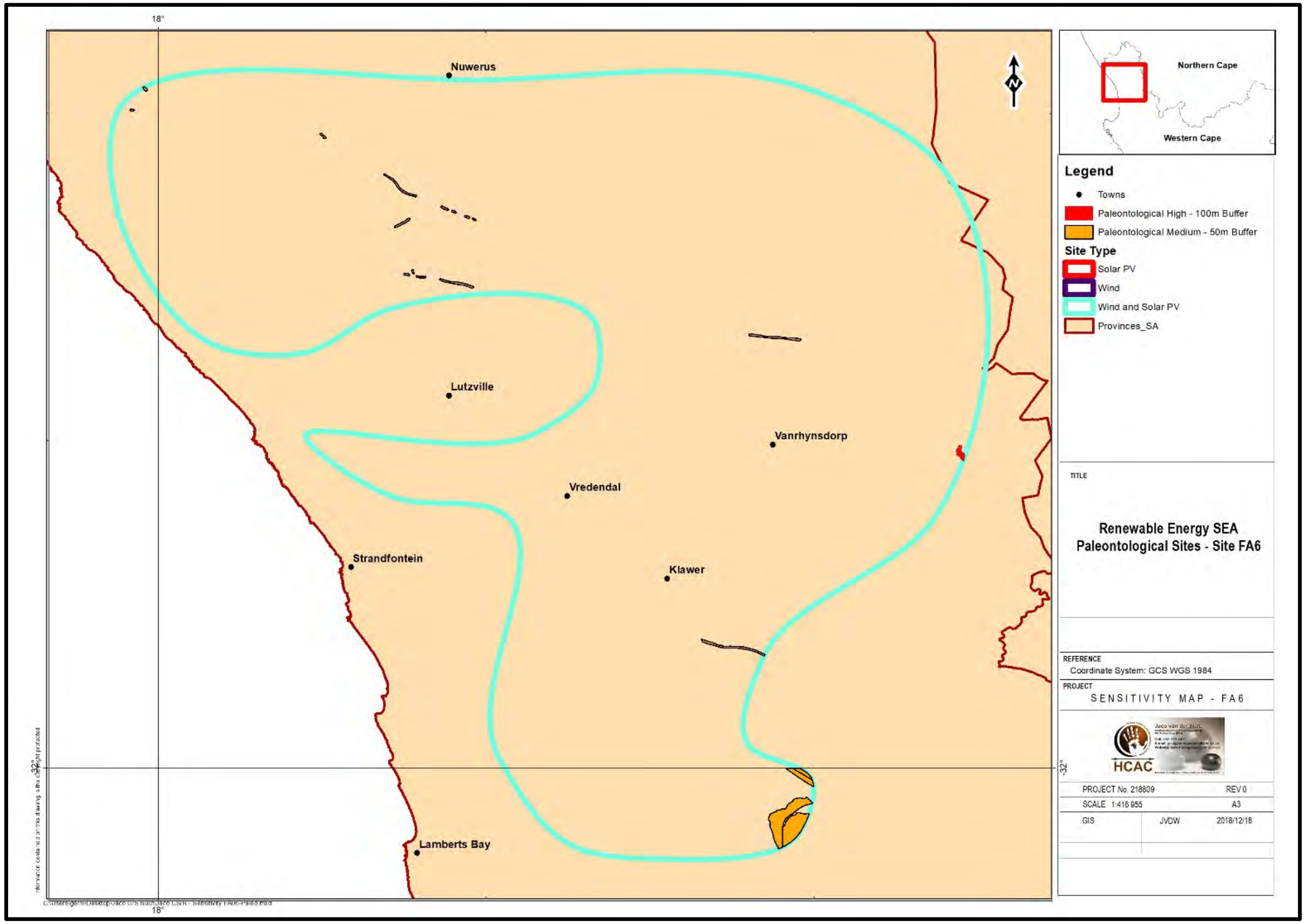

Figure 27. Palaeontological sensitivity of Focus Area 6

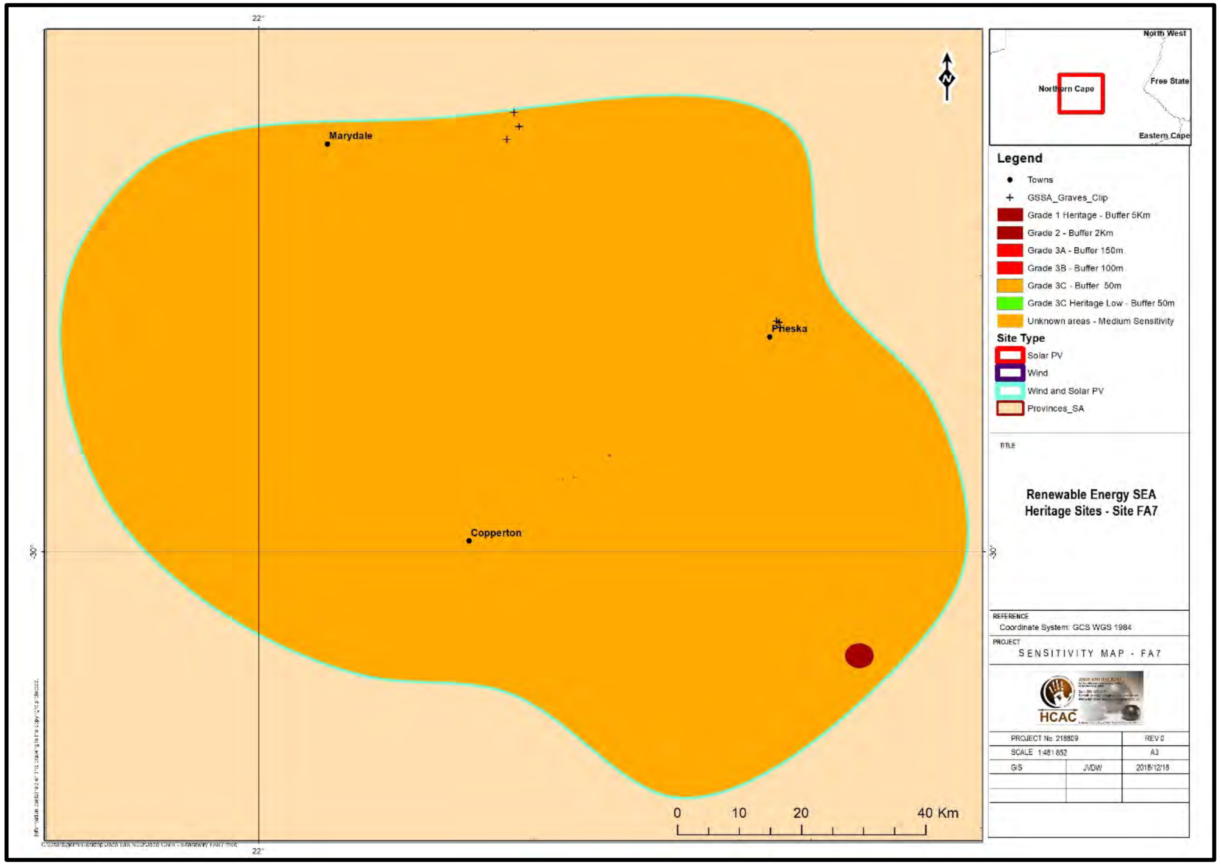

Figure 28. Heritage Sensitivity map for Focus Area 7 mapped onto the Wind & Solar PV site type

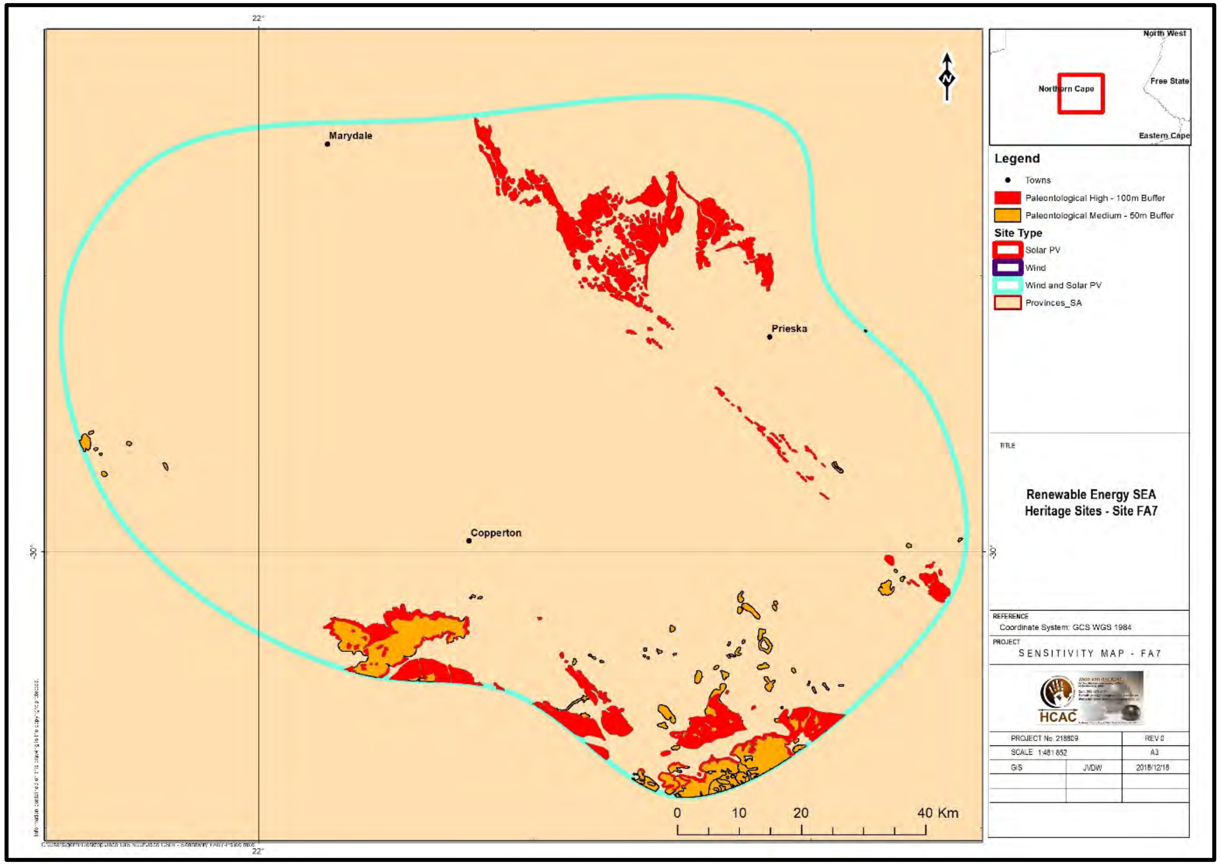

Figure 29. Palaeontological sensitivity for Focus Area 7

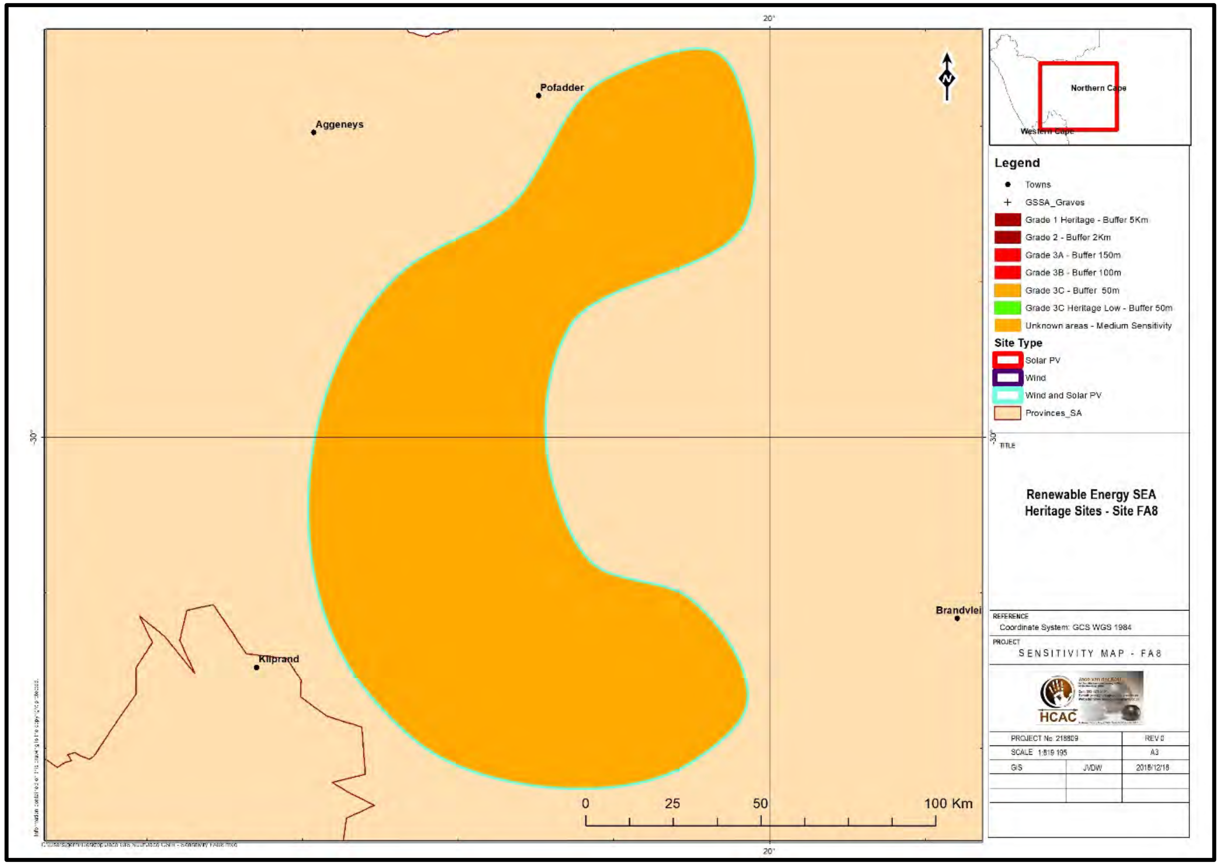

Figure 30. Heritage sensitivity map for Focus Area 8 mapped onto the Wind & Solar PV site type

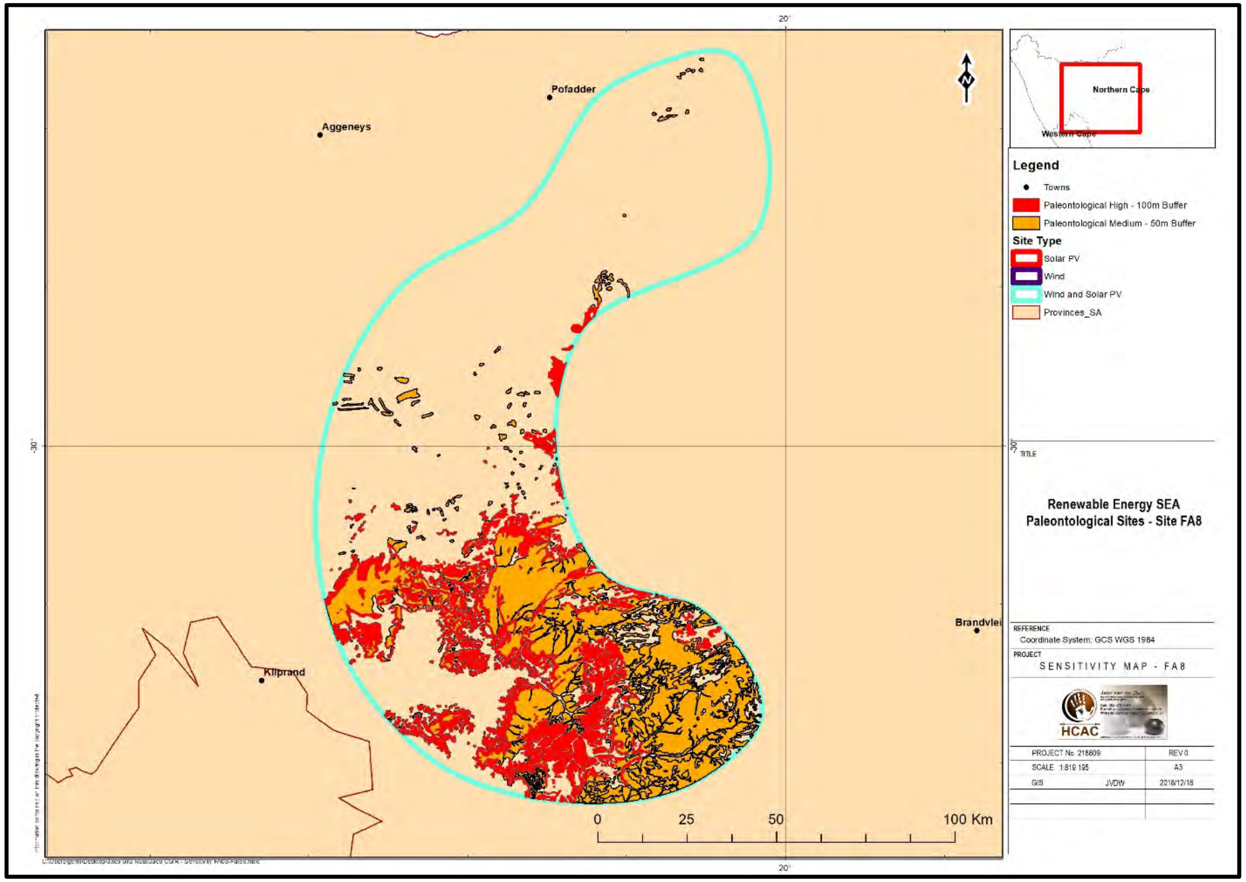

Figure 31. Palaeontological sensitivity of Focus Area 8

5. KEY POTENTIAL IMPACTS AND THEIR MITIGATION

The impacts posed to heritage resources are similar for the development of both solar and wind energy facilities. The biggest threat posed to all types of heritage resources is the damage or destruction of sites and resources during the construction phase of RE facilities. Due to the low survey coverage of the focus areas, it is virtually impossible to predict the range of various heritage resource types in these areas and subsequently the correct mitigation measures applicable for each heritage category. Undetected archaeological and palaeontological sites, as well as graves and sensitive cultural landscapes are most at risk.

5.1 Potential impacts of Wind and Solar Projects on Heritage resources

Any direct impacts that may occur would be during the pre-construction and construction phase only. This will apply to all related infrastructure including access roads and plant construction as well as associated electrical and sanitation infrastructure. With a project of this scope and scale, determining impacts is a multi-faceted exercise. Each different type of development will have a different impact on each different resource, with the impacts varying in scale and extent across each of the proposed study areas. Mitigation, similarly, will be variable at each site. It is however still possible to identify impacts that will be common to RE facilities, regardless of their type, location in South Africa or siting on the landscape.

5.1.1 Pre-Construction phase

It is assumed that the pre-construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure needed for the construction phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

5.1.2 Construction Phase

During this phase, the impacts and effects are similar in nature but more extensive than the pre-construction phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

Potential positive impacts can occur if heritage features are uncovered, identified and properly managed contributing to the archaeological record of the area.

5.1.3 Operation Phase

No impact is envisaged for the recorded heritage resources during this phase.

5.2 Mitigation of Impacts

Mitigation of non-renewable heritage resources can be conducted effectively through preservation of sites *in situ* or through thorough recording of resources. This will include as a minimum the excavation, photographing, describing and recording of sites. Protection of cultural heritage is a legal requirement, with permits required before alteration to, or damage of, these resources is allowed (Section 48(2) of the NHRA, No 25 of 1999). It is expected that open-air archaeological sites would likely not require *in situ* conservation, although this is the preferred option. It is anticipated that most of these sites can be mitigated either through preservation *in situ* or through phase 2 mitigation, where necessary.

Construction of RE facilities involving substantial excavation or disturbance of areas associated with medium and high palaeontological sensitivities (in conjunction with the SAHRIS palaeontological sensitivity map) should be assessed by a professional paleontologist.

Formal and informal cemeteries as well as pre-colonial graves occur widely across Southern Africa. It is generally recommended that these sites are preserved *in situ* and within a development. These sites can however be relocated, adhering to all legal requirements if conservation is not possible, but this option must be seen as a last resort.

The assessment is limited by the fact that palaeontological heritage, built heritage and the cultural landscape have not been assessed by appropriate specialists. However, due to the extent of the focus areas, intact cultural landscapes of significance can occur throughout the focus areas and should be assessed on a case by case basis.

Table 11 summarises the key impacts as envisaged for each of the focus areas of this study, and a guideline of the type of mitigation to be implemented in each case

Table 11: Key impacts on the Focus Areas

Focus Area	Heritage Impact	Mitigation
1 Middelburg Emalahleni Area	**Heritage** Construction of RE Facilities could damage, alter or destroy previously unrecorded heritage resources and graves and impact on cultural landscapes.	Impact areas must be subjected to an HIA. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity map should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
2 Klerksdorp, Viljoenskroon and Potchefstroom Area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA. In the vicinity of the Vredefort Dome a Visual Impact Assessment (VIA) (Grade 1 Site) will also be required. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
3 Danielskuil, Postmasburg, Lime Acres and Hotazel area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
4 Henneman, Virginia, Wesselsbron and Allanridge area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.

Focus Area	Heritage Impact	Mitigation
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
5 Aberdeen Beaufort West Area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
6 Vredendal area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	HWC requires a Notice of Intend to Develop (NID) to be submitted. Comments received on the NID will guide the HIA, if required. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources. Very few areas of high or medium palaeontological sensitivity have been identified in this Focus area.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
7 Prieska Copperton Area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.
8 Riemvasmaak Conservancy and Loeriesfontein area	**Heritage** Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Impact areas must be subjected to an HIA adhering also to the Protected Areas Act in the Riemvasmaak area. Absolute features of moderate to very high sensitivity should be avoided or mitigated prior to construction.
	Palaeontology Construction of RE Facilities could damage or destroy palaeontological resources.	Site specific Palaeontological sensitivities as mapped in this assessment and as per the SAHRIS palaeontological sensitivity should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.

6. POTENTIAL CUMULATIVE IMPACTS ASSOCIATED WITH THE DEVELOPMENT OF WIND AND SOLAR PV PROJECTS AND ASSOCIATED ACTIVITIES

Cumulative impacts occur from the combination of effects of various impacts on heritage resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. RE facilities in the focus areas together with other developments could impact negatively on heritage resources. From a cumulative perspective, it is anticipated that the development of RE Facilities in a REDZs can result in whole-scale changes of the environment as well as depletion of the archaeological record of the area, however this will have to be assessed on a case by case basis.

7. INPUT INTO THE ENVIRONMENTAL ASSESSMENT PROTOCOL

This assessment demonstrated that wind and PV projects can have significant impacts on heritage resources (i.e. on archaeological, palaeontological and historical resources as well as graves and on the cultural landscape). Due to the non-renewable nature of heritage resources, this assessment provides guidelines on the minimum requirements for approval of RE facilities in the REDZs once gazetted. These guidelines could fast track the heritage specialist component of RE facilities, but will require approval from SAHRA and/or the responsible heritage resources authority for each of the provinces where these focus areas are situated.

The lack of a National Heritage Survey that systematically covered the eight Focus Areas excludes the possibility of discarding the need for any type of project specific heritage assessment as part of the authorisation of RE facilities. Therefore the following assessment protocols apply as a minimum requirement for the 8 Focus Areas:

- Submission of a notification of development must be prepared by the developer or competent heritage specialist and submitted to the relevant heritage authority. In accordance with the requirements of Section 38(1) of the NHRA, this notification must include information on the:
  - Details and relevant expertise of the specialist preparing the notification;
  - Location, nature and extent (i.e. footprint) of the proposed development;
  - Available information on project area;
  - Opinion of the specialist on whether further heritage assessment is required, and what level of detail.
- Subsequently, the relevant heritage authority will determine the extent and scope of further studies, if required. The responsible heritage resources authority may then approve the development. Where further work is recommended, the heritage authority will request that the specified additional work be completed before approval.
- Absolute features indicated to be of high and very high heritage sensitivity (SAHRA Grade I and II as well as WHS (including tentative sites)) will trigger a full HIA process including input from specialists depending on the types of sensitivity associated with the development.
- Site specific Palaeontological sensitivities as mapped in this assessment and in conjunction with the SAHRIS palaeontological sensitivity map should be considered and an appropriate study (either desktop or full field-based study) should be conducted by a palaeontologist.

8. GAPS IN KNOWLEDGE

The authors acknowledge that the brief literature review is not exhaustive on the literature of the focus areas; this is due to databases that have not been included in the available electronic dataset and possible incorrect grading/ capturing of heritage resources on SAHRIS as well as the high level of the current assessment. Areas where no previous research or CRM work was conducted are not void of heritage resources, but this is rather due to a lack of survey coverage. Due to the subsurface nature of archaeological artefacts, the possibility exists that some features or artefacts may not have been discovered/recorded during surveys and the possible occurrence of unmarked graves and other cultural material in areas already assessed cannot be excluded. This study did not assess the impact on medicinal plants and intangible heritage and these components will need to be assessed through the public consultation for each RE facility. It is possible that new information could come to light in future, which might change the results of this Assessment.

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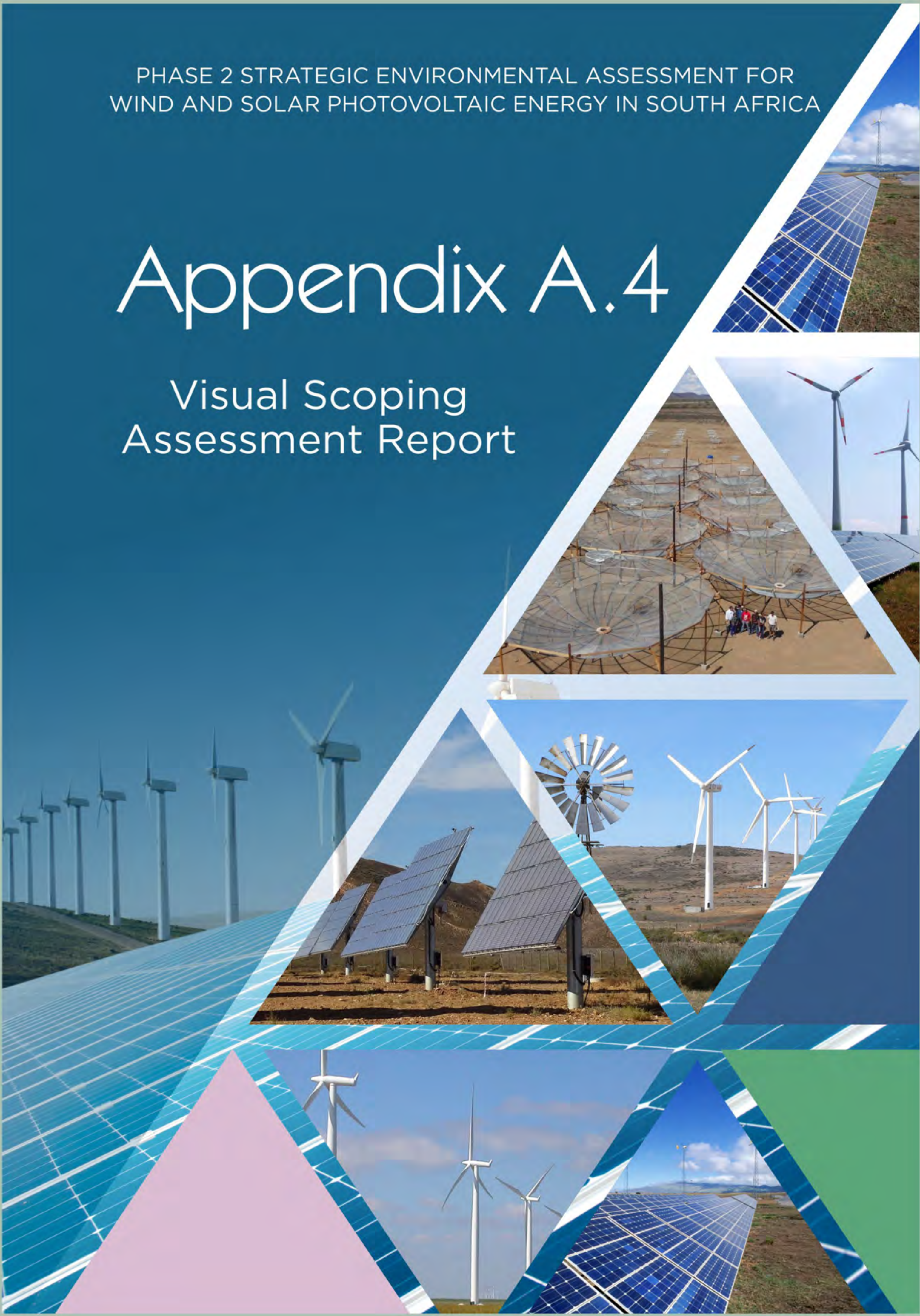
PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A.4

Visual Scoping Assessment Report



Visual and Scening Resources Scoping Assessment Report

Integrating Author	Bernard Oberholzer Landscape Architect
Contributing Authors	Quinton Lawson Architect

CONTENTS

TABLES

ABBREVIATIONS & ACRONYMS

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
EIA	Environmental Impact Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geospatial Information
NHRA	National Heritage Resources Act
PGWC	Provincial Government of the Western Cape
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment
SRTM	Shuttle Radar Topography Mission
VIA	Visual Impact Assessment

1. SUMMARY

This Phase 2 Wind and Solar PV SEA provides a high-level visual assessment of 8 focus areas identified by the CSIR, building on the previous Phase 1 Wind and Solar PV SEA (2015).

A description of the visual and scenic characteristics is given and scenic resources and special features for each focus area are mapped. Visual sensitivity criteria, including buffers, are established and mapped using four levels of sensitivity from low to very high visual sensitivity. Finally, potential visual impacts are identified, along with possible management actions, including thresholds for cumulative visual impacts.

Being regional in scale and strategic in nature, the visual SEA is seen as a broad suitability study for wind and solar PV development, and should not be confused with an EIA, which may be required at the local project scale to assess specific visual impacts.

A summary for each of the identified focus areas is given below:

Focus area	Summary of visual sensitivity
Focus area 1	Focus Area 1, located in Mpumalanga, near Middelburg and Witbank, is characterised by maize and cattle farming, along with coal mining and Eskom power stations. Most of the scenic features are in the north around the Olifants River, Loskop Dam and Bothaberg mountains. These are therefore the most visually sensitive areas, along with the major urban settlements and several nature reserves. A relatively large portion of the Focus Area has low visual sensitivity, suitable for solar PV development from a visual perspective.
Focus area 2	Focus Area 2, which straddles North West and Free State provinces, near Klerksdorp and Potchefstroom, is characterised by maize, cattle and sheep farming, together with gold and uranium mining. The area consists largely of flattish plains, the main scenic features being the Vaal River and the Vredefort Dome geosite, which has been declared a World Heritage Site. Besides the visually sensitive protected areas and urban settlements, the focus area is generally suitable for solar PV development, from a visual perspective.
Focus area 3	Focus Area 3 in the Northern Cape, consists of grassland steppe within the Griqualand West region, known for cattle ranches and game farms. Postmasburg in the south is a mining centre, including diamonds. The main topographic features in the otherwise flat plains, are the dolomitic Kuruman Hills and Asbesberge in the east. There are a large number of game farms in the west. Numerous solar energy farms have received environmental approval in the area, which is generally suitable for solar PV development from a visual perspective.
Focus area 4	Focus Area 4 in the Free State, including Welkom, Odendaalsrus and Wesselbron, consists of a vast plain with few topographical features. The area has maize, cattle and sheep farming, and forms part of the Free State's gold fields. Outside the urban settlements the Focus Area is generally suitable for solar PV development and a number of solar energy farms have already received environmental approval.
Focus area 5	Focus Area 5, which straddles the Western and Eastern Cape boundary, includes the towns of Beaufort West and Murraysburg in the Karoo. The mountain ranges, such as the Nuweveld, and dolerite 'koppies', are the main scenic features, while numerous game farms occur in the plains below. A number of wind and solar energy farms have received environmental approval, the most suitable areas from a visual perspective being the flat plains to the south.
Focus area 6	Focus Area 6 is located in the Western Cape, near the towns of Klawer, Vredendal and Vanrynsdorp, an area ranging from the Gifberg Mountains at the northern end of the Cederberg to the flat coastal plains of the West Coast. High visual sensitivity is expected in the mountains, along the Olifants River and around a number of nature reserves and game farms. The plains of the Knersvlakte and Hardeveld tend to have lower visual sensitivity, with a number of wind and solar energy farms having received environmental authorisation.

Focus area	Summary of visual sensitivity
Focus area 7	Focus Area 7 is located in the Northern Cape, near the town of Prieska on the Orange River. The topography ranges from the Asbesberg mountains in the north to the flat plains of the Bo-Karoo in the west and south. High visual sensitivity relates to the mountainous areas, the large number of game farms and a portion of the SKA wind/solar exclusion corridor. Remaining areas are suitable for both wind and solar energy development, with a number of environmental authorisations already having been given.
Focus area 8	Focus Area 8 lies in the Northern Cape, between Pofadder in the north and Loeriesfontein in the south. Except for some minor topographic features in the south, the region known as Bushmanland consists of vast, arid and unpopulated plains. This Focus Area has the lowest visual sensitivity of all the focus areas, and a number of wind and solar energy developments have received environmental authorisation in the past.

2. INTRODUCTION

The Phase 2 wind and solar PV Strategic Environmental Assessment (SEA,) which is being conducted by the Council for Scientific and Industrial Research (CSIR) at the request of the Department of Environmental Affairs (DEA), aims to identify geographical areas best suited for the rollout of wind and solar PV energy projects in South Africa.

This Second Phase visual assessment of suitable areas for wind and solar PV energy expands on the First Phase SEA which identified eight Renewable Energy Development Zones (REDZs) which were gazetted for implementation in February 2018. A similar format and methodology to that of the First Phase, has been used to provide consistency in assessing the visual sensitivity of the identified focus areas.

The assessment is timely in that both solar and wind energy are predicted to increase in South Africa and elsewhere owing to lower generation costs and the push for more emphasis on renewable energy sources. Added to this, South Africa has a high potential for solar generation in many parts of the country, especially the Northern Cape.

3. SCOPE OF THE VISUAL STRATEGIC ISSUE

The term 'visual' is used in this study in its broadest sense as including visual, scenic, aesthetic and amenity values, which contribute to an area's overall 'sense of place' and which encompass both natural and cultural landscapes (Oberholzer, 2005).

The purpose of this study is to anticipate the visual effects of wind and solar PV energy farms on the country's scenic resources and on sensitive receptors, such as residents and tourists, and to ensure that any potential visual impacts will be within acceptable limits, through careful siting and other mitigatory measures.

The visual assessment is a scoping-level study, focused primarily on interpreting existing information, using recognized visual criteria. The assessment is therefore a desktop study at the regional scale relying on the knowledge and experience of the authors and on available data and related studies, such as the Phase 1 Wind and Solar SEA (DEA, 2015) and the Electricity Grid Infrastructure (EGI) SEA (DEA, 2016).

Given the regional nature of the study, the visual assessment does not include local area resource mapping or viewshed analyses, which would only become relevant at the Environmental Impact Assessment (EIA) stage for specific project sites.

3.1 Visual Assessment Methodology

The format and approach of the visual study follows that of the earlier 2014 Landscape Assessment (DEA, 2015) for purposes of consistency and continuity.

The methodology incorporates the terms of reference for the visual assessment including the following:

- Review of existing literature to compile a baseline description applicable to each focus area;
- Identification of any additional features of interest or any gaps in information not identified in the existing sensitivity analysis, making use of datasets made available by CSIR and SANBI through the draft environmental constraints map and additional information sourced by the specialist;
- Review and update, where required, of the environmental sensitivity/attribute map provided by the CSIR and SANBI and develop/verify the approach for classing each sensitivity feature according to a four-tiered sensitivity rating system i.e. Very High, High, Medium or Low;
- Identification and discussion on the key potential impacts (positive and negative) associated with the development of wind and solar PV projects and associated activities;
- Description of the potential cumulative impacts associated with the development of wind and solar PV projects and associated activities taking into account existing renewable energy projects across South Africa and the existing REDZs;
- Based on the findings of the assessment, provide the relevant information and produce an updated four-tiered sensitivity map related to the visual field of expertise; and
- Review and provide input to the environmental assessment protocol, e.g. additional information and level of assessment is required in each sensitivity category before an authorisation with respect to visual should be considered.

The methodology for this visual assessment involved three basic steps, outlined below:

Step 1: Visual Resource Mapping (descriptive)

The first step involves a description and identification of visual and scenic features to provide a baseline for each of the focus areas. It is a classification method in which following aspects are considered:

- Differentiation of the focus area into landscape types;
- An inventory and mapping of scenic features and visual receptors.

Step 2: Visual Sensitivity Mapping (interpretive)

The second step involves interpretation, using criteria that influence the value of visual / scenic resources, and therefore their 'significance'. The criteria are spatialized, with buffers added, based on the relative sensitivity of the feature or receptor. Four levels of visual sensitivity have been prescribed for the study, namely very high sensitivity, high sensitivity, medium sensitivity and low sensitivity. This step relies to a certain degree on judgement in which the following criteria are considered:

- Visually sensitive landforms and water features;
- Proclaimed or protected areas (national parks, nature reserves);
- Visually sensitive receptors (settlements, routes); and
- Heritage resources.

Step 3: Visual Resource Management (prescriptive)

The third step involves the design of strategies for the protection and management of visual / scenic resources to increase benefits and minimise impacts. This step involves prescription in which the following measures are considered:

- Visual assessment requirements;
- Permit requirements as part of authorization;

- Management measures to avoid, reduce or offset impacts; and
- Input into development protocol document.

3.2 Data Sources

A list and description of data sources on which the landscape assessment was based, and from which sensitive features/criteria were extracted, is given in Table 1, and assumptions and limitations in Table 2 below.

Table 1: Data Sources

Data title	Source and date of publication	Data Description
1:2 000 000 Geological Map of SA	Council for Geoscience, 2011	Geological information.
1:500 000 topographic series maps of South Africa	Surveys and Mapping (several sheets with various dates).	Topographical and cadastral information.
South African Protected Areas Database (SAPAD)	Dept. Environmental Affairs, Q1, 2018.	National Parks and Protected Areas.
South African Conservation Areas Database (SACAD)	Dept. Environmental Affairs, Q1, 2018.	Biodiversity and Conservation Areas.
Heritage and Scenic Resources: Inventory and Policy Framework for the Western Cape	S. Winter and B. Oberholzer, May 2013. For DEADP, Provincial Government of the Western Cape.	Survey and rating of heritage and scenic resources in Western Cape.
National Heritage Sites Inventory Database: Heritage data for Focus Areas	SAHRA Heritage Database, 2017.	Point shape files, KML files of graded heritage sites.
National Freshwater Ecosystem Priority Areas (NFEPA)	South African National Biodiversity Institute (SANBI BGIS) 2017.	River and wetland datasets. Shape files.
SRTM Topographic digital elevation	NASA SRTM (Shuttle Radar Topographic Mission).	Topographic data with resolution of 90x90m and vertical accuracy of 16m.
Conservancies, Private nature Reserves and Game Farms.	South African National Biodiversity Institute (SANBI BGIS), 2018.	Shape files.
AfriGIS Towns National Dataset	SANBI: AfriGIS, 2017	Shape files.
South African Airport and Airfields Dataset	Civil Aviation Authority (CAA), 2018	Point shape files.

Table 2: Visual Assessment Assumptions and Limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Level of mapping detail	1: 500 000 topographical maps, and 1:1 000 000 geological survey maps.	1:250 000 or 1:50 000 topographical maps.	1:500 000 mapping was adequate for a regional scale study. 1:50 000 scale maps better suited for local scale mapping.
Information on scenic resources	Topographical and water features, as mapped by authors.	Minor topographical features and geosites.	More detailed mapping would be required at the local project scale during a VIA.
Information on cultural landscapes	Information to be obtained from Heritage Specialist if possible.	Detailed analysis of local areas using historical airphotos or Google Earth imagery.	Additional heritage assessment probably required on an individual project basis in terms of the National Heritage Resources Act (NHRA).
Information on private reserves, game/ guest farms and resorts.	Information was included where these facilities were known.	Detailed survey of private reserves / game farms.	Detailed information would be needed on an individual project basis.
Connecting powerlines and substations not included in study.	Some mitigation actions indicated in Section 6.1	Visual criteria or buffers not included in the study.	Connecting powerlines and substations need to be considered for individual applications.

International, national, provincial and local legal instruments to protect natural heritage and scenic resources are given in Table 3 below.

Table 3: Landscape and Visual Regulatory Framework

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.
National Instrument	
National Environmental Management Act (NEMA) (Act 107 Of 1998: Regulations in terms of Ch. 5.	Activities requiring authorisation and the procedure to be followed, including proposed engineering and infrastructure projects.
Integrated Coastal Management Act (ICM Act) (Act 24 of 2008)	Protection of the coastal zone including land within 1 km of the High Water Mark (HWM) to 'protect the ecological integrity, natural character and the economic, social and aesthetic value of coastal public property'.
National Heritage Resources Act (Act 25 of 1999 NHRA)	Includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes.
Protected Areas Act (PAA) (Act 57 of 2003, Section 17)	Includes protection of natural landscapes.
Provincial and Local Authority Instruments	
Land Use Planning Ordinance (LUPO)	Local authority zoning schemes can be used to protect natural and cultural heritage resources through 'Conservation Areas', 'Heritage Overlay Zones' and 'Scenic Overlay Zones' including scenic routes.

Provincial Government of the Western Cape, 2006: Strategic Initiative to Introduce Commercial and Land Based Wind Energy Development to the W. Cape.	A broad guiding framework for the location of wind energy facilities based on the sensitivity and capacity of landscape types and the scale of the project.

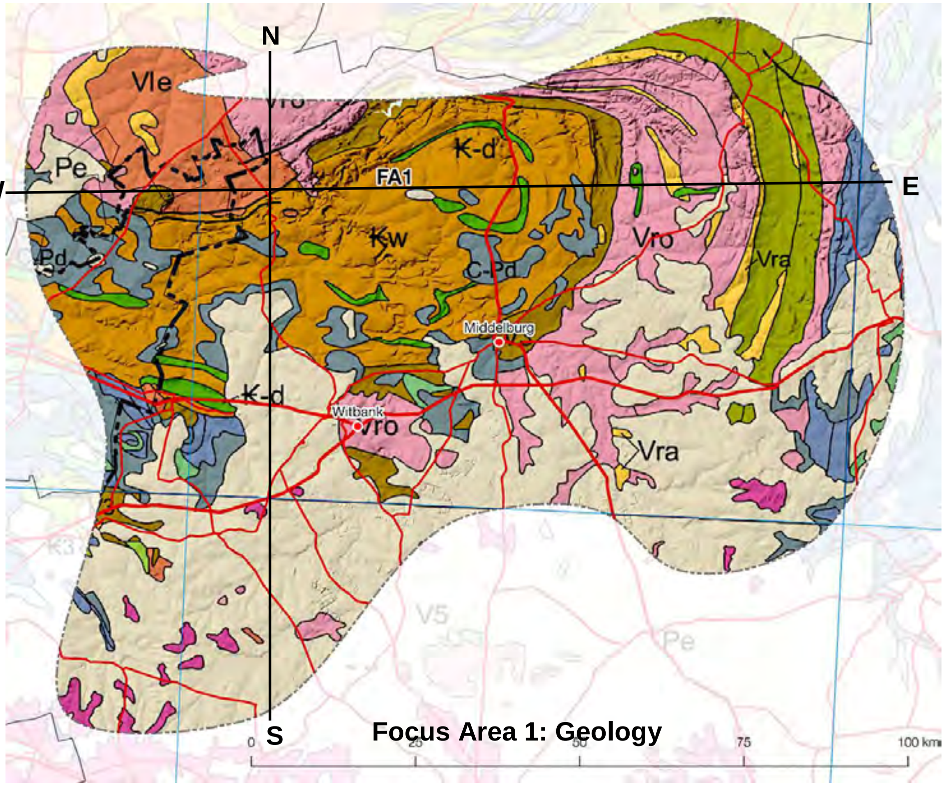
4. KEY VISUAL / SCENIC ATTRIBUTES AND SENSITIVITIES OF THE STUDY AREAS

4.1 Focus Area Description

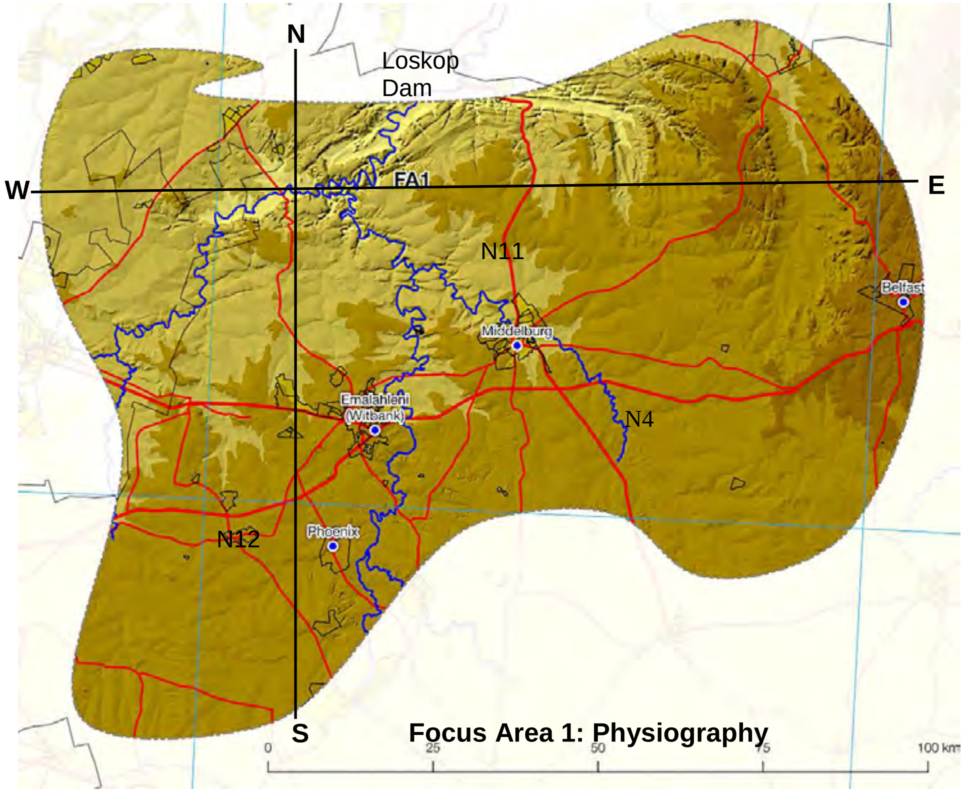
A description of the main attributes and scenic resources of the eight focus areas, listed in Table 4 below, is given in this Section. The brief geological description provides an understanding of the physiography of the landscape, which in turn determines the topographic features – a major component of the scenic resources at the regional scale. The description of each focus area is therefore divided into regional context, geomorphology and landscape features. Characteristic transects are provided for each focus area (shown as black lines in the Geology figures).

Table 4: List of Focus Areas

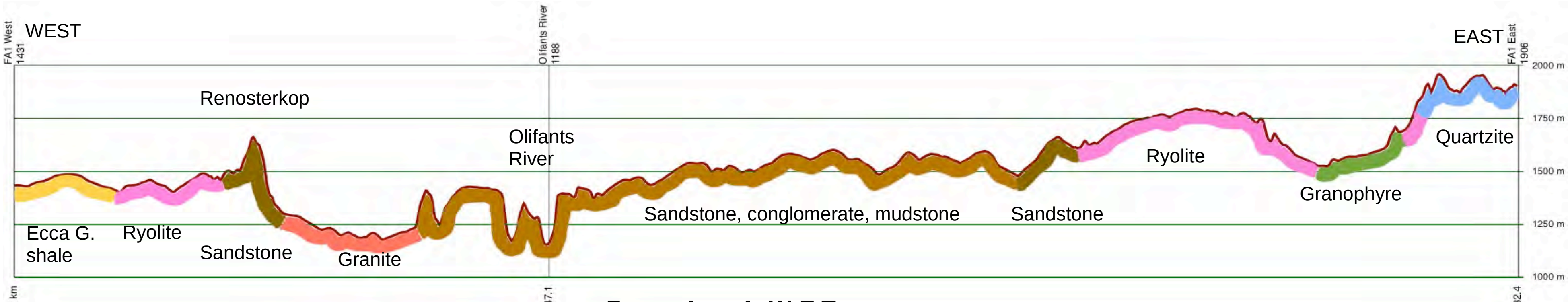
Focus Area	RE Type	Province	Towns
FA1	Solar PV	Mpumalanga	Middelburg, Witbank
FA2	Solar PV	North West / Free State	Potchefstroom, Klerksdorp, Parys
FA3	Solar PV	Northern Cape	Kuruman, Kathu, Postmasburg
FA4	Solar PV	Free State	Welkom, Odendaalsrus, Wesselbron
FA5	Wind	Western / Eastern Cape	Beaufort West, Three Sisters, Murraysburg
FA6	Wind/solar PV	Western Cape	Vredendal, Vanrynsdorp, Klawer
FA7	Wind/solar PV	Northern Cape	Prieska, Copperton, Marydale
FA8	Wind/solar PV	Northern Cape	Between Pofadder and Loeriesfontein



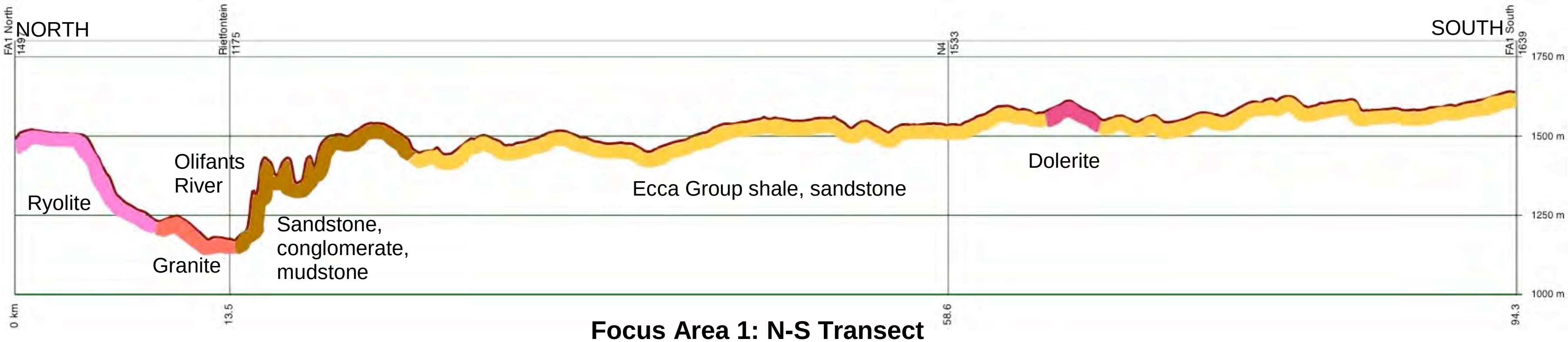
Focus Area 1: Geology



Focus Area 1: Physiography



Focus Area 1: W-E Transect



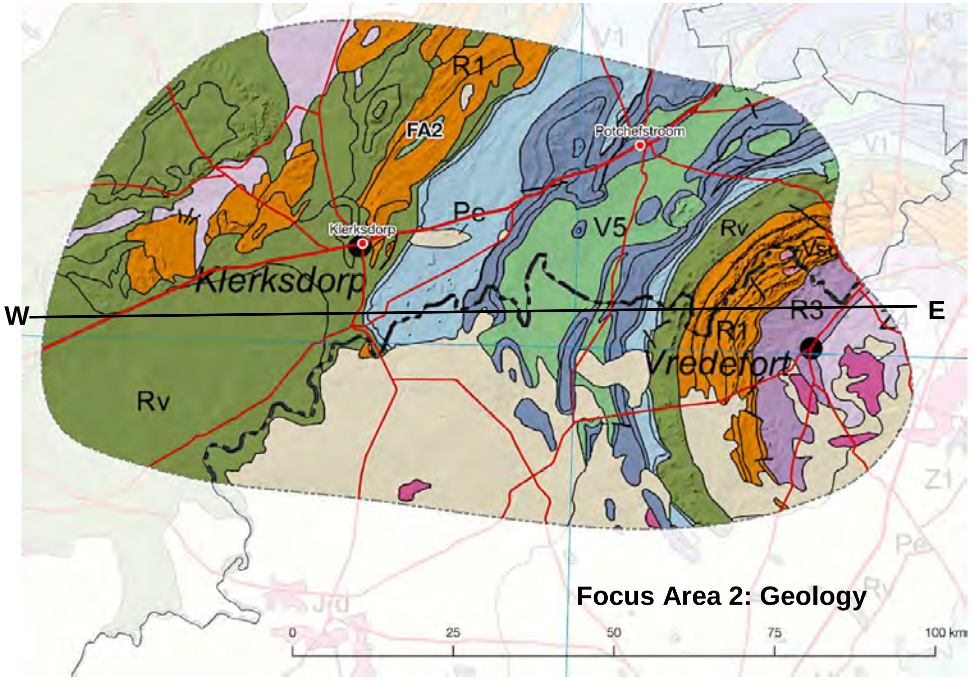
Focus Area 1: N-S Transect

Focus Area 1

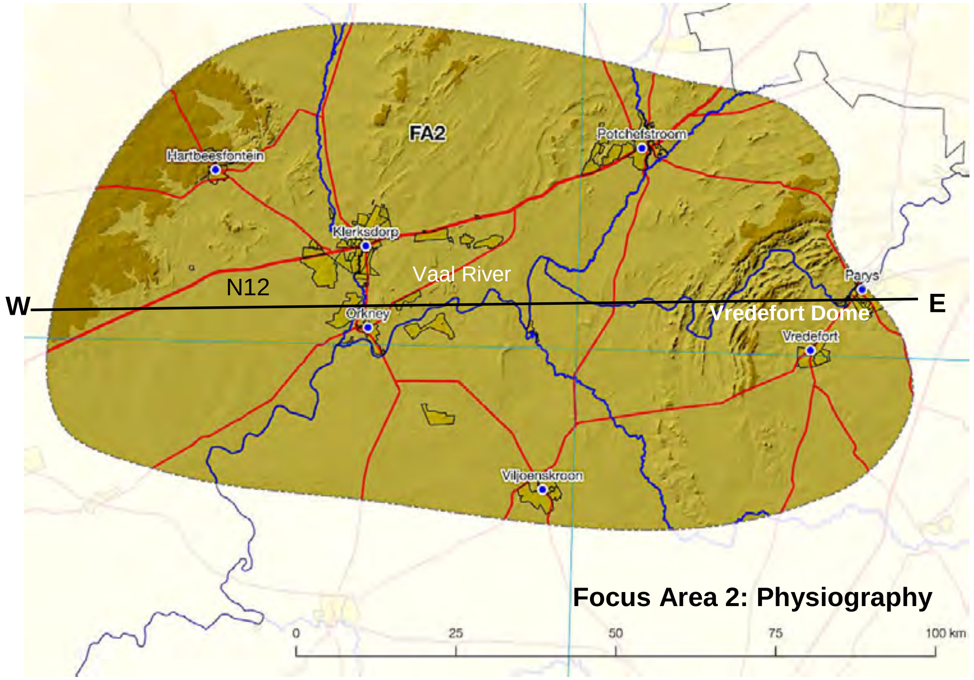
Regional context:
Focus Area 1 is located in Mpumalanga, around the towns of Middelburg and eMalahleni (Witbank), an area crossed by the N4, N11 and N12 National Routes, as well as by rail lines and power lines. The area is known as the Highveld, characterised by savanna and maize crops, as well as cattle farming. Coal mining is prevalent, as are large Eskom power stations and steel production.

Geomorphology:
The focus area consists of 2 broad landscape types: 1) the high-lying (1600-1800m) southern portion composed of shales of the Ecca Group, intruded in places by dolerite, and 2) the lower (1400-1600m) northern portion which includes the Waterberg Group sandstones, as well as rhyolite and granite, deeply incised by the Olifants River and its tributaries.

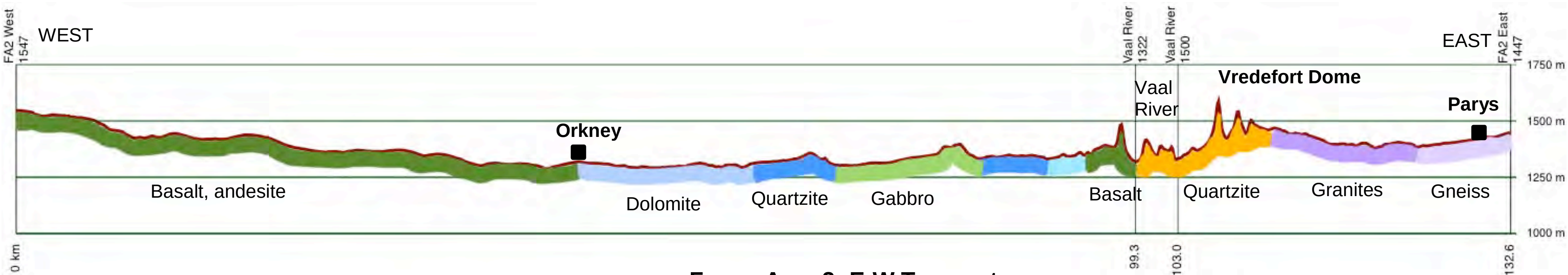
Landscape features:
Except for the Olifants River Valley, and the Loskop Dam / Nature Reserve in the north, there are few topographic features of note, although there are a number of steep ridges in the northern portion and numerous wetlands in the southern portion of the Focus Area. The higher elevation hills, such as the Bothaberg, are in the northeast. The National Routes are important arterials and visual corridors. There are a number of approved solar PV energy farms within the Focus Area.



Focus Area 2: Geology



Focus Area 2: Physiography



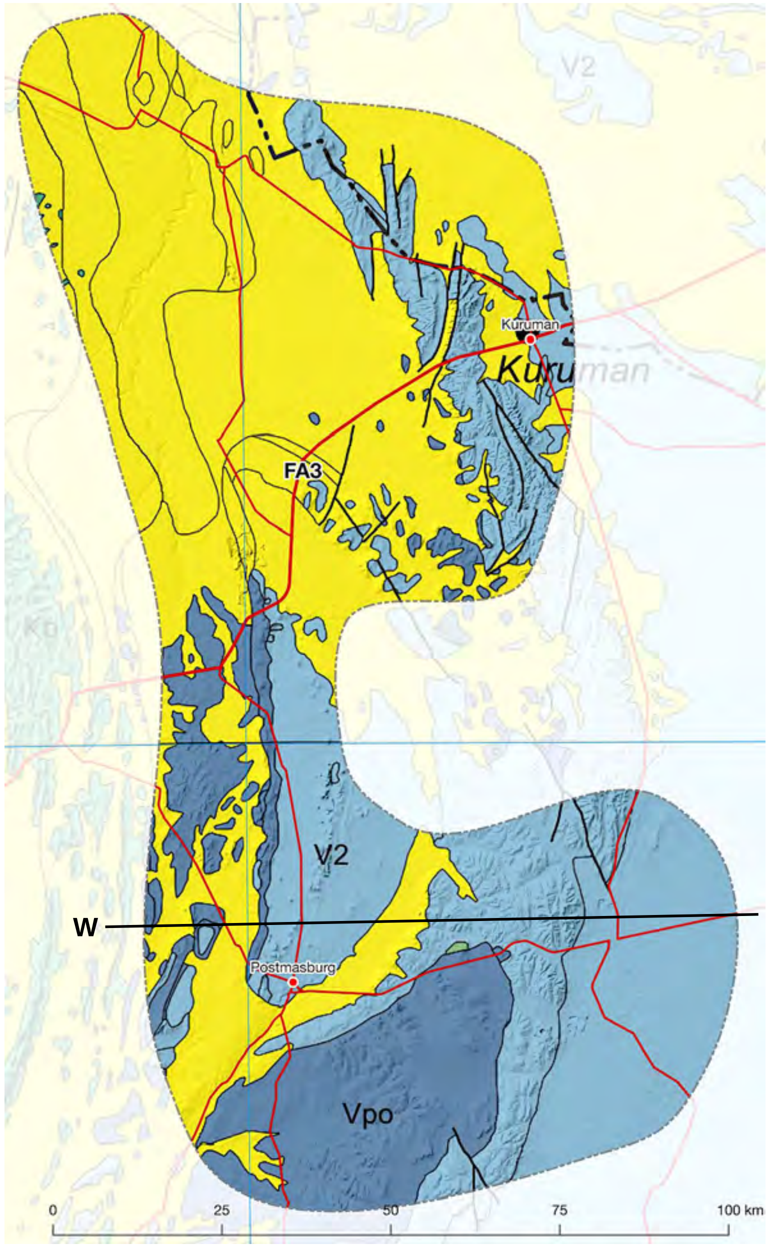
Focus Area 2: E-W Transect

Focus Area 2

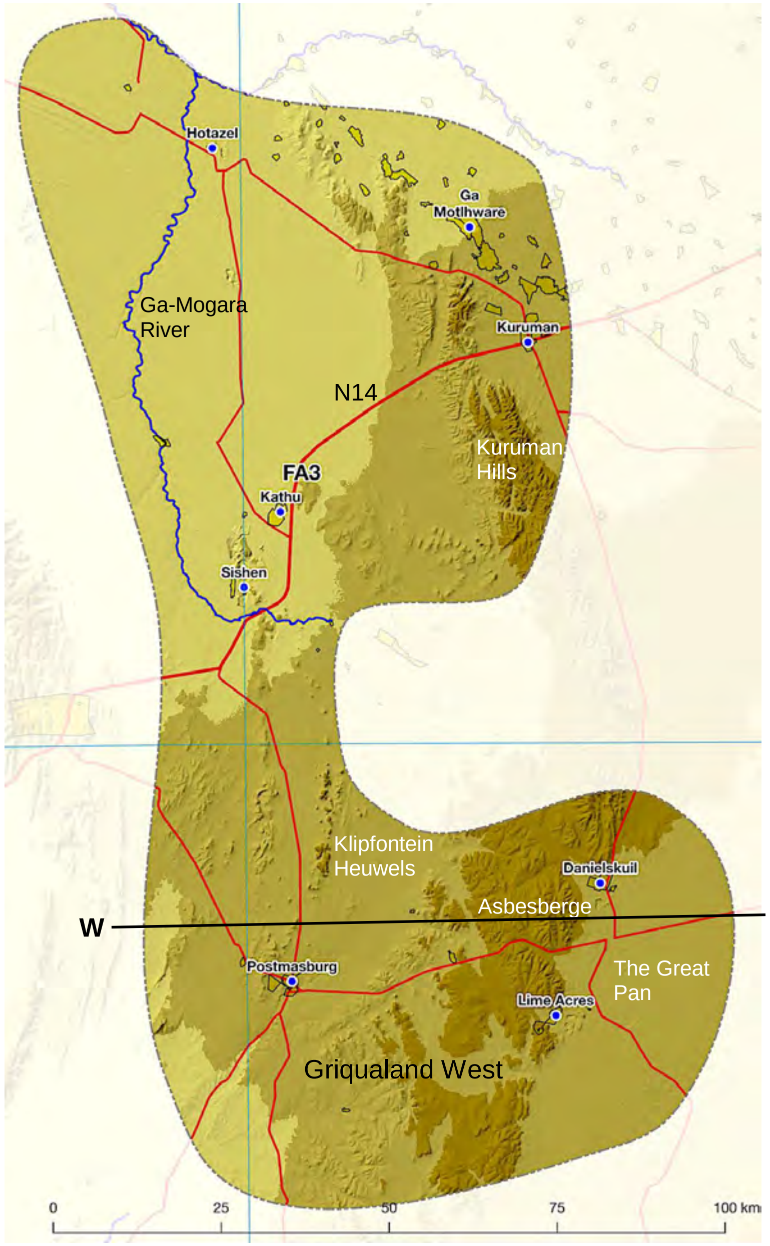
Regional context:
Focus Area 2 straddles the boundary between North-West Province and the Free State, and includes the towns of Potchefstroom and Klerksdorp. The N12 National Route passes through both towns. As in the case of Focus Area 1, the area is rich in minerals, including gold and uranium, notably around Klerksdorp and Orkney. It is also known for maize, cattle and sheep farming. The area is a relatively flat plain 1300-1500m above sea level.

Geomorphology:
The Focus Area can be divided into 2 broad landscape types, similar to that of Focus Area 1: 1) The southern portion composed of shales and sandstones of the Ecca Group, intruded in places by dolerite, and 2) the northern portion consisting of basalt, andesite, dolomite, quartzite and gabbro. An interesting geological feature in the eastern portion of the Focus Area is the ancient 'Vredefort Dome', a meteorite impact site, which has resulted in a semi-circle of concentric ridges, consisting of quartzite, granites and gneiss, centred around the towns of Parys and Vredefort.

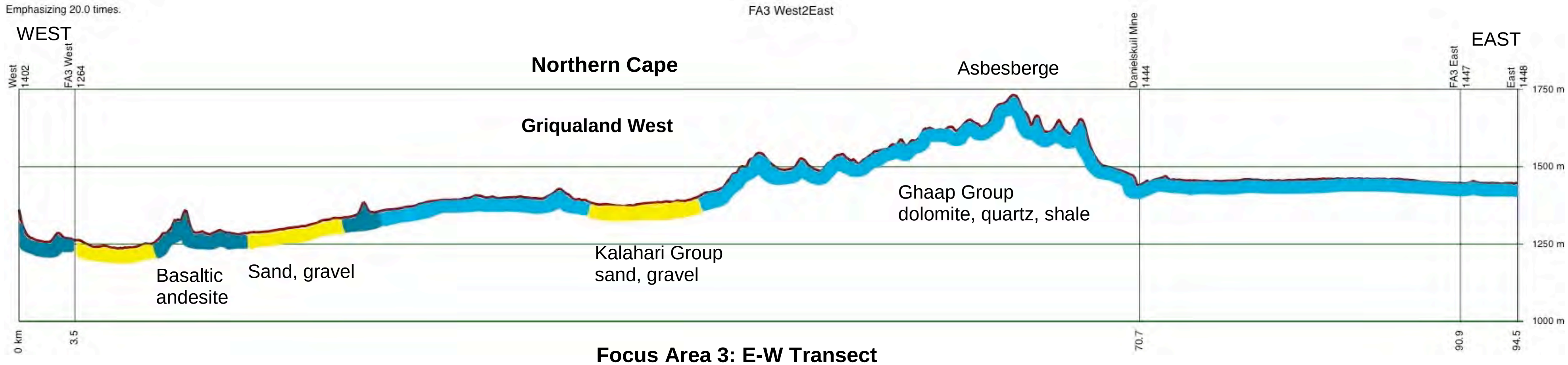
Landscape features:
In a generally featureless plain, the main landscape feature is the Vredefort Dome mentioned above. The Vaal River, the other main feature of the Focus Area, cuts through the Vredefort Dome. Within this area, the Vaal is fed by the Renoster and Skoonspruit Rivers. The Vredefort Dome is considered to be the largest and oldest such structure on Earth and was recently declared a World Heritage Site (Council for Geoscience, 2018). There are a number of private reserves and game farms within the Focus Area, as well as several approved solar PV energy farms.



Focus Area 3: Geology



Focus Area 3: Physiography



Focus Area 3: E-W Transect

Focus Area 3

Regional context:

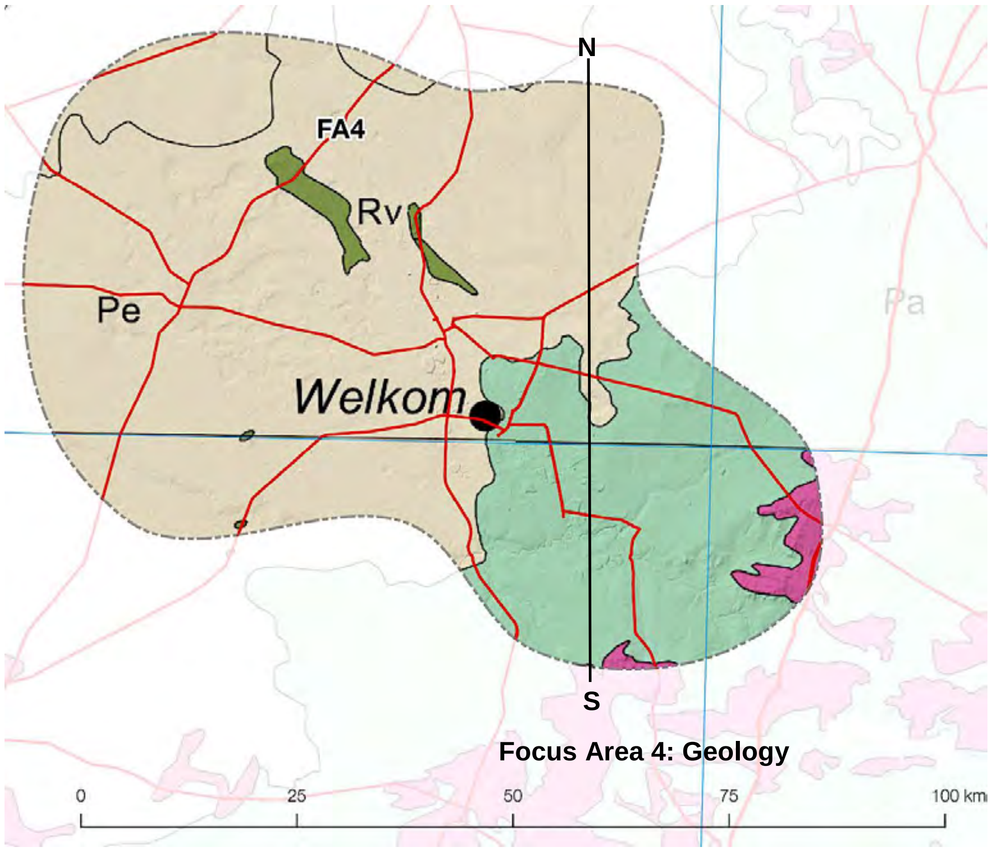
Focus Area 3 is a fairly arid area in the Northern Cape, forming part of Griqualand West, an area of grass and scrub steppe. The main towns are Kuruman and Postmasburg, the N14 National Road passing through Kuruman. The area is known for cattle ranching, game farms and diamond mining in the south. Kuruman, which started as a mission station, has a large freshwater spring (the Eye) that gushes from the dolomitic rock and supplies the whole town. Postmasburg is a centre for mining in the area, including diamonds, iron-ore and manganese.

Geomorphology:

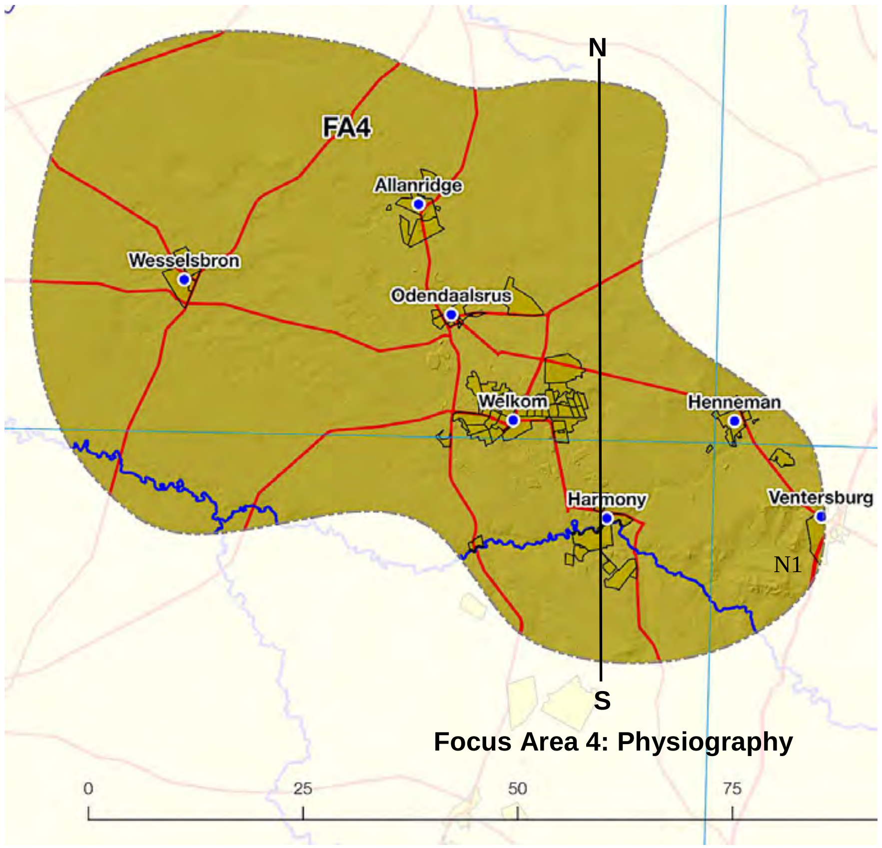
The focus area consists of 2 broad landscape types, being 1) the northern portion, a flat plain consisting of Kalahari Group sands, gravels and clay, and 2) the more mountainous southern portion composed notably of dolomite belonging to the Ghaap Group. A high-quality limestone is mined in the Dolomite Series of the Asbesberge near the company settlement of Lime Acres. Diamonds are mined south of Lime Acres at the Finsch Diamond Mine. Marble is also obtained from the dolomite, while asbestos mining in the Asbesberge has been discontinued (On Route in South Africa, 2014).

Landscape features:

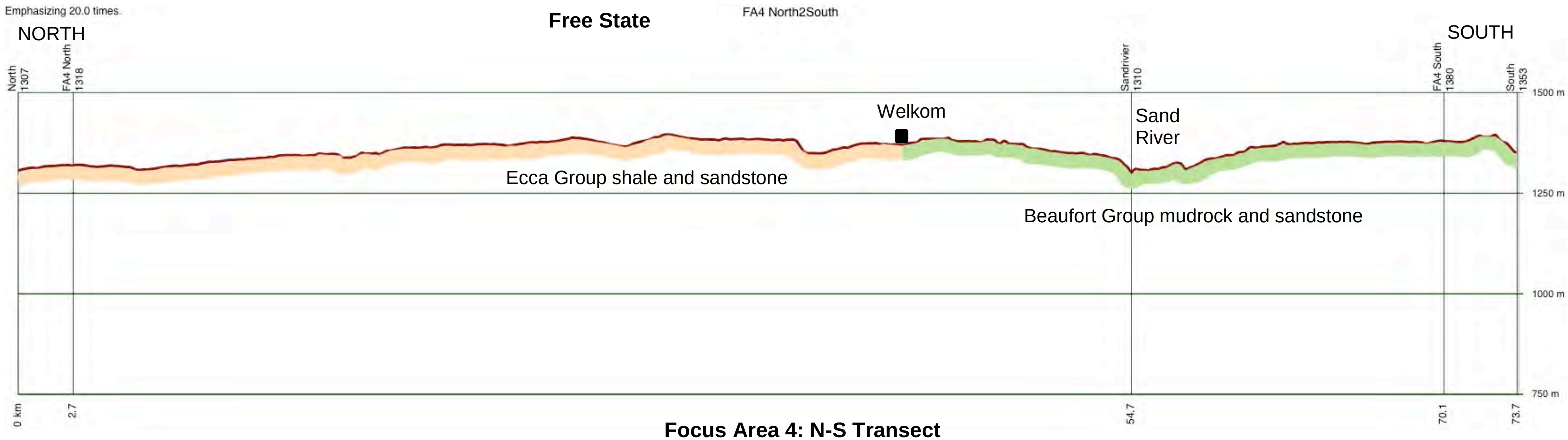
The main landscape features are the Kuruman Hills in the northeast and the Asbesberge in the southeast. There are few drainage features in the arid landscape, the most notable being the Ga-Mogara flowing north, The Great Pan and other smaller pans east of Lime Acres. A large archaeological site occurs on a low hill northeast of Kathu, a mining town located in a camelthorn forest. A large number of solar PV and CSP energy facilities have been approved in the Focus Area.



Focus Area 4: Geology



Focus Area 4: Physiography



Focus Area 4: N-S Transect

Focus Area 4

Regional context:

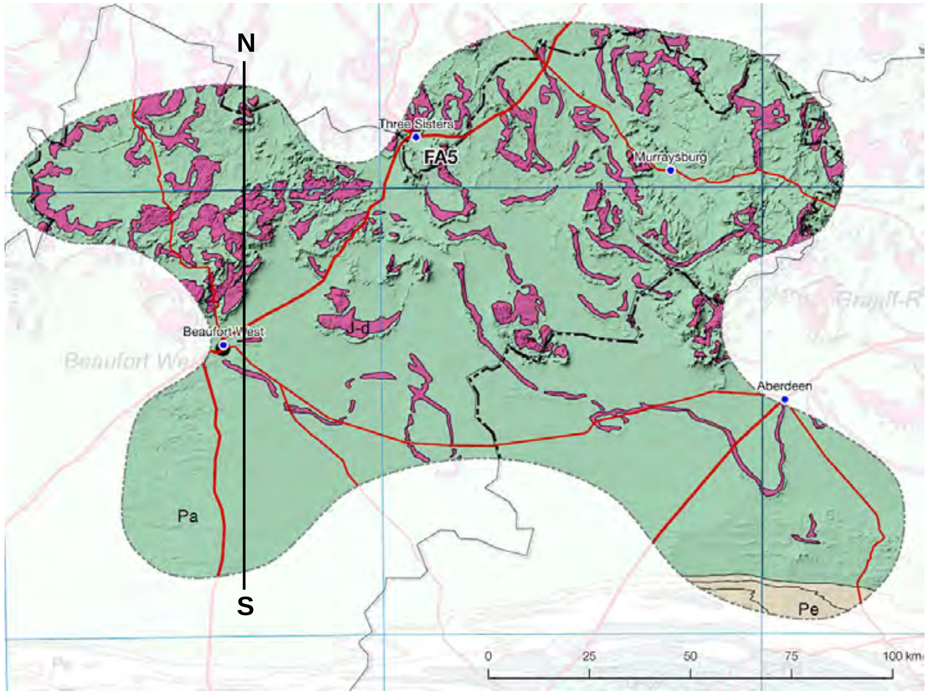
Focus Area 4 forms part of the Free State's gold fields, centred around the main town of the area, Welkom. A new town, Virginia, lies 19km southeast of Welkom, on the banks of the Sand River, a popular destination for water sports and home for some of the Harmony Gold mines. Agricultural activities in the area include maize and dairy farming, along with cattle and sheep. The main rail line between Bloemfontein and Johannesburg passes through the area as well as a number of powerline corridors. A number of solar PV energy farms have been approved within the Focus Area.

Geomorphology:

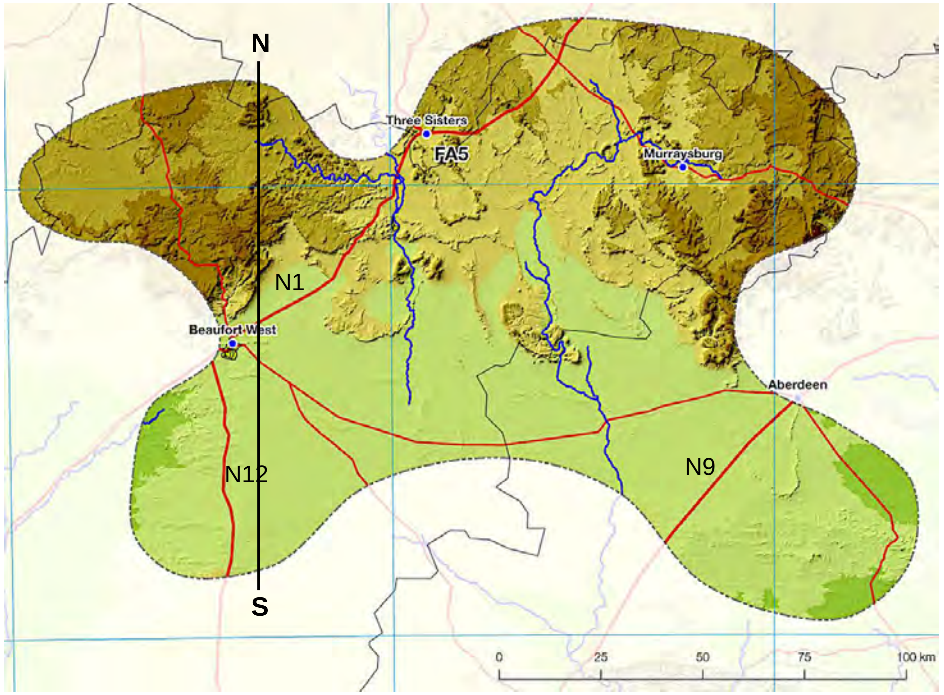
Geologically the Focus Area is divided into 2 broad landscape types: 1) the western portion composed of shales and sandstone of the Ecca Group and 2) the eastern portion consisting of mudrock and sandstone of the Beaufort Group, intruded to the southeast by dolerite. The result of these geological formations is a vast plain with few topographical features. The general elevation is 1200-1400m.

Landscape features:

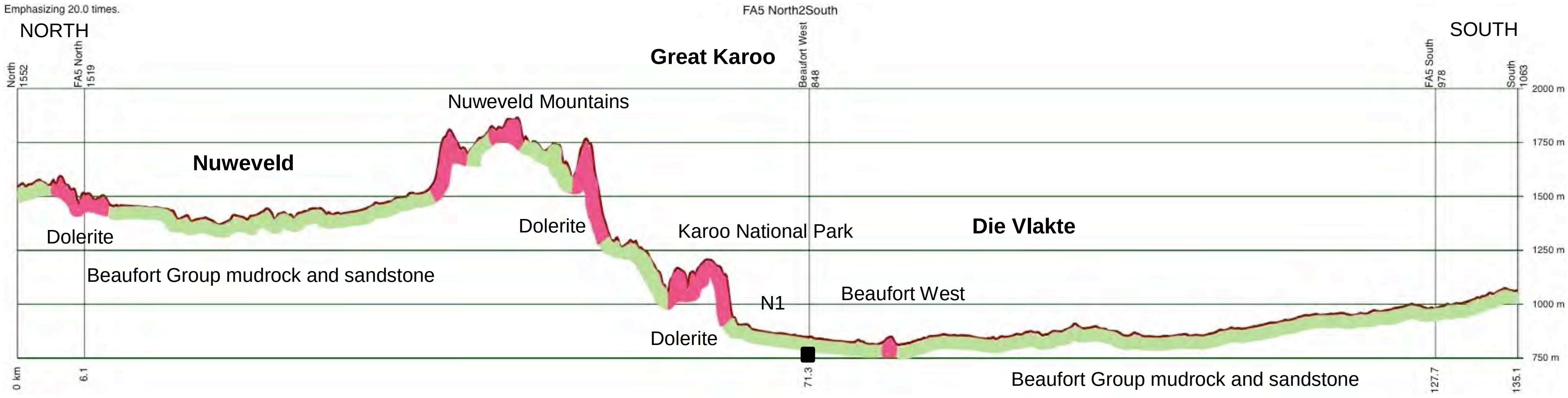
As indicated, there are few topographic features in the expansive Free State landscape. Salt pans are a characteristic feature between Welkom and Wesselsbron, in an area where other drainage features are absent. The Sand River is the main feature in the south.



Focus Area 5: Geology



Focus Area 5: Physiography



Focus Area 5: N-S Transect

Focus Area 5

Regional context:

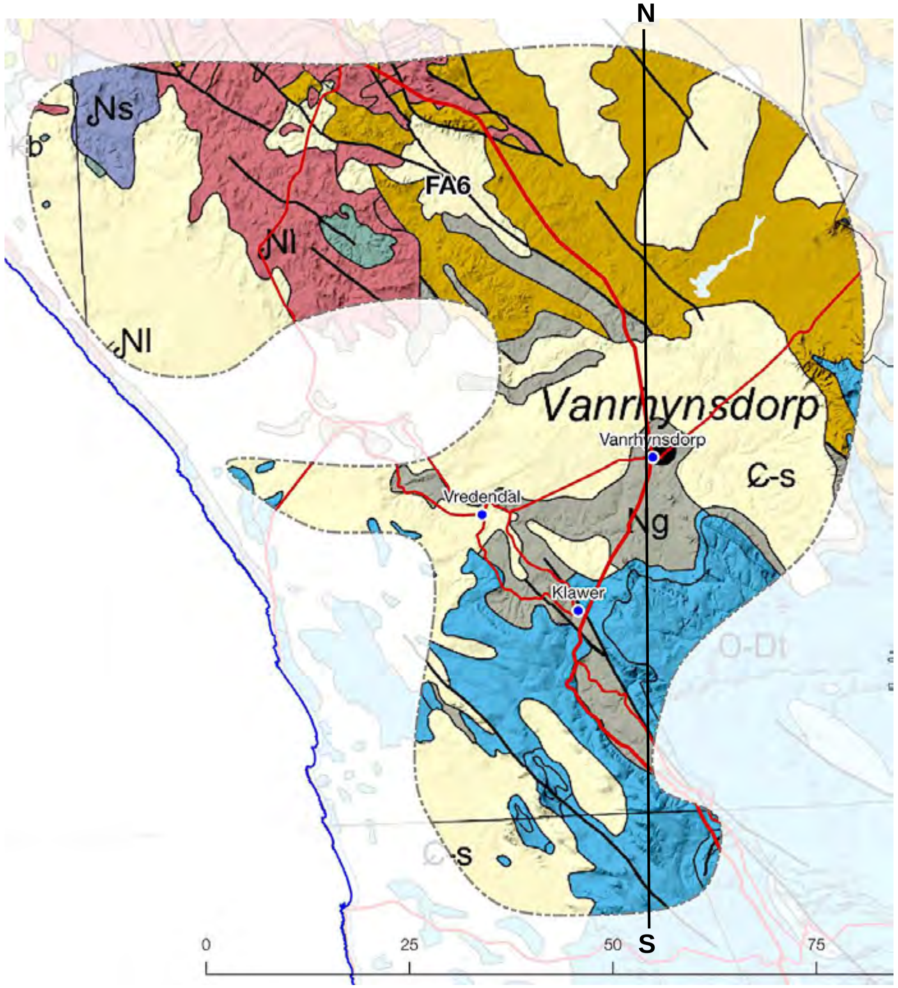
Focus Area 5 lies within the Great Karoo at the confluence of the Western, Eastern and Northern Cape, the largest towns being Beaufort West and Murraysburg. The N1, N9 and N12 National Roads cross parts of the Focus Area. The arid Karoo landscape, with its succulent scrub vegetation, is known for merino sheep farming and game farms, many of which are also guest farms. A number of wind energy farms have been approved in the Focus Area, mainly to the north of Murraysburg.

Geomorphology:

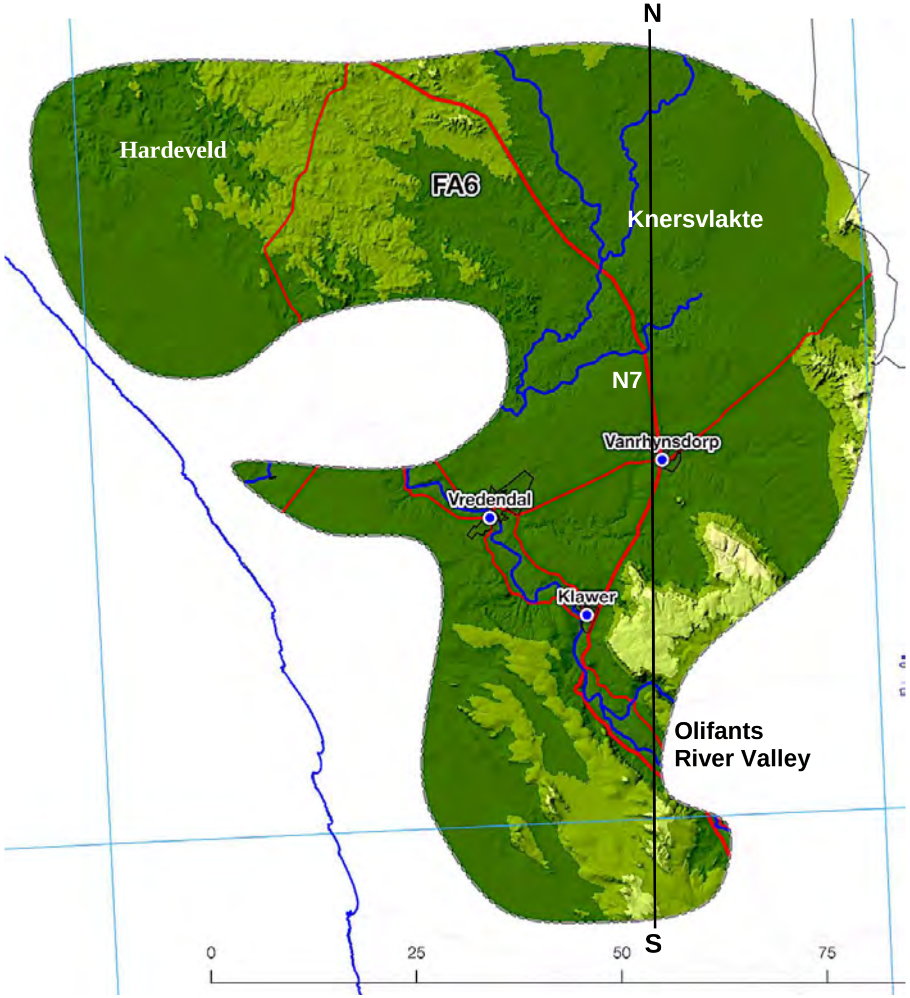
The geology of the Focus Area is typical of the vast Karoo, being mudrock and sandstone of the Adelaide Formation, part of the Beaufort Group of rocks. The Focus Area also lies within the region intruded by dolerite, the characteristic flat-topped hills and mesas deriving their form from the weather-resistant dolerite capping. The escarpment divides the Focus Area into the southern low-lying 'Vlaktes' (600-800m elevation), and the northern upland plateau (1400-1800m elevation), although some mountain ranges, such as the Toorberg, are over 2000m.

Landscape features:

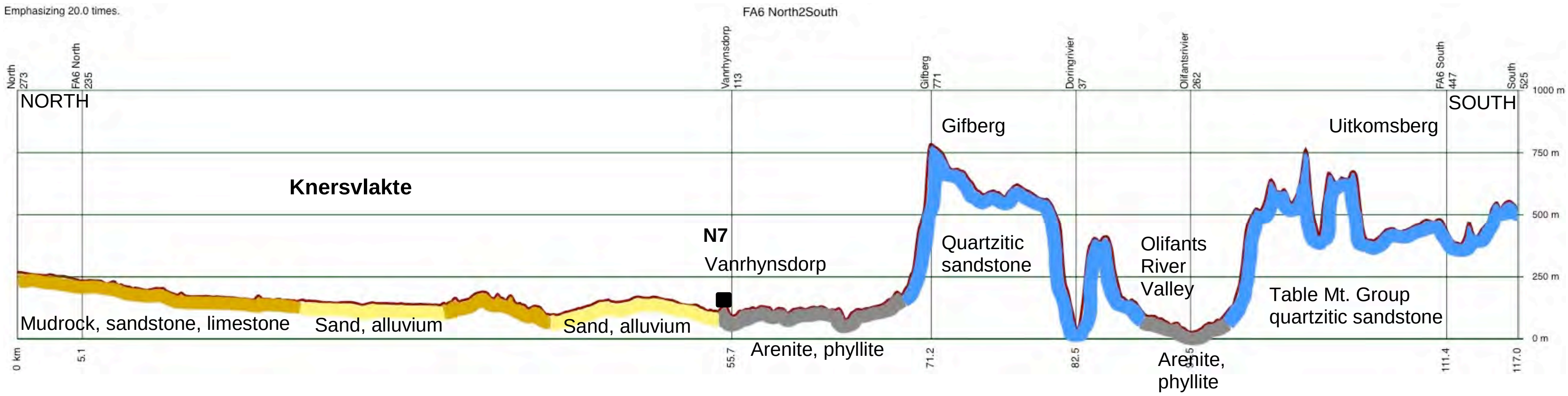
The relentless Karoo plains are contrasted in the Focus Area by mountain ranges making up the escarpment, including the Nuweveld range near Beaufort West, and the Kamdeboo and Toorberg ranges south of Murraysburg. The Three Sisters are well-known 'koppies' adjacent to the N1 National Route and there is an important archaeological site near Nelspoort. The Karoo National Park and scenic Molteno Pass are to the north of Beaufort West.



Focus Area 6: Geology



Focus Area 6: Physiography



Focus Area 6: N-S Transect

Focus Area 6

Regional context:

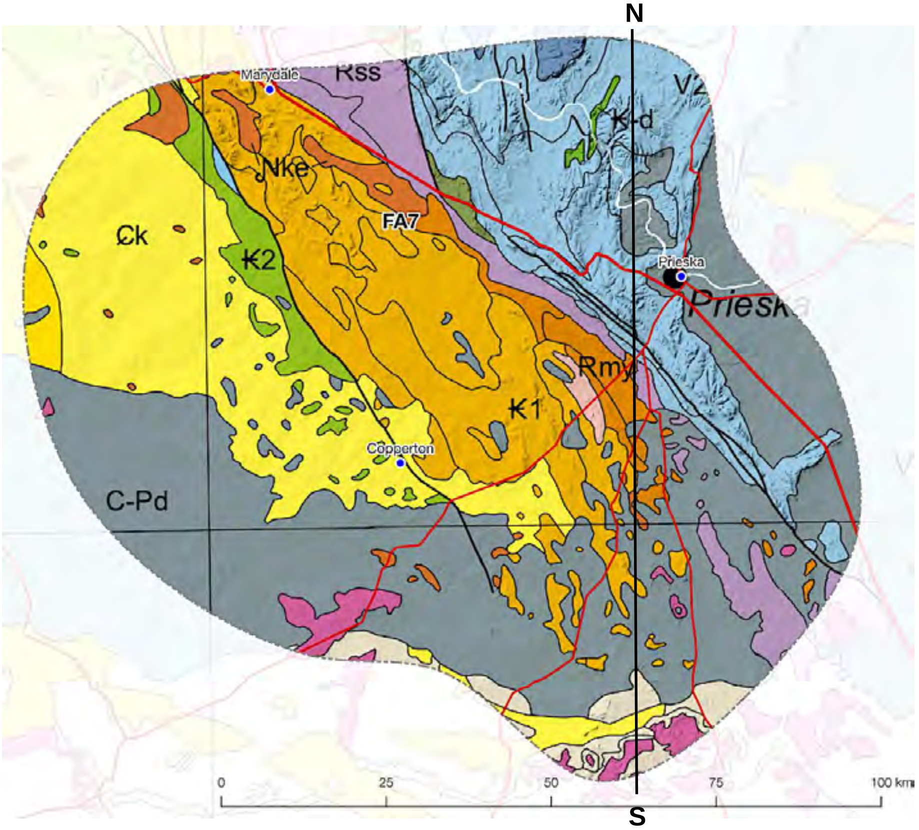
Focus Area 6 is located at the northern extremity of the Cederberg and Olifants River Valley, and opens out further north into the broad plains of the Knersvlakte. The Olifants River Valley, along with an extensive irrigation canal system, supports intensive citrus fruit farming, as well as vineyards, vegetables and lucerne. The N7 National Road is the Cape to Namibia Route passing through Klawer and Vanrhynsdorp. The other main town of the area is Vredendal.

Geomorphology:

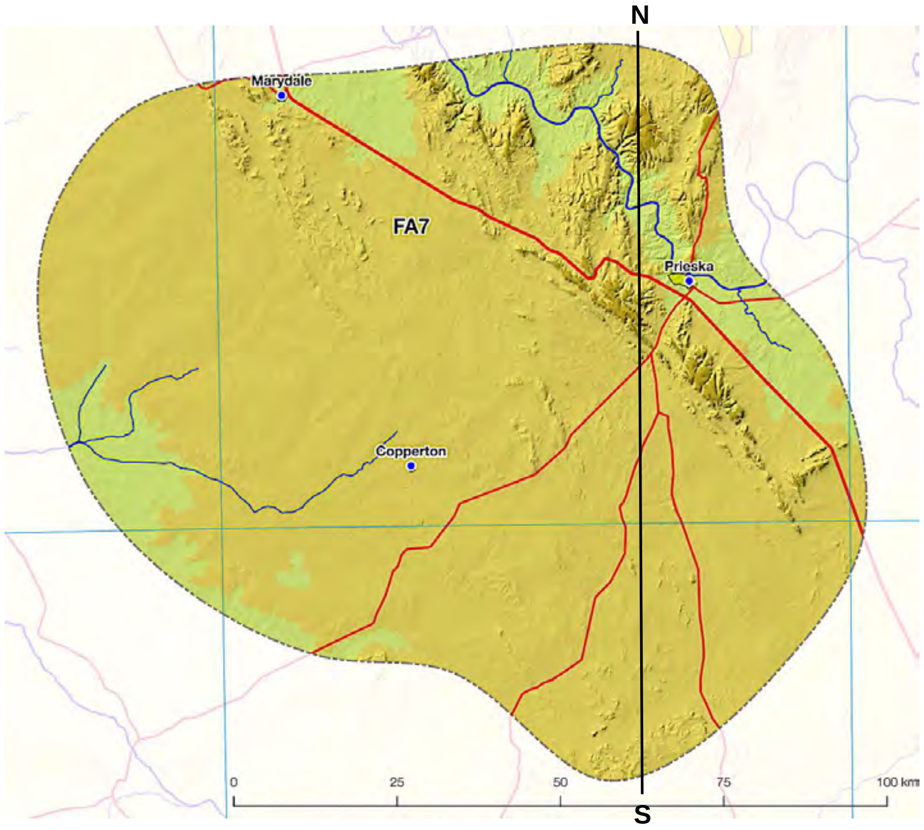
The focus area can be divided into 2 broad landscape types: 1) the northern portion consisting of a wide coastal plain with recent sand, alluvium and calcrete, and further inland the mudrock, sandstones and limestones of the Vanrhynsdorp Group, and 2) the southern portion consisting of rugged mountains at the northern end of the Cederberg, formed by the quartzitic sandstones of the Table Mountain Group. Gypsum is mined north of Vanrhynsdorp and marble south of the town, while dolomite is quarried outside Vredendal.

Landscape features:

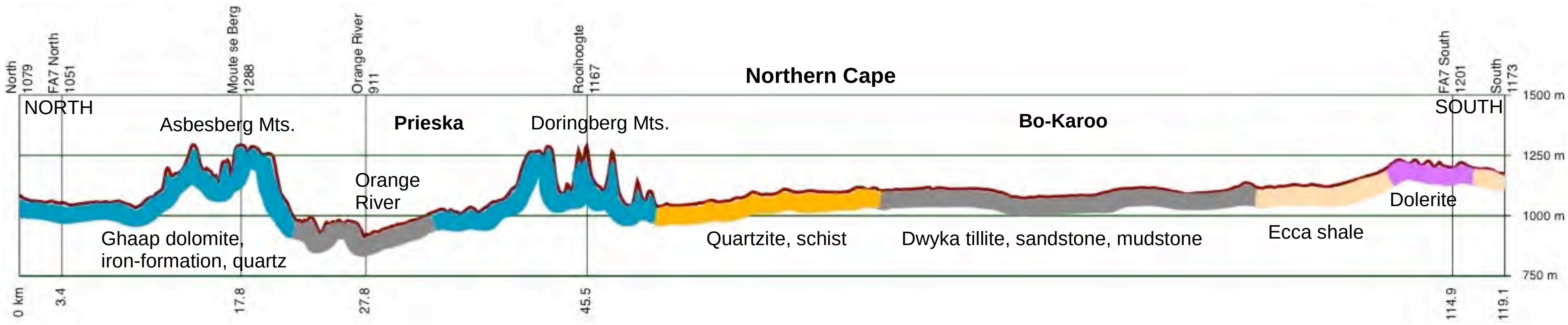
The Olifants River Valley and Bulshoek Dam are major landscape features with scenic, agricultural and recreational value. The flanking mountain ranges, which reach 800-1000m, and the Doring River, which has carved a gorge through the mountains, as well as a number of mountain passes, are other landscape features of note. The granitic-gneiss hills of the Hardeveld in the northwest have both scenic value and importance for wild flowers in spring. Wind energy projects have been approved in the Hardeveld.



Focus Area 7: Geology



Focus Area 7: Physiography



Focus Area 7: N-S Transect

Focus Area 7

Regional context:

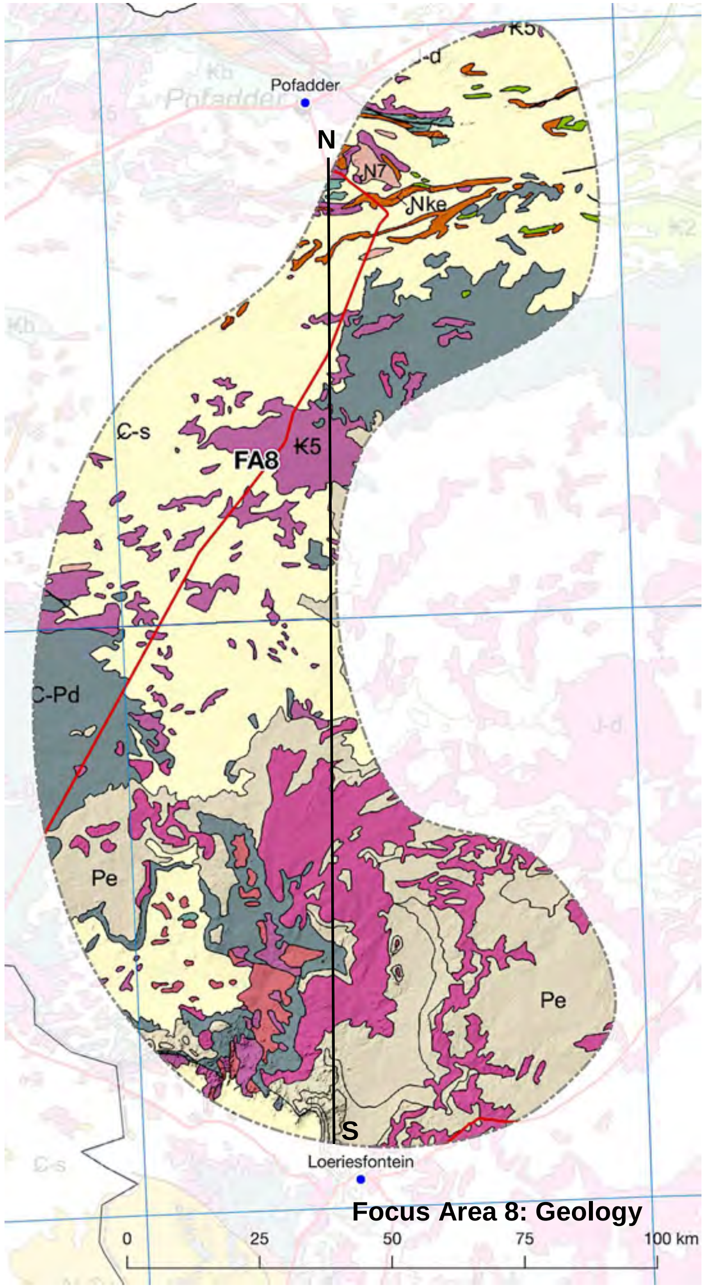
Focus Area 7 is located in the Bo-Karoo region of the Northern Cape, where the main town is Prieska on the Orange River. A British fort on the koppie overlooking Prieska is a reminder of the Anglo-Boer War fought in the region. The N10 National Road links Prieska with the other main town of Marydale and a rail line follows a similar route. The Focus Area has an arid landscape with succulent Karoo scrub and grasses supporting merino and karakul sheep farming. Crops, including lucerne and wheat, are grown under irrigation from the orange River. Copper mining once took place at Copperton to the southwest of Prieska.

Geomorphology:

The focus area consists of 2 broad landscape types, being 1) The more mountainous north-eastern portion comprising the dolomitic Asbesberg and Doringberg mountains (similar to Focus Area 3), and 2) the relatively flat plains of the south-western portion consisting mainly of Dwyka tillite, sandstone and mudstone, covered to the west by Kalahari sand. In the southernmost area, the Ecca shales are intruded by dolerite to form outcrops and small koppies. The plains are at about 1100m elevation, while the low mountains rise to over 1300m.

Landscape features:

The Orange River valley, along with the flanking mountain ranges, are the main landscape features of the Focus Area. Dolerite koppies, although very low, are the only features in the expansive plains to the south. A series of powerlines cross the Focus Area near Copperton, and a number of solar PV energy farms have been approved in the Prieska and Copperton areas.


Pofadder
N
N7
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FA8
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Loeriesfontein
Focus Area 8: Geology
0
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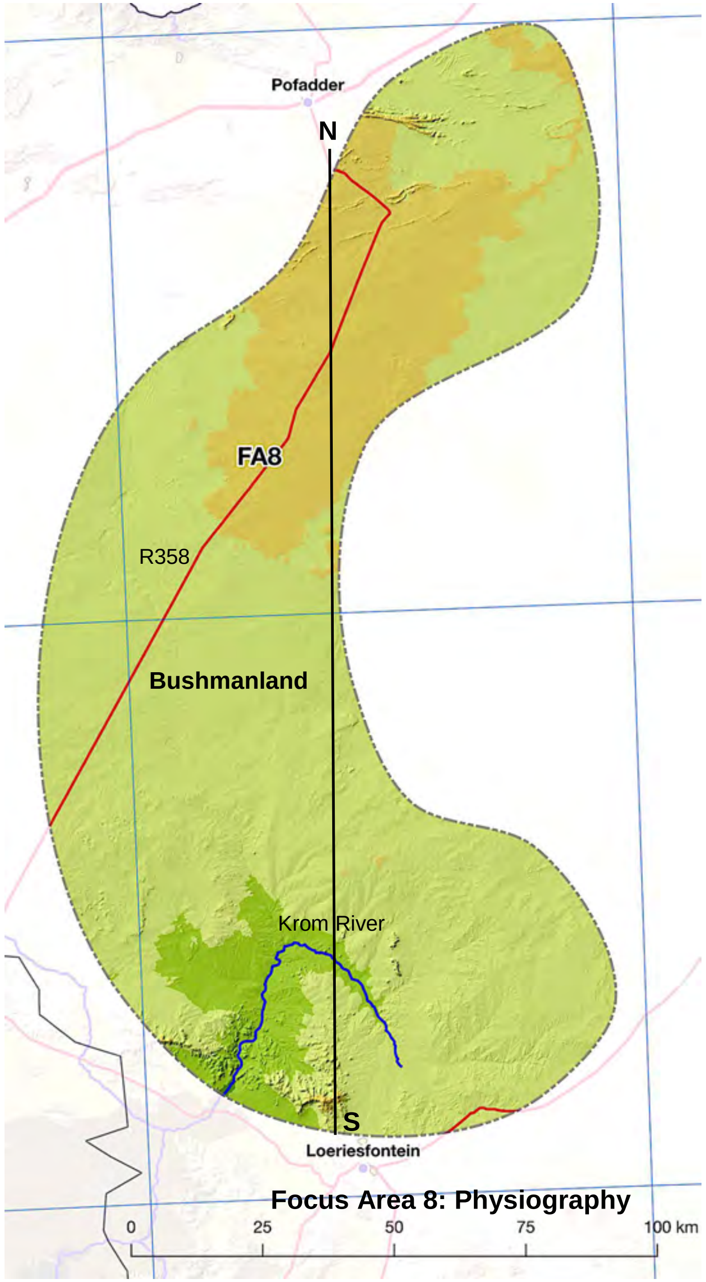
50
75
100 km


Pofadder
N
FA8
R358
Bushmanland
Krom River
S
Loeriesfontein
Focus Area 8: Physiography
0
25
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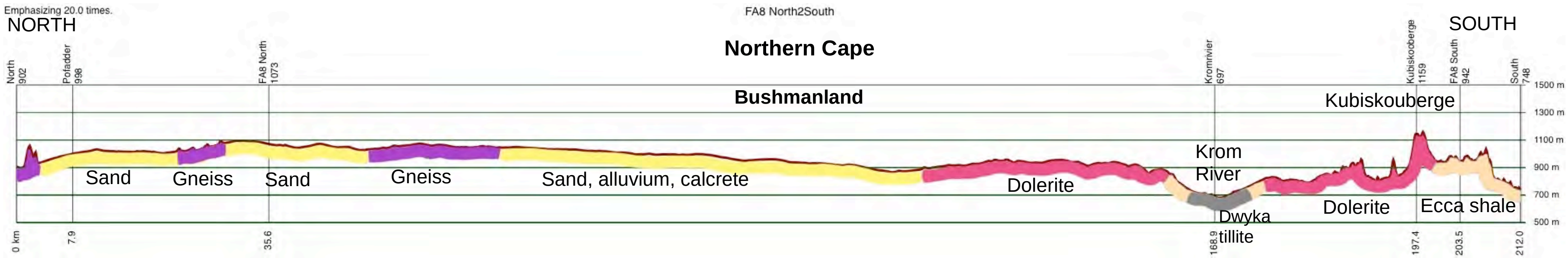
75
100 km



Focus Area 8: N-S Transect

Focus Area 8

Regional context:
Focus Area 8 lies within Bushmanland in the Northern Cape, with Pofadder just to the north of the Focus Area and Loeriesfontein to the south. The R358 Route runs as straight as an arrow across the flat plain. It is an arid landscape with sparse vegetation and numerous pans with salt deposits. The land supports merino, dorper and karakul sheep farming.

Geomorphology:
The Focus Area consists of two broad landscape types, being 1) the flat northern portion underlain by gneiss and grandiorite, and covered by sand, alluvium and calcrete in places, and 2) the Ecca shales and Dwyka tillite of the southern portion, intruded in places by dolerite, the more resistant dolerite forming the low mountain ridges and koppies. Patches of hardpan calcrete result in the characteristic salt pans of this area.

Landscape features:
Except for the dolerite outcrops there are few topographic features in the expansive landscape. The salt pans are a characteristic feature in an area where other drainage features are absent or consist only of dry river beds. A number of solar PV and wind energy farms have been approved in the general area.

4.2 Feature Sensitivity Mapping

Key features and criteria considered during the visual assessment of each focus area are given in this Section. These are similar to those contained in the Phase 1 Wind and Solar PV SEA (DEA, 2015) for purposes of continuity, along with some minor refinements. The rationale for the inclusion of scenic resource features and visually sensitive receptors are given in Table 5 below. Information sources for the features, and the sensitivity rating, with buffers, are given in Tables 6 (wind) and 7 (solar PV), providing the basis for the visual sensitivity mapping.

The visual features and sensitivity maps are provided at a larger scale in Attachment A.

Table 5: Criteria for Determining Visual Sensitivity

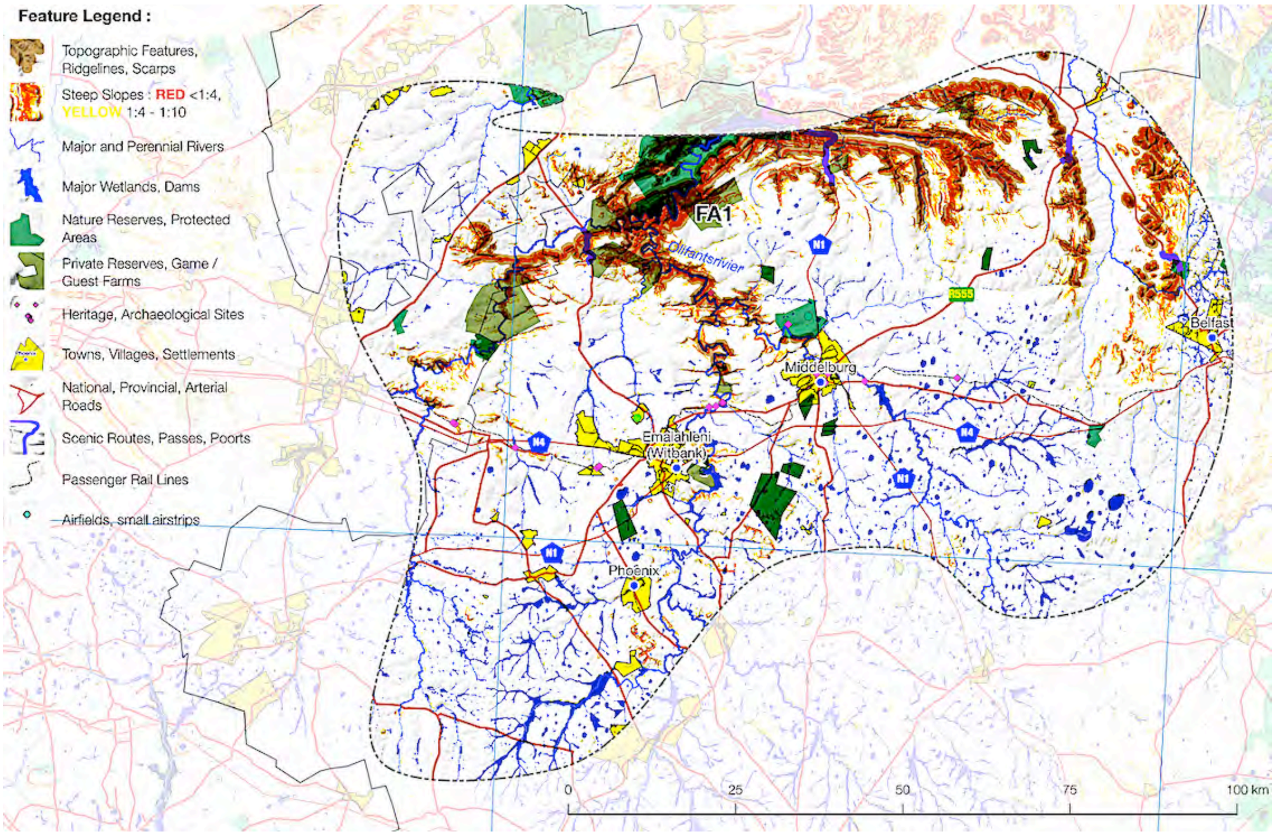
Scenic Resources	Contributing Factors
Topographic features	Landscape features in the area contribute to scenic and natural heritage value. These include features that provide visual interest or contrast in the landscape such as peaks, scarps, ridges, steep slopes and geological features. Intact wilderness or rural landscapes tend to have higher scenic value and therefore increased sensitivity.
Water Features	Water features, such as rivers (mainly perennial rivers), estuaries, large dams, wetlands and pans, generally have aesthetic, scenic, recreational and amenity value. Sensitivity generally relates to their national, regional or local significance. Coastal shorelines, particularly promontories, tend to be visually sensitive. A one-kilometre setback is based on the Integrated Coastal Management Act.
Cultural landscapes	Cultural landscapes, often along fertile river valleys, tend to have rural scenic value and historical or cultural significance. These need to be correlated with heritage data.
Sensitive Receptors	**(includes residents, commuters, visitors and tourists)**
Protected Areas	These include national parks and nature reserves, which have wilderness and scenic attributes in addition to their biological conservation role, serving as important visitor / tourist destinations. Visual significance is increased by their protection status. Development within 10km of National Parks and 5km of Protected Areas requires authorisation in terms of NEMA.
Game reserves / resorts	Private nature reserves, game farms, recreation resorts and tourist accommodation are important for the local economy, and tend to be sensitive to loss or degradation of scenic quality.
Human settlements	Towns, villages and farmsteads, particularly historical settlements, residential and resort areas, tend to be sensitive to visual intrusions, including an effect on property values and tourism. Farmsteads and rural dwellings have not been mapped at the regional scale of the SEA.
Heritage sites	These include archaeological sites, battle sites, cemeteries etc. These generally form part of the heritage study, but could have visual implications. Only Grade I and II heritage sites have been mapped at the regional scale of the SEA. Buffers generally depend on the type of heritage resources and input by a heritage specialist.
Scenic / arterial routes and passenger rail lines	Scenic and arterial routes, such as national roads, mountain passes and *poorts*, as well as passenger rail lines form scenic corridors with historical, recreational and tourism importance, and are therefore visually sensitive.

Table 6: Visual Sensitivity Categories for Wind Energy

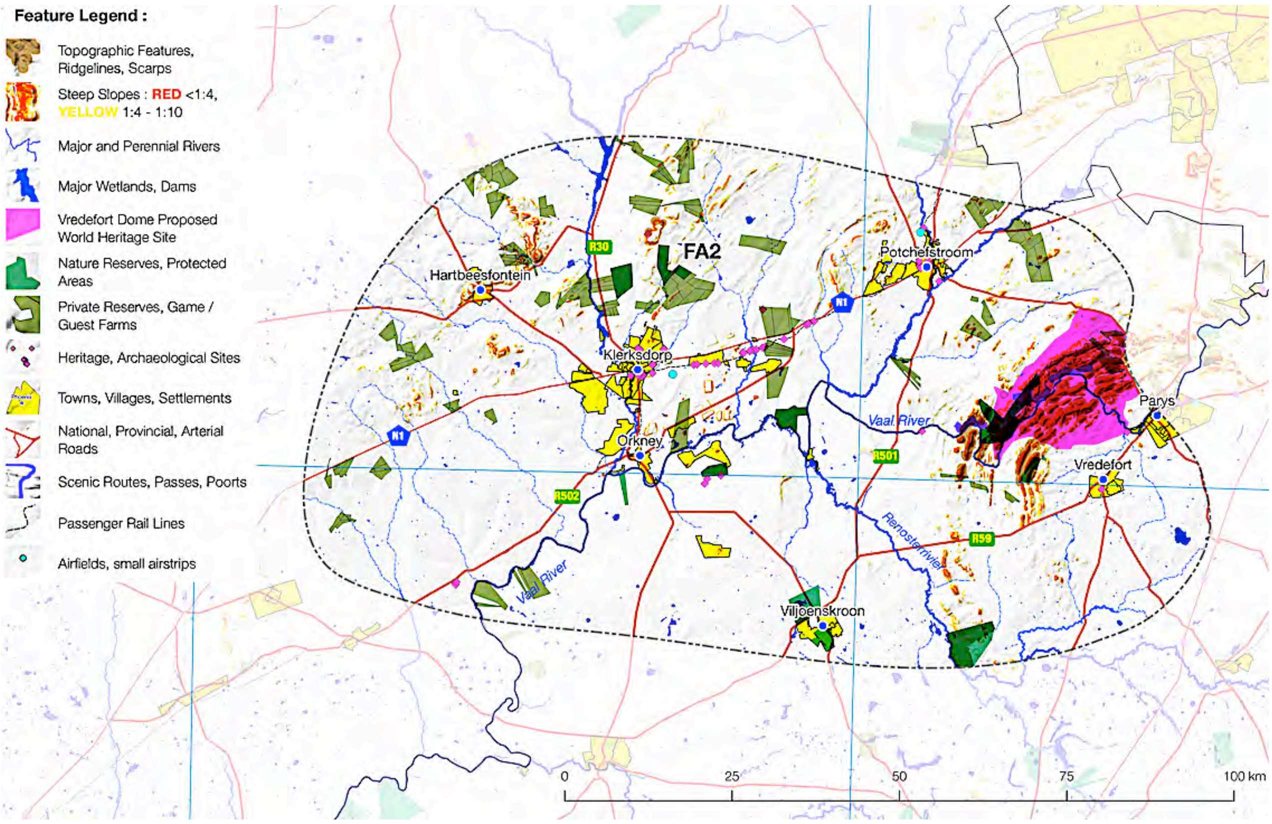
Sensitivity Feature Class	Data Source + Date of Publications	Sensitivity rating	Wind buffer distance	Methodology for sensitivity verification
Topographic features, incl. mountain ridges.	Inferred from digital elevation model, 2015, NGI.	Very high	0-500m	1:500 000 topo map used for mapping. Wind Ph.1 SEA.
Steep slopes >1:4 (25%). 1:4-1:10	Modelled from DEM, 2015, NGI.	Very high High	feature feature	SRTM DEM data used for mapping. Wind Ph.1 SEA.
Major rivers	National Freshwater Ecosystem Priority Areas 2011.	Very high	0-500m	SANBI-NFEPA data used for mapping.
Freshwater features, Wetlands	National Freshwater Ecosystem Priority Areas 2011.	High Medium	0-250m 250-500m	SANBI-NFEPA data used for mapping. Wind Ph.1 SEA.
Coastal zone	SANBI 2004.	Very high High Medium	0-1 km 1-2 km 2-4 km	NGI Spatial Data used. Wind Ph.1 SEA.
Protected Areas: National Parks	SAPAD-Q2, 2017, SANParks.	Very high High Medium	0-5 km 5-10 km 10-15 km	Updated info from SAPAD-Q1, 2018. Wind Ph.1 SEA.
Protected Areas: Nature Reserves	SAPAD-Q2, 2017, Provincial. SACAD-Q1, 2017	Very high High Medium	0-3 km 3-5 km 5-10 km	Updated info from SAPAD-Q1, 2018. Wind Ph.1 SEA.
Private reserves and game farms	Provincial Private Reserves/Conservation Areas and Game Farms	Very high High Medium	0-1,5 km 1,5-3 km 3-5 km	Updated info from SAPAD, 2018. Reduced from Ph.1.
Cultural landscapes	Not mapped	Very high High Medium	feature 0-500m 500m-1 km	Requires input from heritage specialists. Wind Ph.1 SEA.
Heritage Sites	SAHRA, 2015	Very high High Medium	feature 0-500m 500m-1 km	Updated info from SAHRA, 2017. Wind Ph.1 SEA.
Towns and villages	AfriGIS SG Towns, 2017	Very high High Medium	0-2 km 2-4 km 4-6 km	Correlated with NGI 1:500 000 topo maps. Wind Ph.1.
National roads	National Geospatial Information (NGI) 2016.	Very high High Medium	0-1 km 1-2,5 km 2,5-5 km	Correlated with Open Street Map data 2018.
Scenic routes	W. Cape Dept. of Transport, 2013	Very high High Medium	0-1 km 1-2,5 km 2,5-5 km	Additional routes from NGI 1:500 000 topo maps.
Provincial and arterial routes		Very high High Medium	0-500m 500m-1 km 1-3 km	Open Street Map data 2018. Reduced from Ph.1 SEA.
Passenger rail lines		Very high High Medium	0-500m 500m-1 km 1-3 km	Open Street Map data 2018. PRASA Maps. Reduced.
Small airfields	REDZs 1 SEA dataset, EGI SEA dataset, 2015	Very high	0-3 km	SA CAA Database.
Square Kilometre Array (SKA) corridors	Square Kilometre Array (SKA) SEA, 2017	Very high	0-36 km	36 km corridor for wind energy.

Table 7: Visual Sensitivity Categories for Solar PV Energy

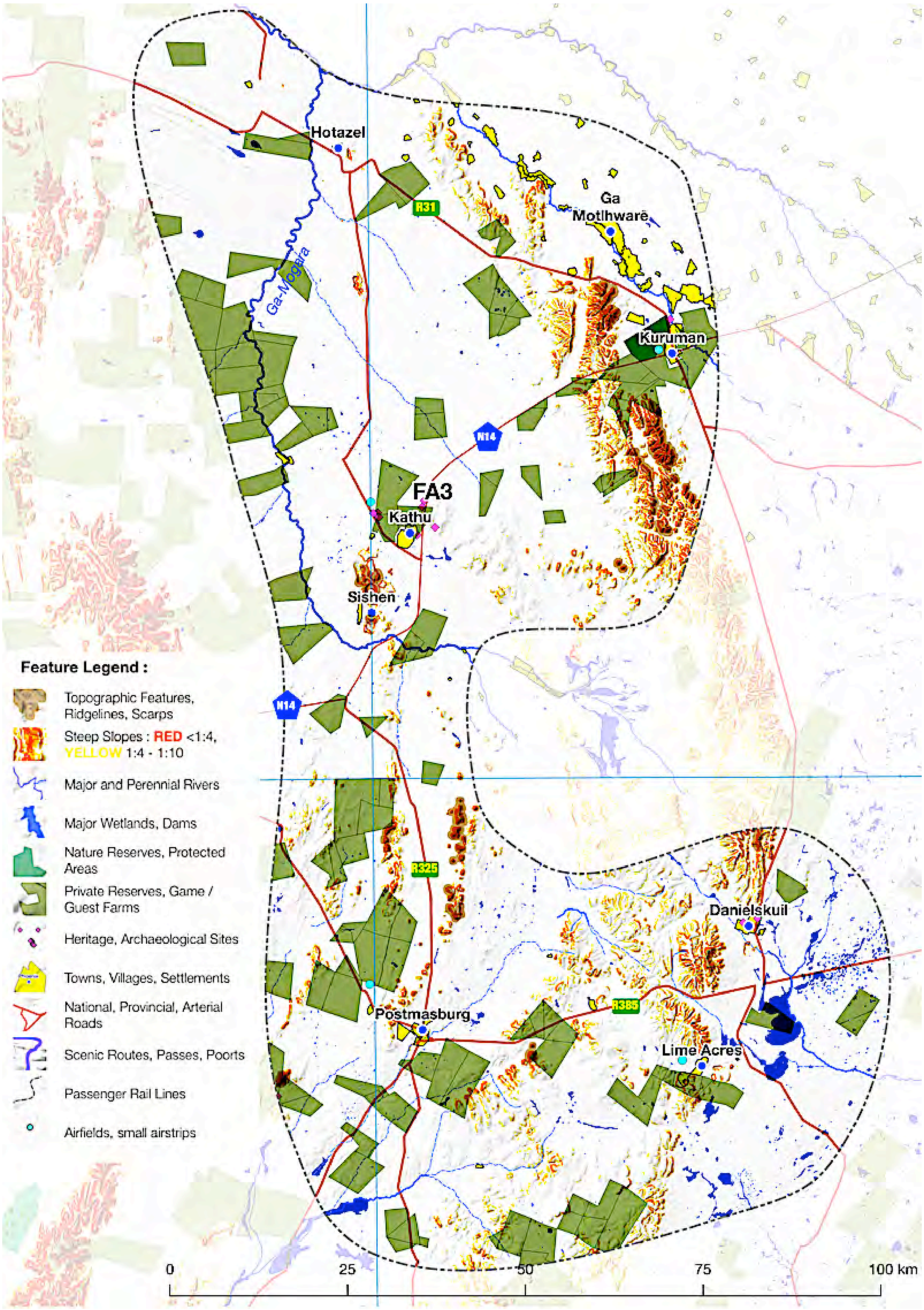
Sensitivity Feature Class	Data Source + Date of Publications	Sensitivity rating	Solar buffer distance	Methodology for sensitivity verification
Topographic features, incl. mountain ridges.	Inferred from digital elevation model, 2015, NGI.	Very high	0-250m	1:500 000 topo map. Solar Ph.1 SEA.
Steep slopes >1:4 (25%). 1:4-1:10	Modelled from DEM, 2015, NGI.	Very high High	feature feature	SRTM DEM data used for mapping. Solar Ph.1 SEA.
Major rivers	National Freshwater Ecosystem Priority Areas 2011.	Very high	0-500m	SANBI-NFEPA data used. Solar Ph.1 SEA.
Freshwater features, Wetlands	National Freshwater Ecosystem Priority Areas 2011.	High Medium	0-250m 250-500m	SANBI-NFEPA data used. Solar Ph.1 SEA.
Coastal zone	SANBI 2004.	Very high High Medium	0-1 km 1-2 km 2-3 km	NGI Spatial Data used. Reduced from Solar Ph.1.
Protected Areas: National Parks	SAPAD-Q2, 2017, SANParks.	Very high High Medium	0-2 km 2-4 km 4-6 km	Updated info from SAPAD-Q1 2018. Reduced.
Protected Areas: Nature Reserves	SAPAD-Q2, 2017, Provincial. SACAD-Q1, 2017	Very high High Medium	0-1 km 1-2 km 2-3 km	Updated info from SAPAD-Q1, 2018. Reduced.
Private reserves and game farms	Provincial Private Reserves/Conservation Areas and Game Farms	Very high High Medium	0-500m 500m-1 km 1-2 km	Updated SAPAD, 2018, CSIR spatial data. Reduced.
Cultural landscapes	Not mapped	Very high High Medium	feature 0-500m 500m-1 km	Requires input from heritage specialists.
Heritage Sites Grades I, II and III.	SAHRA, 2015. I and II: Grade IIIa Grade IIIb	Very high High Medium	feature 0-500m 500m-1 km	Updated info from SAHRA, 2017. Solar Ph.1 SEA.
Towns and villages	AfriGIS SG Towns, 2017	Very high High Medium	0-500m 500m-1km 1-2 km	Correlated with NGI 1:500 000 topo maps.
National roads	National Geospatial Information (NGI) 2016.	Very high High Medium	0-500m 500m-1km 1-2 km	Correlated with Open Street Map data 2018
Scenic routes	W. Cape Dept. of Transport, 2013	Very high High Medium	0-500m 500m-1km 1-2 km	NGI 1:500 000 topo maps. Solar Ph.1 SEA.
Provincial and arterial routes		Very high High Medium	0-250m 250m-500m 500m-1 km	Open Street Map data 2018. Solar Ph.1 SEA.
Passenger rail lines		Very high High Medium	0-250m 250m-500m 500m-1 km	Open Street Map data 2018. PRASA Maps. Reduced.
Small airfields	REDZs 1 SEA dataset, EGI SEA dataset, 2015	High	0-3 km	SA CAA Database.
Square Kilometre Array (SKA) corridors	Square Kilometre Array (SKA) SEA, 2017	Very high	0-16 km	16 km corridor for solar PV energy.



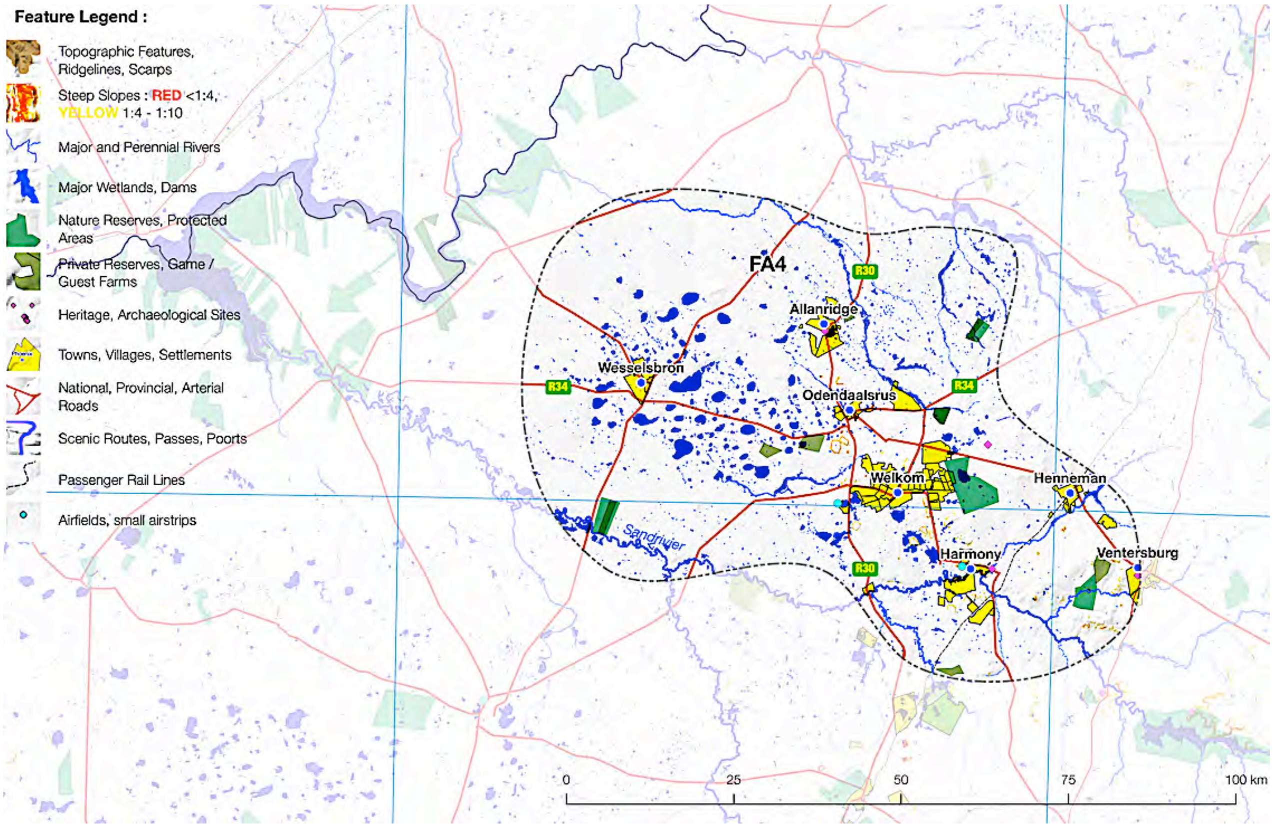
Focus Area 1: Visual Features



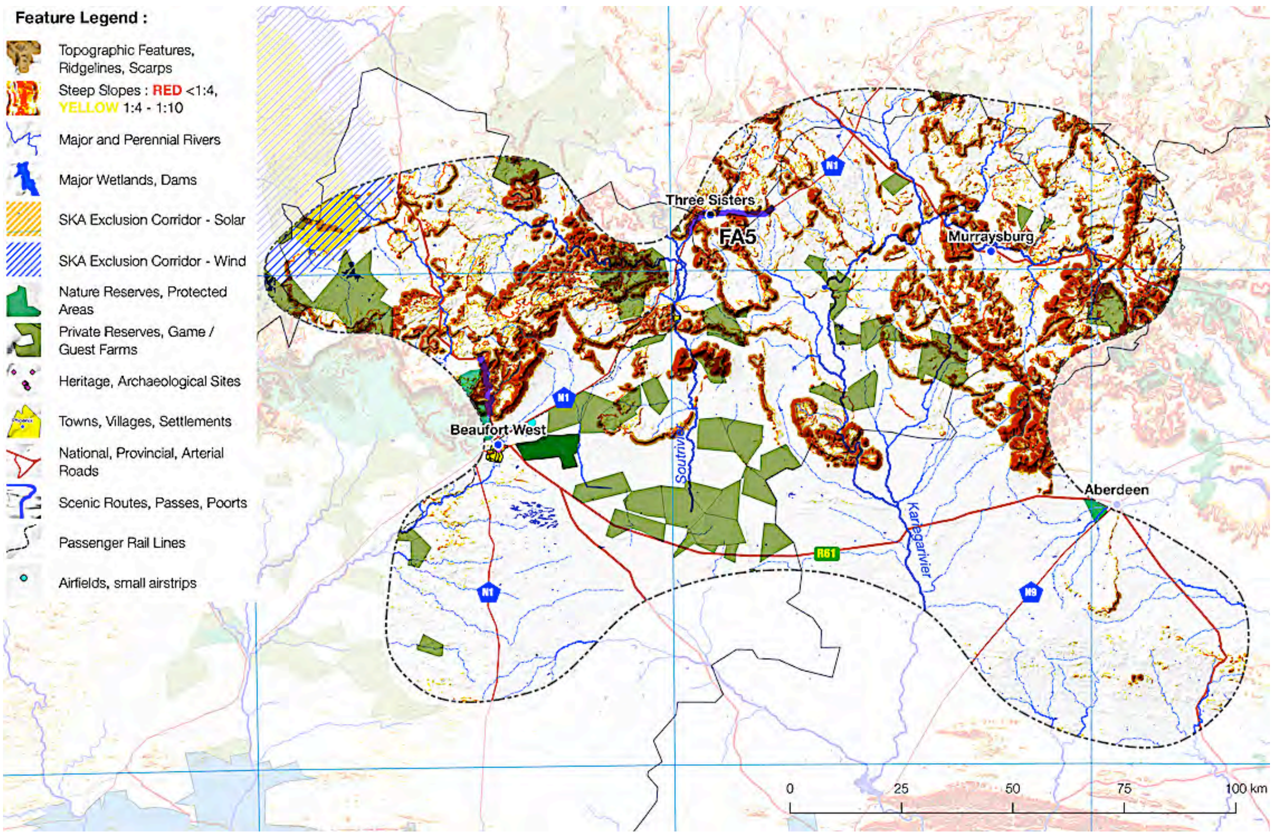
Focus Area 2: Visual Features



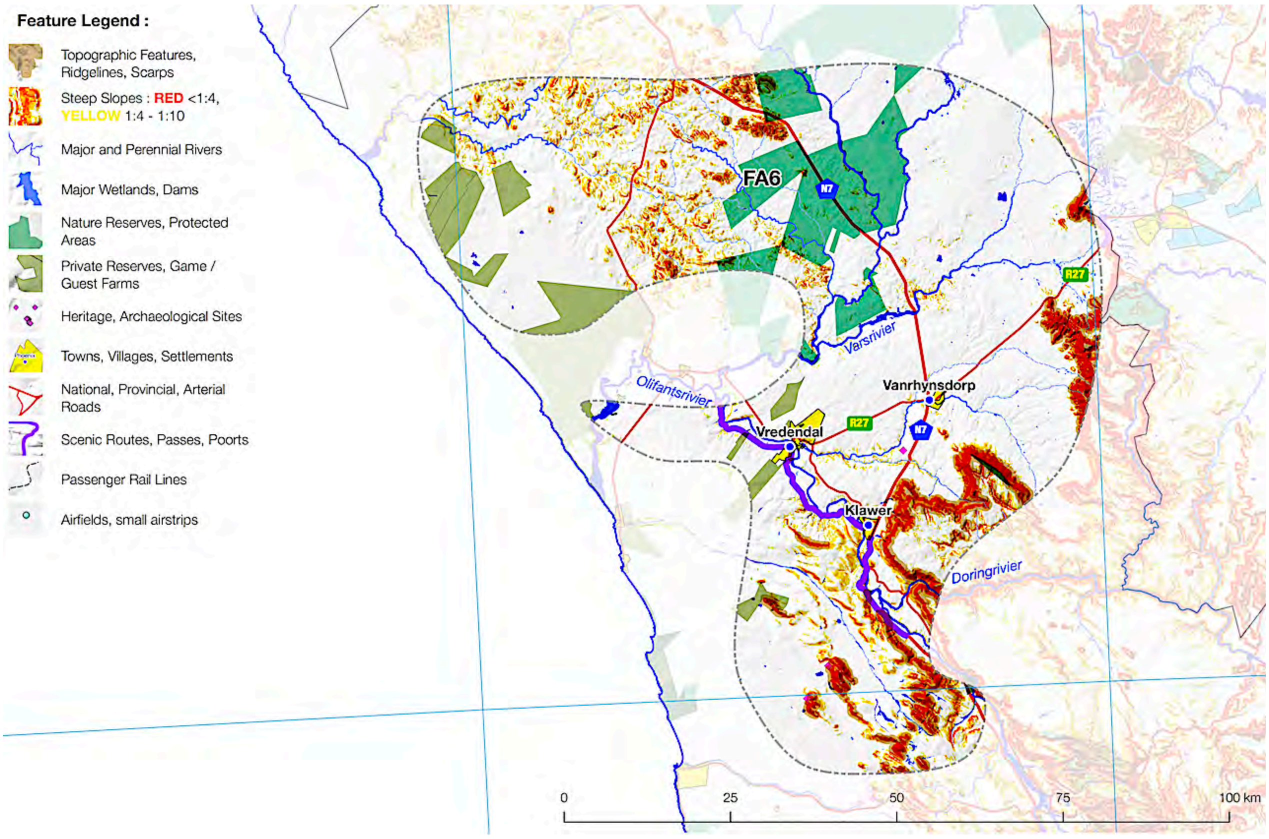
Focus Area 3: Visual Features



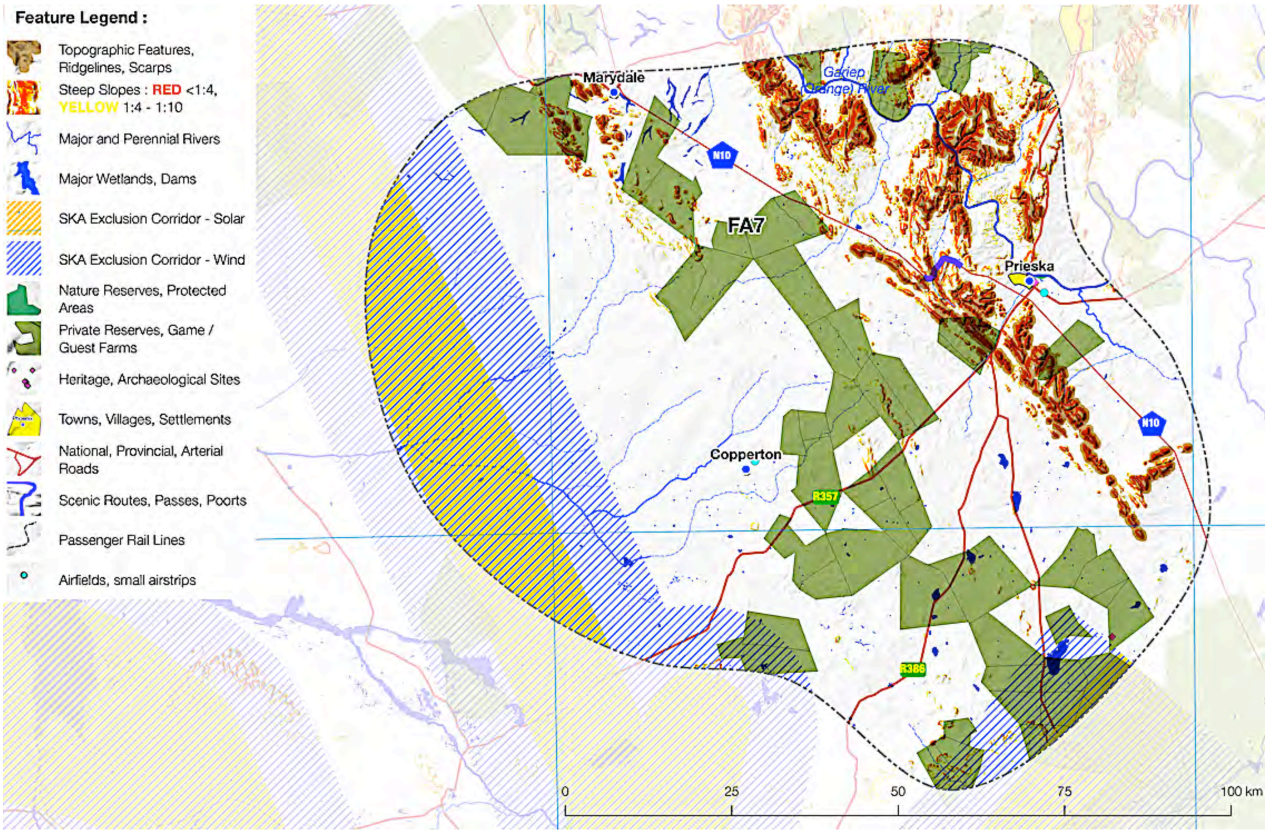
Focus Area 4: Visual Features



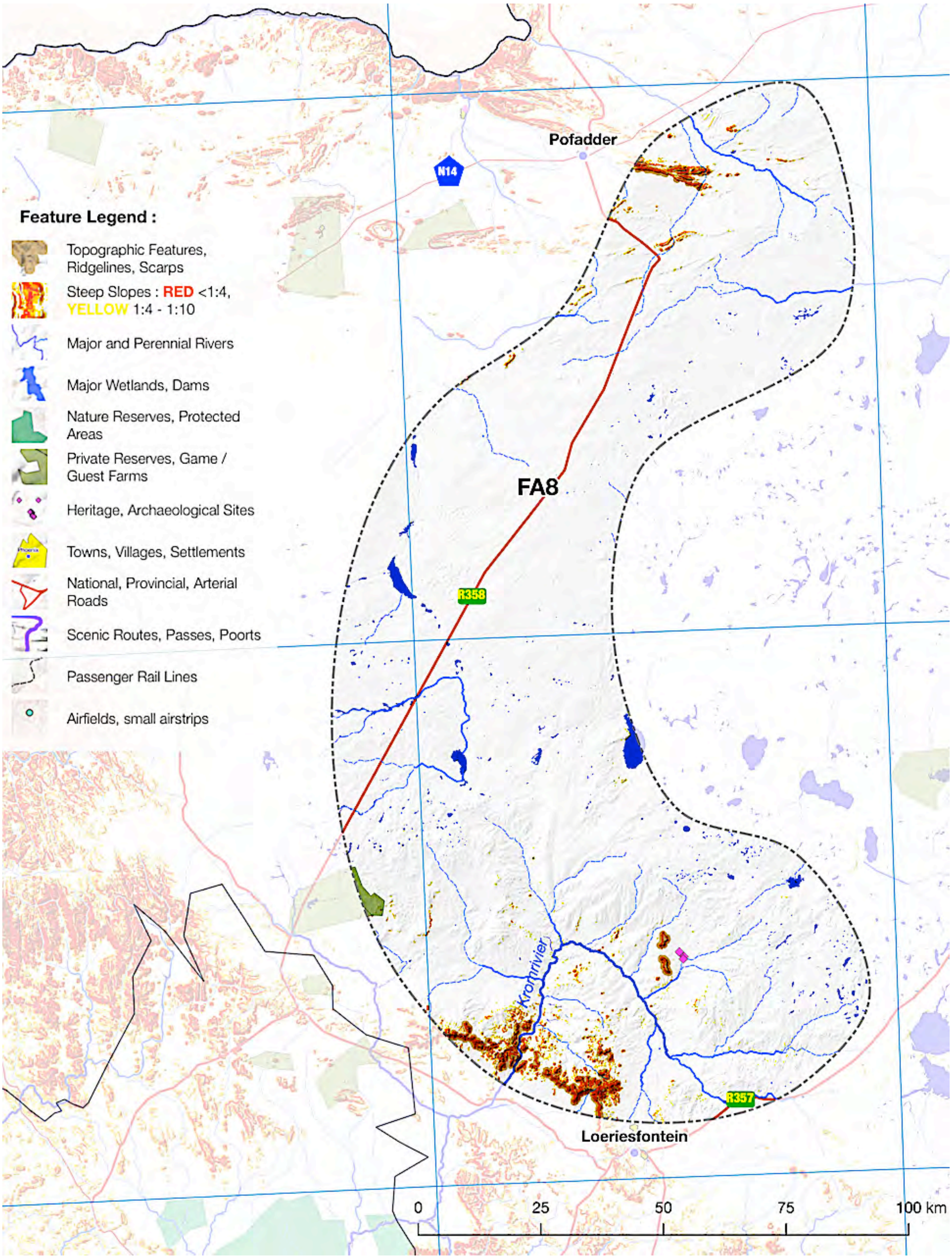
Focus Area 5: Visual Features



Focus Area 6: Visual Features



Focus Area 7: Visual Features



Focus Area 8: Visual Features

4.3 Four- Tier Visual Sensitivity Mapping

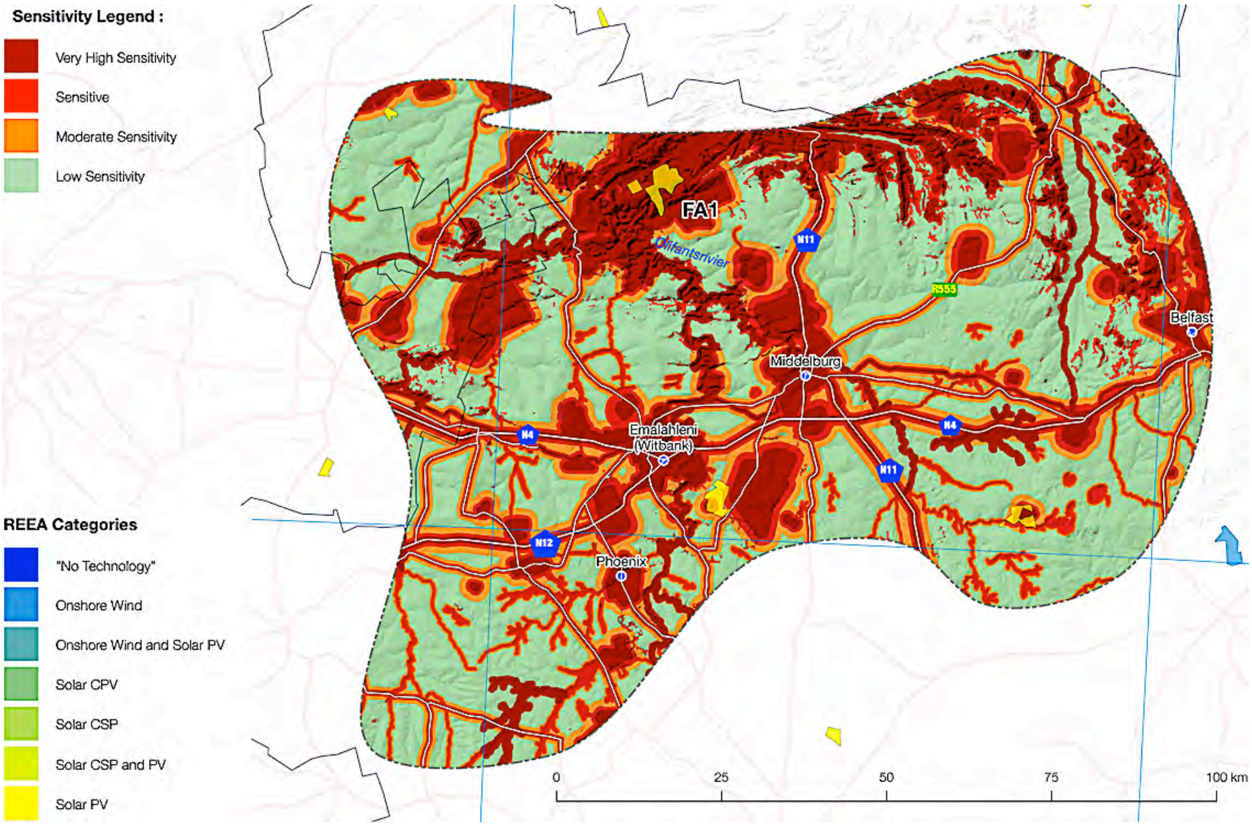
The relative visual sensitivity mapping follows a four-tier sensitivity class approach using the following colours:

- *Dark Red: Very High Visual Sensitivity*
- *Red: High Visual Sensitivity,*
- *Orange: Medium Visual Sensitivity*
- *Green: Low Visual Sensitivity*

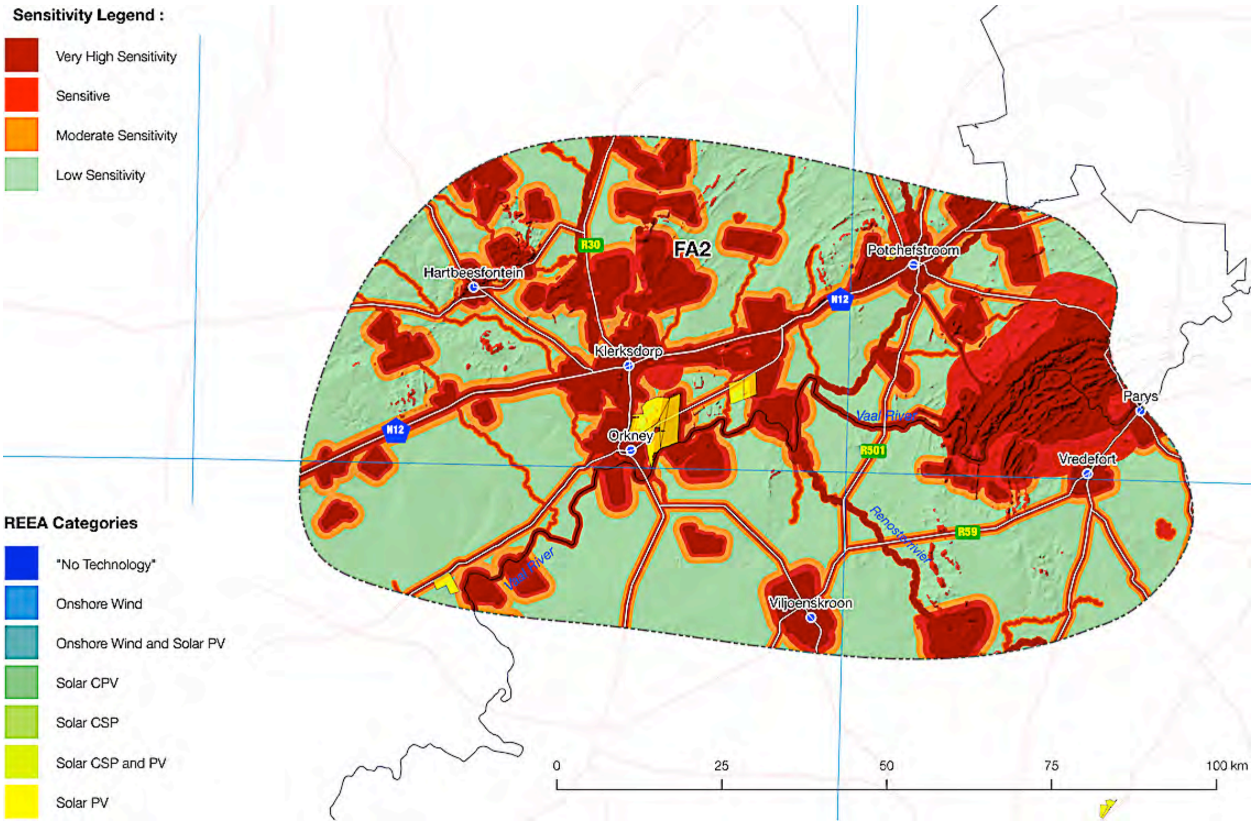
The visual sensitivity maps include the buffers indicated in Tables 6 and 7. The buffers have been slightly adjusted from those used in the Phase 1 Wind and Solar PV SEA, mainly for solar energy development, based on experience with EIAs where solar farms are seldom visible beyond about 2 or 3 km.

It is important to note that the buffers indicated in the visual SEA are not intended as prescriptive setbacks or exclusion areas, but rather as an indication of relative visual sensitivity, which can in turn be used to determine levels of suitability for wind or solar PV energy development.

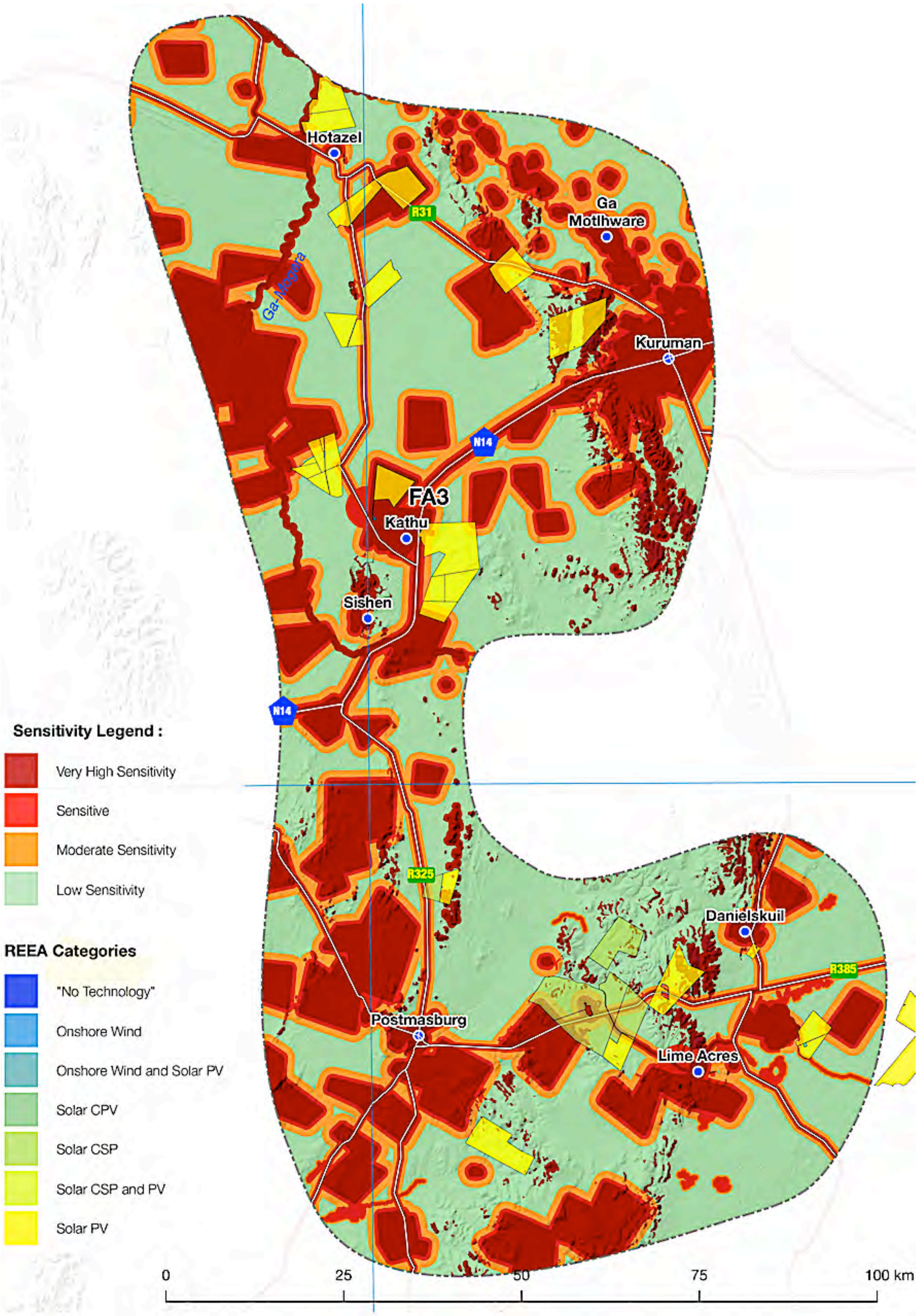
The visual sensitivity maps illustrated below include all those renewable energy (RE) projects that have environmental authorisation (EA), indicated by means of the acronym REEA. This provides a useful indication of how previous applications compare with the visual sensitivity mapping.



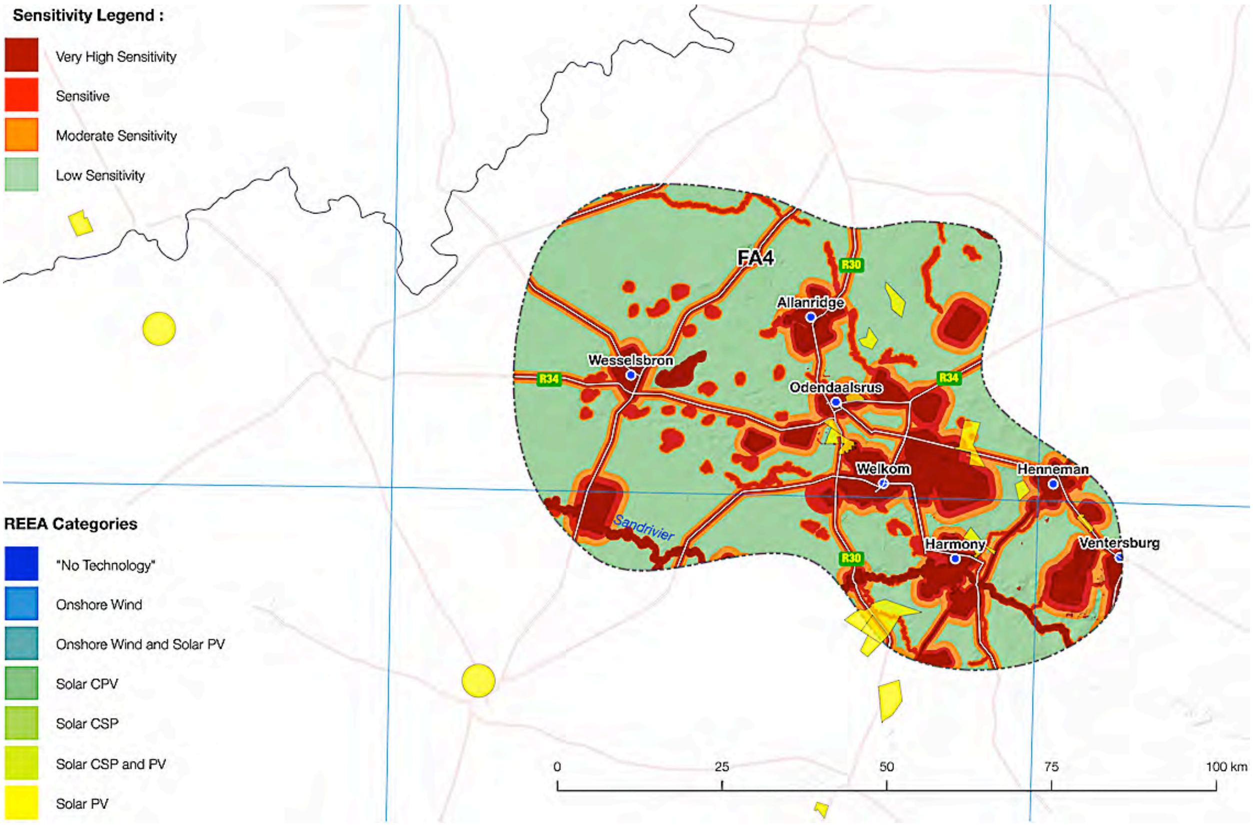
Focus Area 1: Visual Sensitivity for Solar PV



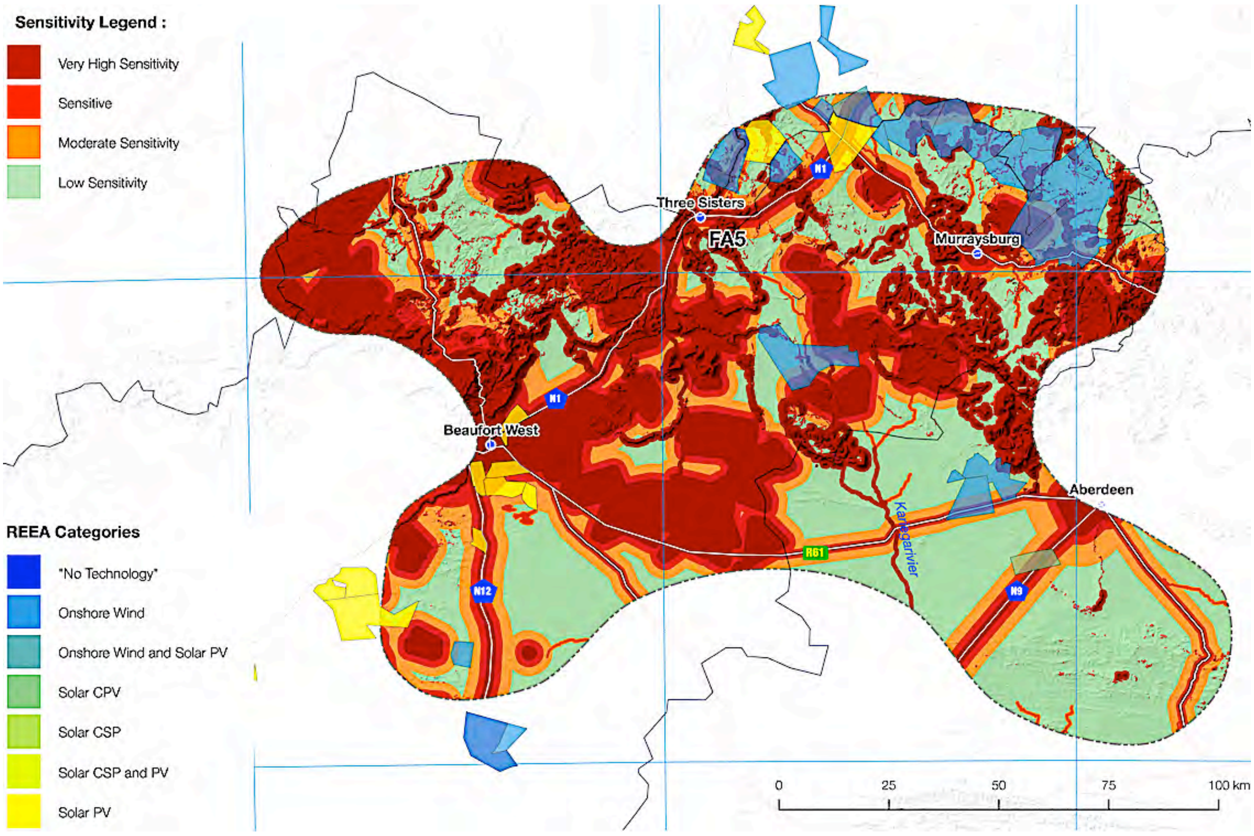
Focus Area 2: Visual Sensitivity for Solar PV



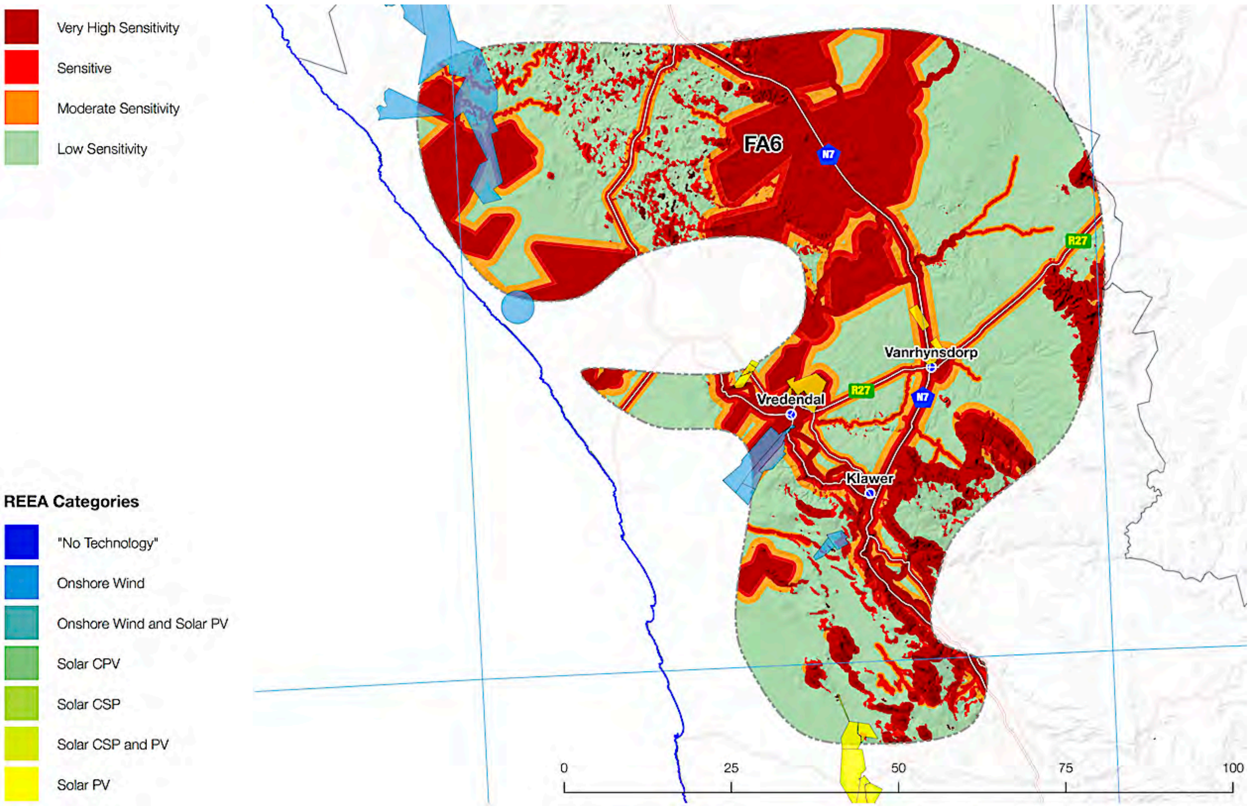
Focus Area 3: Visual Sensitivity for Solar PV



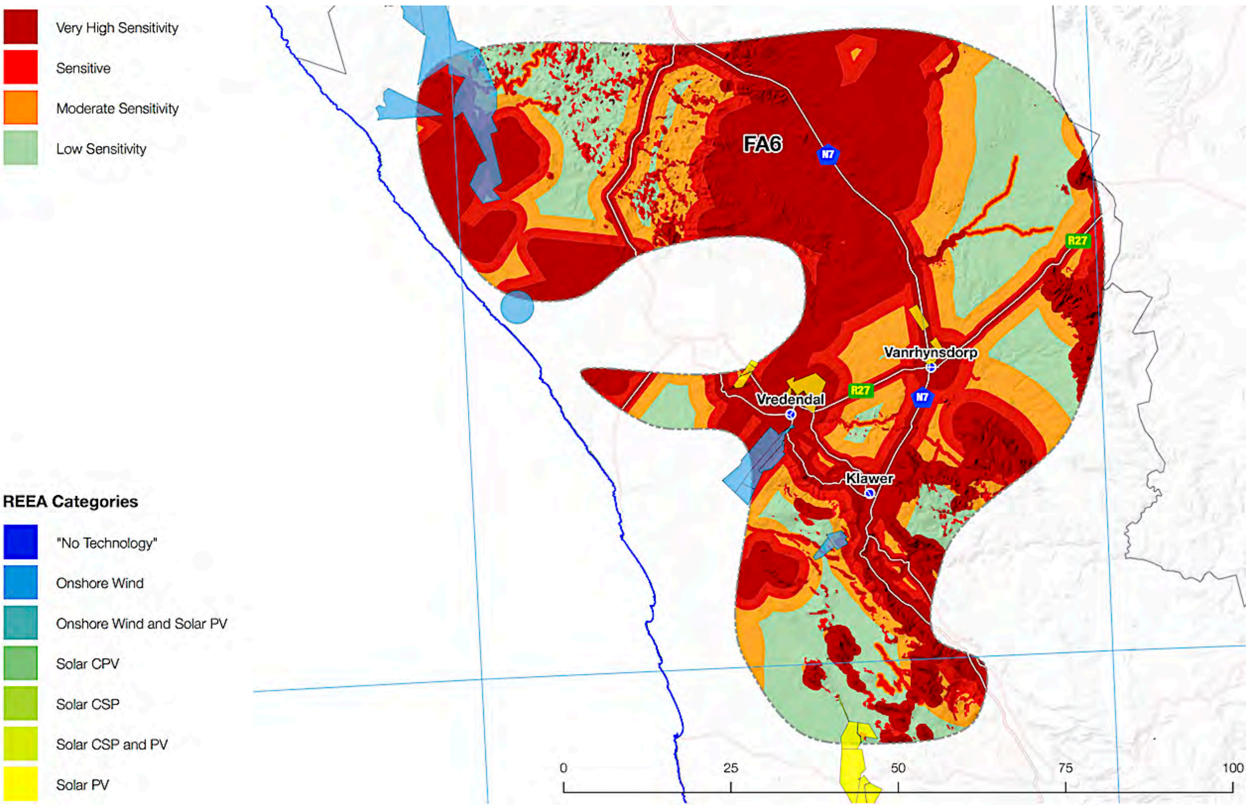
Focus Area 4: Visual Sensitivity for Solar PV



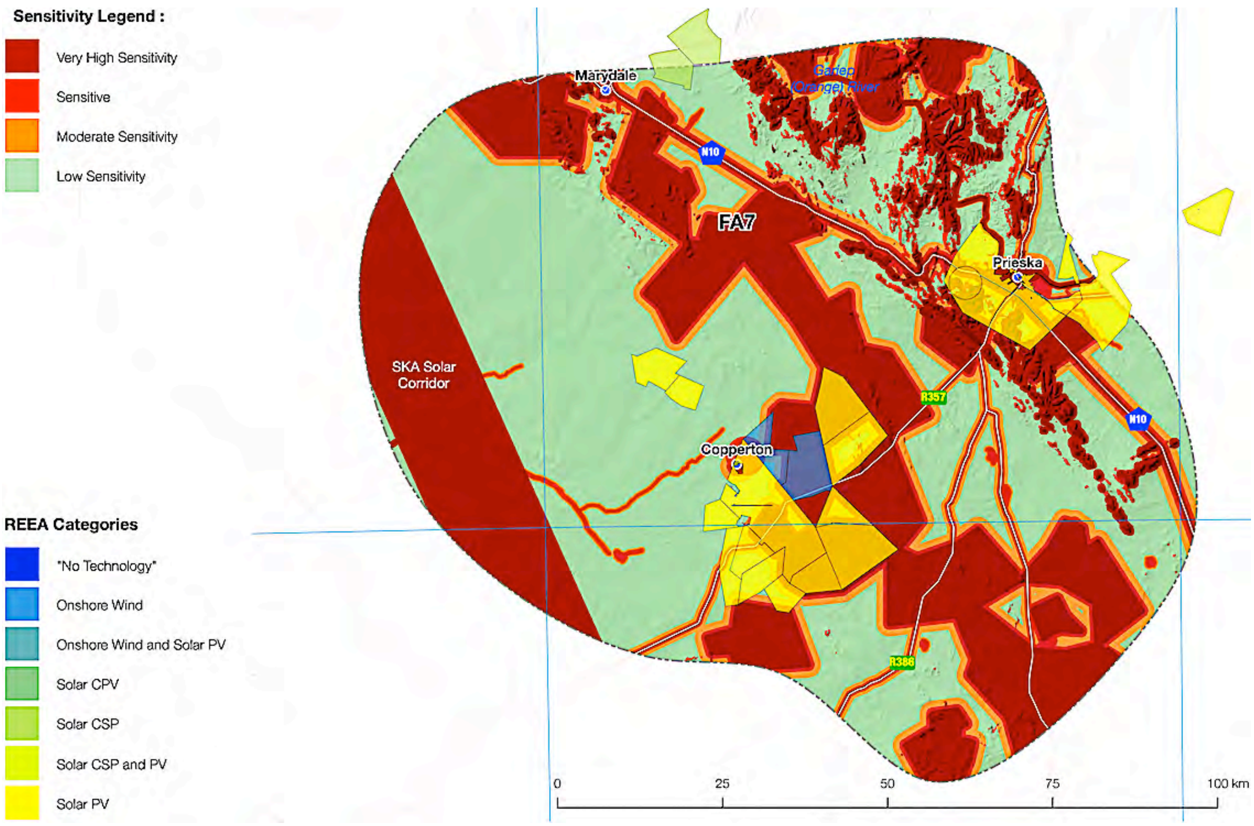
Focus Area 5: Visual Sensitivity for Wind



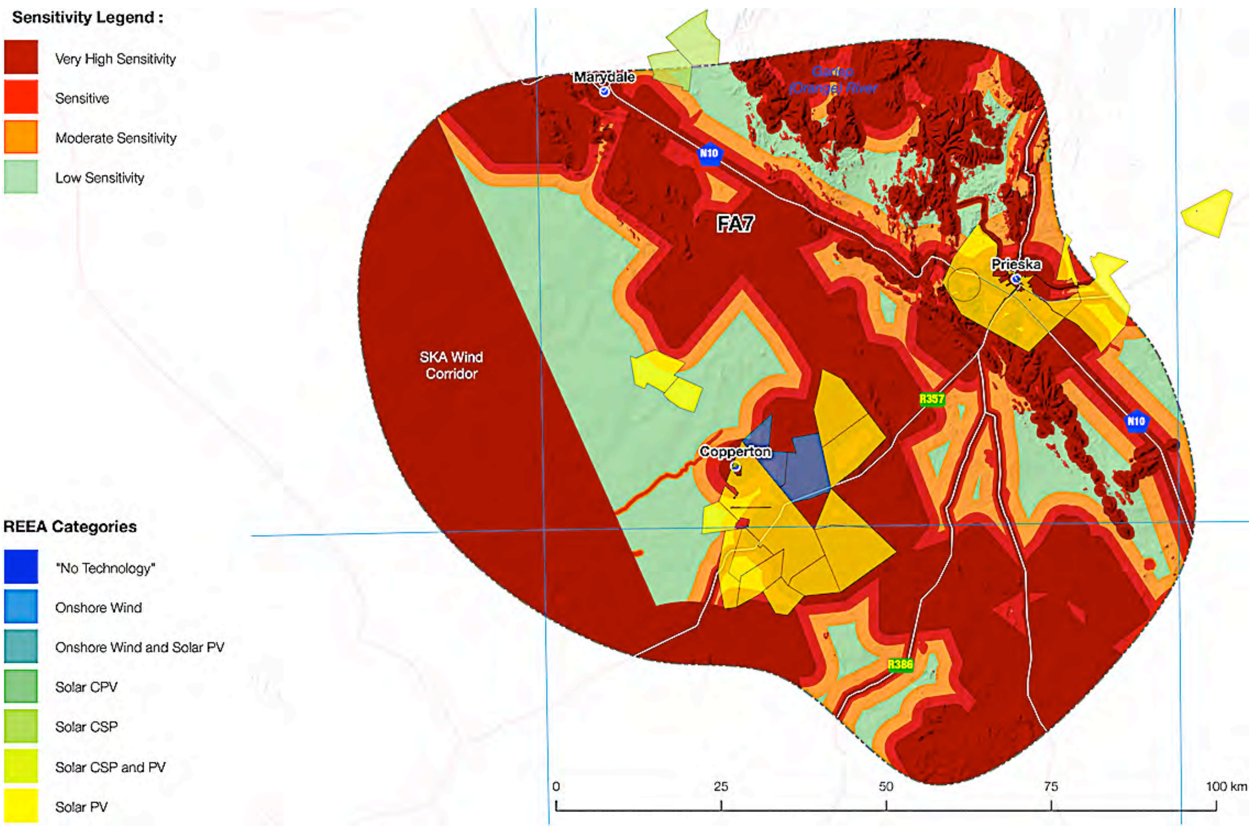
Focus Area 6: Visual Sensitivity for Solar PV



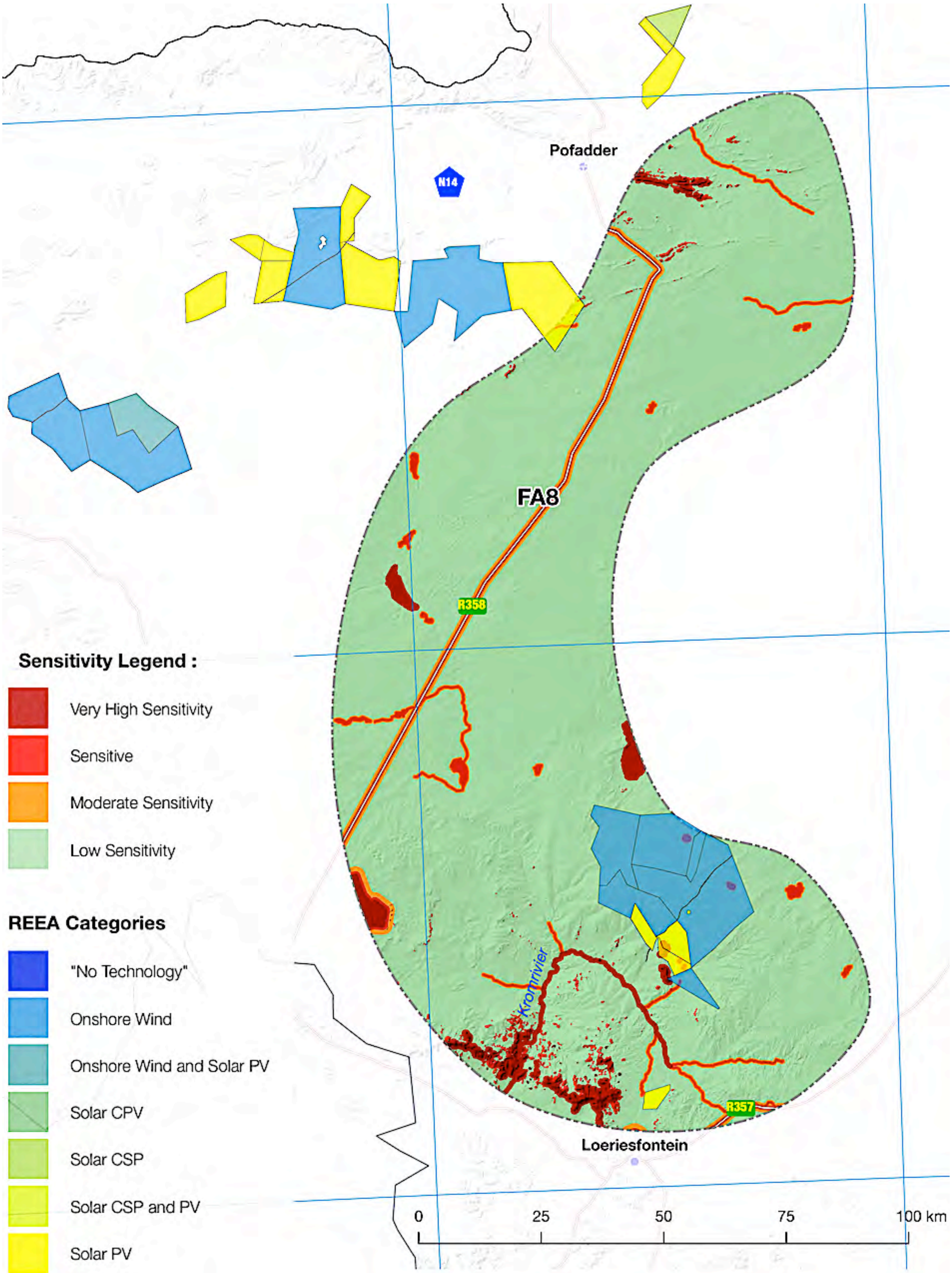
Focus Area 6: Visual Sensitivity for Wind



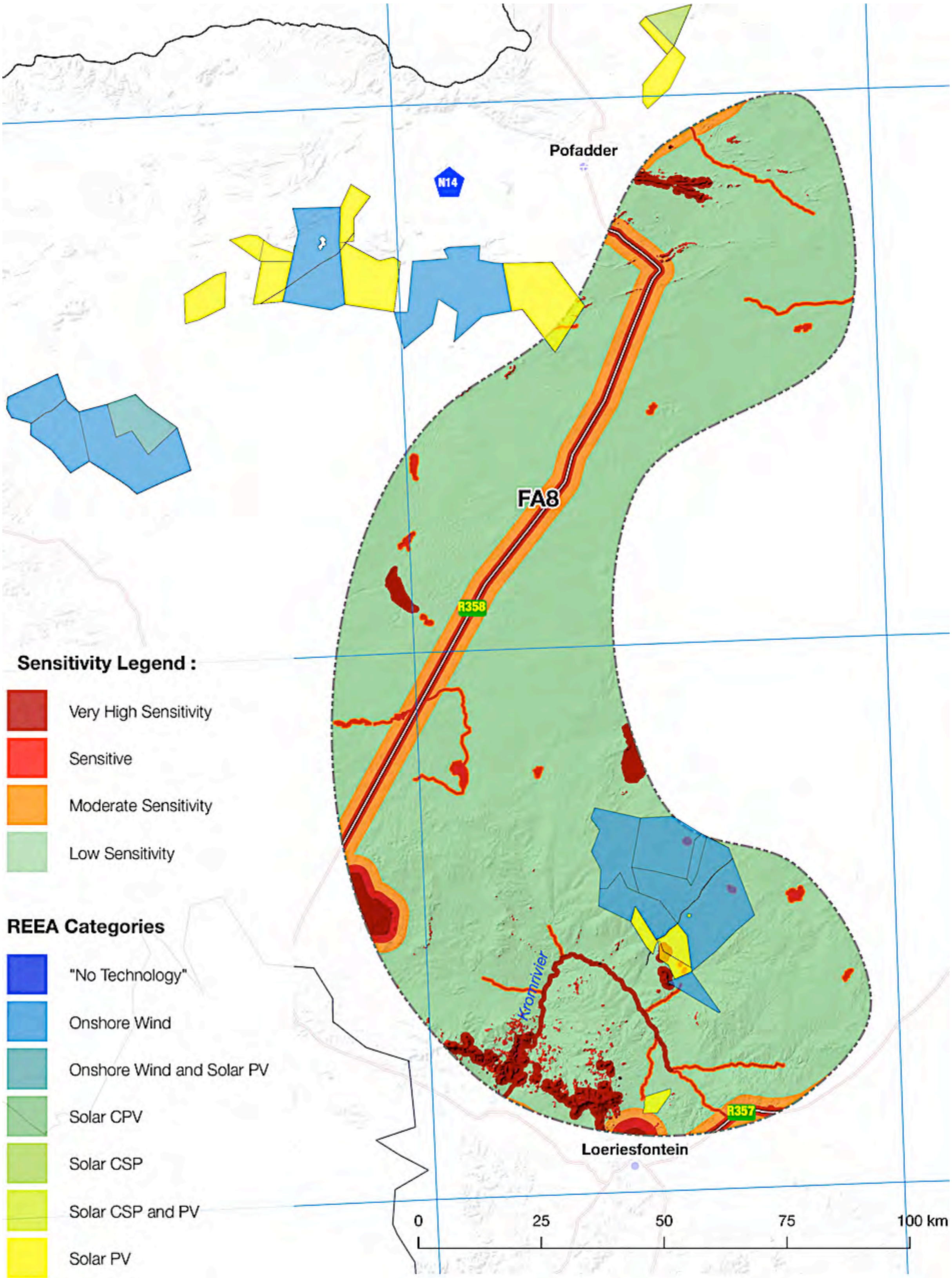
Focus Area 7: Visual Sensitivity for Solar PV



Focus Area 7: Visual Sensitivity for Wind



Focus Area 8: Visual Sensitivity for Solar PV



Focus Area 8: Visual Sensitivity for Wind

5. POTENTIAL VISUAL IMPACTS AND POSSIBLE MANAGEMENT ACTIONS

Table 8 below lists the type of generic visual impacts that can be expected within each of the focus areas, along with specific sites where scenic resources or receptors could be compromised. Possible management actions to avoid or minimise potential visual impacts are included. Being a SEA, as opposed to an EIA, the predominant management action is avoidance, as reflected in the visual sensitivity mapping.

The potential visual impacts, their possible effects and the management actions are common to both solar PV and wind energy developments for the purpose of the visual SEA.

Table 8: Visual Impacts and Management Actions

Focus Area	Potential Impacts	Typical Locations	Possible Effects	Management Actions
1: Mpumalanga Middelburg, Loskop Dam and Olifants River areas	Potential visual impact on elevated landforms	Bothaberg and other hills to the northeast.	Visual scarring on steep slopes and mountain ridges, which are visible from a distance.	Avoid development where possible on visually sensitive mountain skylines and steep slopes >1:4.
	Potential visual impact on scenic river valleys, gorges and large water features (dams).	Olifants (Lepelle) River Valley and tributaries. Loskop and Witbank Dams.	Visual effect on river corridors and dams, which provide scenic and recreational amenity.	Avoid development in scenic ravines and gorges where possible. Apply visual buffers around water features.
	Potential visual impact on nature reserves, private reserves, game farms and heritage sites.	Loskop Dam NR, Botshabelo NR, Zemvelo NR and Rhenosterpoort NR.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised. Apply visual buffers around nature reserves.
	Potential visual impact on national, arterial and scenic routes.	National Routes N4, N11 and N12, particularly the section of the N11 at the Loskop Dam.	Visual effect on major arterial and scenic routes, which have scenic and tourism value.	Apply visual buffers along arterial and scenic routes. Screen substations. Avoid powerlines crossing scenic routes.
2: North West, Free state Klerksdorp, Vaal River area	Potential visual impact on landforms, geosites.	Vredefort Dome meteorite site / World Heritage Site (WHS).	Effect on visual integrity of World Heritage Site of geological interest.	Observe visual buffer around Vredefort WHS.
	Potential visual impact on scenic river valleys and water bodies.	Vaal River and Renoster / Skoonspruit tributaries. Johan Neser Dam.	Visual effect on river corridors and dams, which provide scenic and recreational amenity.	Avoid development within river corridors if possible and apply visual buffers.
	Potential visual impact on nature reserves, private reserves, game farms.	Faan Meintjies NR and a number of other private reserves and game farms.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised. Apply visual buffers.
	Potential visual impact on national, arterial and scenic routes.	N12 National Route and several other Arterial routes, particularly within the Vredefort Dome landform.	Visual effect on WHS and scenic sections of Vaal River, which have tourism value.	Apply visual buffers along arterial and scenic routes. Screen substations. Avoid powerlines crossing scenic routes.

Focus Area	Potential Impacts	Typical Locations	Possible Effects	Management Actions
3: Northern Cape Kuruman, Griqualand West areas	Potential visual impact on prominent landforms	Dolomitic Kuruman Hills, Wonderwerk Caves, and Asbesberg Hills. Numerous rock outcrops in the open plains.	Potential visual scarring on steep slopes and mountain ridges, which are visible from a distance.	Avoid development where possible on visually sensitive mountain skylines, steep slopes and rock outcrops.
	Potential visual impact on water courses and pans which serve as features in an arid landscape.	Ga-Mogara River course, The Great Pan and Rooipan. Natural spring at Kuruman.	Visual effect on drainage courses and pans which provide visual relief in a dry featureless landscape.	Avoid development along drainage courses and on pans. Apply visual buffers around drainage features.
	Potential visual impact on nature reserves, private reserves and game farms.	Billy Duvenhage NR at Kuruman. Numerous private game farms.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised.
	Potential visual impact on national and arterial routes.	N4 National Route, and R31, R325 and R385 arterial routes.	Visual effect on arterial routes, which are visual corridors for commuters and visitors.	Apply visual buffers along arterial routes. Screen substations.
4: Free State Welkom gold fields area	Potential visual impact on river courses and pans.	Sand River. Numerous salt pans between Welkom and Wesselsbron.	Visual effect on rivers and pans, which have added scenic and recreational significance in the featureless landscape.	Avoid development along drainage courses and on pans. Apply visual buffers around drainage features.
	Potential visual impact on nature reserves and heritage sites.	Nature Reserve near Welkom incorporating the Doringpan, and several other small reserves.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised. Apply visual buffers around nature reserves.
	Potential visual impact on arterial routes.	R30, R34 and R70 arterial routes.	Visual effect on arterial routes, which are visual corridors used by commuters and visitors.	Apply visual buffers along arterial routes. Screen substations and other infrastructure.
5: Western Cape, Eastern Cape Groot Karoo, Nuweveld and Die Vlakte areas	Potential visual impact on skyline of escarpment and mountain ridges.	Nuweveld, Onder Sneeuberg, Kamdebooberg and Toorberg mountain ranges, and numerous koppies.	Visual intrusion on steep slopes, mountain ridges, and the escarpment, which are visible from a distance.	Avoid development where possible on visually sensitive mountain skylines and steep slopes >1:4.
	Potential visual impact on water courses which serve as features in an arid landscape.	Sout and Kariega Rivers and tributaries. Pans south of Beaufort West.	Visual effect on drainage courses which provide visual relief in the featureless landscape of 'Die Vlaktes'.	Avoid development along drainage courses and on pans. Apply visual buffers around drainage features.
	Potential visual impact on private reserves and game farms.	Edge of the Karoo National Park. Numerous private game farms.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised. Apply visual buffers around private reserves and game farms.

Focus Area	Potential Impacts	Typical Locations	Possible Effects	Management Actions
	Potential visual impact on national, arterial and scenic routes.	National Routes N1, N9 and N12, and arterial routes R61 and R381, including scenic Molteno Pass.	Visual effect on national, arterial and scenic routes, which have scenic and tourism value.	Apply visual buffers along arterial and scenic routes. Screen substations. Avoid powerlines crossing scenic routes.
6: Western Cape Hardeveld, Knersvlakte and Olifants River Valley area	Potential visual impact on skyline of mountain ridges.	Northern end of the Cederberg, including the Gifberg. Granite domes of the Hardeveld.	Visual intrusion on steep slopes and mountain ridges, which are visible from a distance.	Avoid development where possible on visually sensitive mountain skylines and steep slopes >1:4.
	Potential visual impact on scenic river valleys, gorges and wetlands.	Olifants River Valley and tributaries including the Doring, Vars and Sout Rivers.	Visual effect on river corridors, which provide scenic and recreational amenity, as well as fertile agricultural land.	Avoid development in agricultural river valley (Olifants R.) and scenic gorges (Doring R.) where possible. Apply visual buffers along river courses.
	Potential visual impact on nature reserves and game farms.	Nature reserves in the Knersvlakte and game farms in the Hardeveld.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised. Apply visual buffers around nature reserves and game farms.
	Potential visual impact on national, arterial and scenic routes.	N7 National Route, R27, including the scenic Vanrhyns Pass and R362 along Olifants River.	Visual effect on national, arterial and scenic routes, which have scenic and tourism value.	Apply visual buffers along arterial and scenic routes. Screen substations. Avoid powerlines crossing scenic routes.
7: Northern Cape Prieska, Orange River area	Potential visual impact on mountain ridges and prominent landforms.	Dolomitic Asbesberg and Doringberg mountains. Numerous rock outcrops in the open plains.	Potential visual intrusion on steep slopes and mountain ridges, which are visible from a distance.	Avoid development where possible on visually sensitive mountain skylines, steep slopes and rock outcrops.
	Potential visual impact on rivers and pans, being landscape features in an arid landscape.	Orange River Valley and numerous pans to the south including Middelwater se Pan.	Visual effect on scenic and recreational value of Orange River, and on pans in an otherwise featureless landscape.	Avoid development along orange River corridor and on pans. Apply visual buffers around drainage features.
	Potential visual impact on private reserves and game farms.	Numerous private game farms.	Visual effect on wilderness character, recreation amenity and tourism economy.	Avoid development where wilderness experience or tourism facilities would be compromised.
	Potential visual impact on national and arterial routes.	N10 National Route, and R357, including Prieska Poort.	Visual effect on arterial routes, which are visual corridors for commuters and visitors.	Apply visual buffers along arterial routes. Screen substations.
	Potential visual impact on SKA telescope facility.	SKA arms Exclusion Corridors.	Visual interference of SKA facility.	Observe SKA Exclusion Corridors.
8: Northern Cape Bushman Land	Potential visual impact on prominent landforms.	Dolerite ridges and koppies, such as the Langberg to the south.	Potential visual intrusion on ridges, koppies and outcrops, which stand out in the expansive plain.	Avoid development where possible on visually sensitive ridges and rock outcrops.

Focus Area	Potential Impacts	Typical Locations	Possible Effects	Management Actions
area south of Pofadder	Potential visual impact on dry river courses and pans.	Krom River in the south and numerous pans throughout the Focus Area.	Visual effect on drainage courses and on pans in an otherwise featureless landscape.	Avoid development along drainage courses and on pans. Apply visual buffers around drainage features.
	Potential visual impact on pans.	No known reserves or game farms, but the large pans are important features.	Visual effect on visually exposed pan features.	Avoid development where pan features could be compromised.
	Potential visual impact on arterial routes.	R358 arterial route and district roads.	Visual effect on arterial routes, which are visual corridors for commuters and visitors.	Apply visual buffers along arterial routes. Screen substations.

The visual effects of wind turbines are difficult to screen or mitigate visually because of their construction and size, being visible for long distances. Cumulative visual impacts, together with substations and powerlines, could result in an industrial or energy landscape. A number of visual management measures are indicated below.

5.1 Planning Phase

- Wind and solar PV energy farms should where possible be located in disturbed landscapes, in preference to pristine or wilderness areas.
- Wind and solar PV farms should ideally be located in areas of even topography in preference to complex landscapes to avoid seeing these in silhouette against the skyline.
- Substations should ideally be located in unobtrusive low-lying positions, rather than on hill crests, preferably away from roads and settlements. Where this is not possible, they must be screened by means of earth berms and/or tree planting.

5.2 Construction Phase

- Strategically placed foreground planting can be used to screen views from sensitive viewpoints or receptors.
- Buildings that form part of substations should be in keeping with their local context, and should be in sympathy with the regional or vernacular architecture.
- Maintenance and access roads should use existing access roads or farm roads as far as possible to minimise further fragmentation of the landscape.
- Access roads should be sympathetically aligned with the grain of the topography and layout of agricultural fields. Roads should be diagonally aligned up slopes to minimise cut and fill.
- Areas disturbed by construction should be revegetated to match the surrounding flora or agricultural crops.
- Lighting should be unobtrusive and fitted with reflectors to avoid light spillage. Low-level bollard type lighting is preferred. High mast lighting should be avoided.
- Signage, if essential, should be discrete and confined to entrance gates. No bill boards or advertising signage should be permitted.

5.3 Operations Phase

There are no special visual management actions that are applicable during the operational phase once the wind or solar PV infrastructure has been installed, except for the standard maintenance of revegetation work as part of an Environmental Management Programme (EMPr).

5.4 Rehabilitation and Post-closure

- All above-ground structures should be removed, safely disposed of or possibly recycled for use elsewhere.
- The affected area should be regraded to pre-development topographic conditions, unless the area is required for new specific uses.
- Compacted areas, including access or maintenance roads that are no longer required, should be scarified and exposed areas re-vegetated or re-seeded.
- Vegetation used for the restoration should match that of the surrounding veld, unless new uses are planned for the site.
- Re-vegetation should be according to an EMPr provided by a rehabilitation ecologist.

5.5 Monitoring Requirements

- Monitoring of the construction and rehabilitation phases should be carried out by an Environmental Management Team, including an Environmental Control Officer (ECO), who would be responsible for regular reporting during construction and rehabilitation.

Visual monitoring by the ECO would include photographic records of the pre-construction and post-construction stages.

6. DESCRIPTION OF THE POTENTIAL CUMULATIVE IMPACTS

A methodology for evaluating potential visual cumulative impacts for wind and solar farms was developed in the Phase 1 Wind and Solar PV SEA (2015). This involved 2 steps described below, intended for the broad regional scale of an SEA. At the local project scale, viewsheds would also need to be considered when determining cumulative visual impacts.

Step 1: Development Density

This involves determining a suitable development density for each thresholds of visual sensitivity as indicated in Table 9 below. These apply to the Visual Sensitivity maps in Section 4 above.

Table 9: Guideline for Development Density for Wind and Solar PV Energy

Threshold	Development density
Level 1 Very high sensitivity	No wind or solar PV development recommended.
Level 2 High sensitivity	Limited development on a small scale, subject to setback, clustering and spacing considerations.
Level 3 Mod. sensitivity	Development on a moderate scale subject to setback, clustering and spacing considerations.
Level 4 Low sensitivity	Development generally permitted subject to micro-siting considerations.

Step 2: Development Clustering

The second step takes into account the size and spacing of the wind or solar PV facilities, again in relation to the threshold levels indicated in Table 9 above. This helps to determine an acceptable level of development density when considering cumulative visual impacts for wind and solar PV projects as indicated in Tables 10 and 11 below. Seen in another way, the size of wind or solar PV farms would vary according to the visual sensitivity level of the area.

Table 10: Size and spacing of wind farm clusters

Development density limit	Recommended cluster limit [1]	Approx. footprint/ cluster [2]	Buffer between clusters
Very high sensitivity	Not considered suitable for development		
High sensitivity	Small clusters up to 15 turbines/ cluster	± 9 km²	6 km if within same viewshed as another cluster, subject to local context.
Medium sensitivity	Medium clusters up to 30 turbines/ cluster	± 18 km²	
Low sensitivity	Large clusters up to 60 turbines/ cluster	± 36 km²	

[1] Assumes turbine hub height of 120m and rotor diameter of 130m. Larger turbines may result in fewer number of turbines.
[2] Assumes average area of 60 ha per turbine. This is the net footprint of the cluster, excluding site constraints.

Table 11: Size and spacing of solar PV farms

Development density limit	Recommended solar PV farm size limit	Buffer between solar PV farms
Very high sensitivity	Not considered suitable for development	
High sensitivity	Small solar farms up to 25 ha (±10 MW)	2 km if within same viewshed as another solar farm, subject to local context.
Medium sensitivity [5]	Medium solar farms up to 100 ha (±35 MW)	
Low sensitivity [5]	Large solar farms up to 200 ha (±75 MW)	

At the local project scale the cumulative visual impact of wind and solar PV farm projects need to be considered, particularly where these are in the same viewshed. Similarly, related infrastructure, such as powerlines and substations need to be taken into account.

7. VISUAL INPUT TO THE ENVIRONMENTAL ASSESSMENT PROTOCOL

The level of visual assessment required is dependent on a number of factors, such as the proposed scale of the project, the landscape or townscape context and issues raised as part of the public participation process. Liaison between the Environmental Assessment Practitioner, visual specialist and relevant authorities is also generally required. In addition, where heritage resources are affected, a visual impact assessment may be required as part of the heritage assessment.

Table 12 below provides an indication of the recommended level of visual assessment and permit requirements, based on the 'Guideline for Involving Visual and Aesthetic Specialists in EIA processes'

(Oberholzer, 2005). However, the specific circumstances of each project application need to be taken into account.

All visual impact assessments should ideally be preceded by a visual screening study to identify visual issues at an early stage, and to make input into the project siting and layout. A full specialist VIA is recommended if density limits in Section 6 above are exceeded.

Information in Table 12 below should be incorporated into the protocol for wind and solar PV development.

Table 12: Recommended level of visual assessment required for authorisation

Sensitivity Class	Interpretation (see Note 1 below)	Assessments at project level (see Note 2 below)	Permit requirements
Very High (dark red)	Visually sensitive resources with major visual constraints and/or protected areas or sensitive receptors. (Very high potential visual impact).	A **Level 4** specialist visual assessment. (Visual Impact Assessment with alternatives, management actions and 3D modeling / montages.	Permit from SAHRA or appropriate provincial heritage agency if landscape or heritage features are affected.
High (red)	High level of visual constraints and/or proximity of protected areas or sensitive receptors. (High potential visual impact).	A **Level 3** specialist visual assessment. (VIA with recommended management actions).	Permit from SAHRA or appropriate provincial heritage agency if heritage or landscape features are affected.
Moderate (orange)	Moderate level visual constraints and intermediate proximity of protected areas / sensitive receptors. (Moderate potential visual impact).	A **Level 2** specialist visual assessment. (Basic assessment with recommended management actions).	Comment from SAHRA or appropriate provincial heritage agency if heritage features are affected.
Low (green)	Few visual constraints and/or sensitive receptors. Disturbed or transformed land. (Minimal potential visual impact).	A **Level 1** specialist visual assessment. (Site visit and statement by a visual specialist).	Comment from SAHRA or delegated authority only if heritage features are affected.

Note 1: *Definitions of potential visual impacts are given below:*

Very high potential visual impact:

- Significant visual effect on wilderness / rural quality or scenic resources;
- Fundamental change in visual character of the area;
- Creates a major precedent for development in the area.

High potential visual impact:

- Intrusion on intact landscape or scenic resources;
- Noticeable change in visual character of the area;
- Creates a new precedent for development in the area.

Moderate potential visual impact:

- Some effect on intact landscape or scenic resources;
- Some change in visual character of the area;
- Adds to development in the area.

Minimal potential visual impact:

- Low level of intrusion on landscapes or scenic resources;
- Limited change in visual character of the area;
- Similar in nature or compatible with existing development.

Note 2: *Categories of visual assessments are as follows:*

Specialist assessment 'Levels' 1 to 4 are adapted from the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes*. CSIR Report No. ENV-S-C 2005 053, (Oberholzer, B. 2005).

The same Guideline indicates that wind and solar PV projects would fall under Type A assessments, being large-scale infrastructure. A visual specialist would preferably have qualifications in landscape architecture or environmental planning, or alternatively, recognised expertise and experience in the field of visual assessments.

8. GAPS IN KNOWLEDGE

There is at present no standard data base on scenic resources for the country as a whole, nor an agreed grading system in terms of their relative importance, in contrast with heritage resources for which there is a grading system. The authors have therefore relied on their personal knowledge and experience, as well as a number of references to identify these resources.

The information sources and limitations are indicated in Tables 1 and 2 in Section 3.2 above. Specific data that is difficult to source is spatial information on 'cultural landscapes', mainly because it is a contested subject and because input from heritage specialists is required.

Being a desktop study at a regional scale, no ground-truthing has been carried out, although the level of information is considered adequate for regional mapping purposes. More detailed surveys would be required at the local project scale as part of a VIA.

9. REFERENCES

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PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix B

Consultation

PART 1. INTRODUCTION

B 1- 1. Background and Approach

For the SEA to be effective in achieving its set objectives, inputs from a range of stakeholders were required. The SEA served as a platform to have different stakeholders work together to reach agreement on additional Renewable Energy Development Zones. A Project Steering Committee (PSC), which consisted of government officials and an Expert Reference Group (ERG), which represented key stakeholder organisations, guided the SEA. In addition to these groups, a technical working group and an environmental working group guided the criteria used in identifying REDZs.

In addition to the formal PSC and ERG structures, dedicated provincial and local government consultation was undertaken to further inform and guide the process. Key stakeholder groups that were able to provide additional information and insight were furthermore consulted through focus group meetings and the broader public was provided the opportunity to engage with the process through an online platform and conference proceedings.

This Appendix of the main SEA report details the consultation process that formed part of the SEA. All formal and informal submissions and engagements have informed the process and the SEA report constitutes the official response to all submissions received before the time of finalising this section on 20 September 2019. In addition to the report as an official response, brief feedback is provided in this section to key official submissions received.

B 1-2. Overview of Consultation

The following table provides a brief overview of key stakeholder engagements during the SEA process. These interactions are described in more detail in the following sections.

Table 1: Brief overview of stakeholder engagements

PSC and ERG meetings	
Stakeholders	**Date of public meeting**
PSC Meetings ERG Meetings	23 July 2017
	25 July 2017
	19 August 2018
	26 September 2019
Consultation with District and Local Municipalities	
District municipality with their relevant local municipalities consulted	**Date of consultation**
Overberg District Municipality	17 September 2019
Central Karoo District Municipality	18 September 2019
Central Karoo District Municipality	18 September 2019
Cacadu District Municipality	19 September 2019
Chris Hani District Municipality	20 September 2019
Nkangala District Municipality	25 September 2019
Dr Kenneth Kaunda District Municipality	27 September 2019
Namakwa District Municipality	30 September 2019
ZF Mgcawu District Municipality	30 September 2019

Dr Ruth Segomotsi Mompati District Municipality	1 October 2019
Lejweleputswa/Frances Baard District Municipality	1 October 2019
Conferences and Seminars	
Events	**Date**
International Association for Impact Assessment South Africa Conference 2016	August 2016
Windaba	2 November 2016
UCT Guest lecture	22 August 2017
Birds and Renewable Energy	29 September 2017
Bats and renewable energy	04 October 2017
WINDAc Conference	5 – 60 November 2018
International Association for Impact Assessment Conference 2019	29 April - 2 May 2019
International Association for Impact Assessment South Africa Conference 2019	23 – 26 August 2019
Conference for Wind Energy Impacts on Wildlife	27 – 30 August 2019
Other focus group meetings	
Stakeholder	**Date**
Animal Demographic Unit – University of Cape Town	08 July 2016
Industry Technical Working Group	04 August 2016
NGO Working Group	10 August 2016
Birdlife SA	27 October 2016
SAWEA Working Group	22 November 2016
SAEON and SANBI	25 November 2016
Birdlife SA and EWT	12 May 2017
Johan Stander- CSIR Energy Centre	23 May 2017
SAPVIA representatives	27 June 2017
SANBI	28 June 2017
Vulpro	29 June 2017
Henk Nel - Birdlasa	29 June 2017
Dr Jan Venter and Francis Martens -NMMU	3 July 2017
South African Bat Association	12 July 2017
Sonja Kruger	12 July 2017
Birdlife SA	19 July 2017
Sibanye Gold	2 August 2017
Birdlife SA	3 August 2017
SAWEA Working Group	4 August 2017
South African Heritage Resource Agency	11 August 2017
Anglo Gold	2 September 2017
Sasol	4 September 2017
Birdlife SA	29 September 2017
SABA	4 October 2017
DTU	10 November 2017
Ian Rushmore Ezemvelo Wildlife	29 November 2017
Birdlife and Avisense Consulting	12 February 2018
SAWEA chair	14 February 2018
Visual specialists	5 March 2018
Bat specialist	6 March 2018
Eskom –Peter Langley	15 March 2018
Eskom –Kevin Chetty	19 March 2018

CSIR Energy Center and members of SAPVIA	20 March 2018
Heritage specialist	20 March 2018
Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	28 March 2018
Meeting with biodiversity specialists	29 March 2018
Visual specialists	17 April 2018
Alistair McMaster- Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEAET)	28 May 2018
Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	27 March 2019
Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	16 May 2019
Bat specialist	13 June 2019

PART 2. OVERVIEW OF CONSULTATION

B 2- 1. Project Steering Committee and Expert Reference Group

Since the inception of the SEA process, the project team received guidance and advice from the PSC and ERG at a strategic and governmental level. All members of the PSC also served on the ERG and were provided the opportunity to review the process, technical data and the draft report used for the analysis. The Department of Environment, Forestry and Fisheries (DEFF) was the lead agent and chair at all PSC meetings, which were hosted at the CSIR Knowledge Commons venue on the Pretoria CSIR campus.

The main objective of the PSC was to identify means of giving effect, in the most effective and expeditious manner, to the implementation of the SEA's findings while ensuring compliance with all plans, policies or legislation which are relevant to the SEA. The main objective of the ERG was to provide technical review, inputs and insight to the SEA process.

The following authorities were represented on the PSC:

- Department of Economic Development, Environment, Conservation and Tourism in the North West Province (DEDECT);
- Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT);
- Eskom;
- Free State Department of Tourism, Environmental and Economic Affairs (DTEEA);
- National Department of Agriculture, Forestry and Fisheries (DAFF);
- National Department of Defence (DoD);
- National Department of Energy (DoE);
- National Department of Environmental Affairs (DEA);
- National Department of Mineral Resources (DMR);
- National Department of Public Enterprises (DPE);
- National Department of Rural Development and Land Reform (DRDLR);
- National Department of Trade and Industry (DTI);
- National Department of Water and Sanitation (DWS);
- National Department of Energy Independent Power Producer Office (DoE IPP);
- National Treasury;
- Northern Cape Department of Environment and Nature Conservation (DENC);
- Presidential Infrastructure Coordinating Commission (PICC);
- South African Air Force (SAAF);
- South African Local Government Association (SALGA);
- South African National Biodiversity Institute (SANBI); and
- Western Cape Department of Environmental Affairs and Development Planning (DEADP).

The following agencies and associations were represented on the ERG:

- Air Traffic Navigational Services (ATNS);
- Birdlife South Africa (Birdlife SA);
- Business Unity South Africa (BUSA);
- Cape Nature;
- Chamber of Mines of South Africa
- Civil Aviation Authority (CAA);
- Council for Geoscience (CGS);
- CSIR Defence, Peace, Safety and Security (DPSS);
- Endangered Wildlife Trust (EWT);
- Energy Intensive User Group (EIUG) of South Africa;
- Eskom;
- KwaZulu Natal Department of Transport (DoT) SIP 2
- Industrial Development Corporation (IDC);
- National Department of Agriculture, Forestry and Fisheries (DAFF);
- National Department of Defence (DoD);
- National Department of Energy (DoE);
- National Department of Environmental Affairs (DEA);
- National Department of Mineral Resources (DMR);
- National Department of Public Enterprises (DPE);
- National Department of Rural Development and Land Reform (DRDLR);
- National Department of Trade and Industry (DTI);
- National Department of Water and Sanitation (DWS);
- National DoE Independent Power Producer Office (DoE IPP);
- National Heritage Council South Africa (NHCSA);
- National Treasury;
- Northern Cape Department of Environment and Nature Conservation (DENC);
- Presidential Infrastructure Coordinating Commission (PICC);
- Sentech;
- South African Air Force (SAAF);
- South African Bat Assessment Advisory panel (SABAAP);
- South African Heritage Resources Agency (SAHRA);
- South African Local Government Association (SALGA);
- South African National Biodiversity Institute (SANBI);
- South African National Energy Development Institute (SANEDI);
- South African National Roads Agency Limited (SANRAL);
- South African Photovoltaic Industry Association (SAPVIA);
- Southern Africa Solar Thermal and Electricity Association (SASTELA);
- South African Weather Services (SAWS);
- South African Wind Energy Association (SAWEA); and
- Square Kilometre Array (SKA) South Africa as part of the Department of Science and Technology (DST);
- Sustainable Energy Society of Southern Africa (SESSA); and
- Transnet

B 2- 3. Phase 1 Consultation on the Study Areas

Phase 1 of the SEA identified a number of focus areas based on criteria used by the SEA team. The SEA team put out these focus areas for public comment on the SEA website and to the ERG and PSC. The commenting period took place 21 August 2017 – 21 September 2017.

The report and corresponding areas contained details of Phase 1 positive and negative mapping and identification of the resulting study areas. An official commenting form was provided to the all stakeholders for submitting comments on the study areas to the SEA team. The report, commenting form and the kmz file of the study areas was uploaded to the website and a notification was sent to all stakeholders registered on the SEA database indicating the availability of those documents for download. All commenting forms completed and sent back to the SEA team within the commenting period are included in this report. The study areas were also presented to the PSC and ERG as well as at various focus group meetings with key stakeholders. The comments received on the focus areas can be seen in Table below.

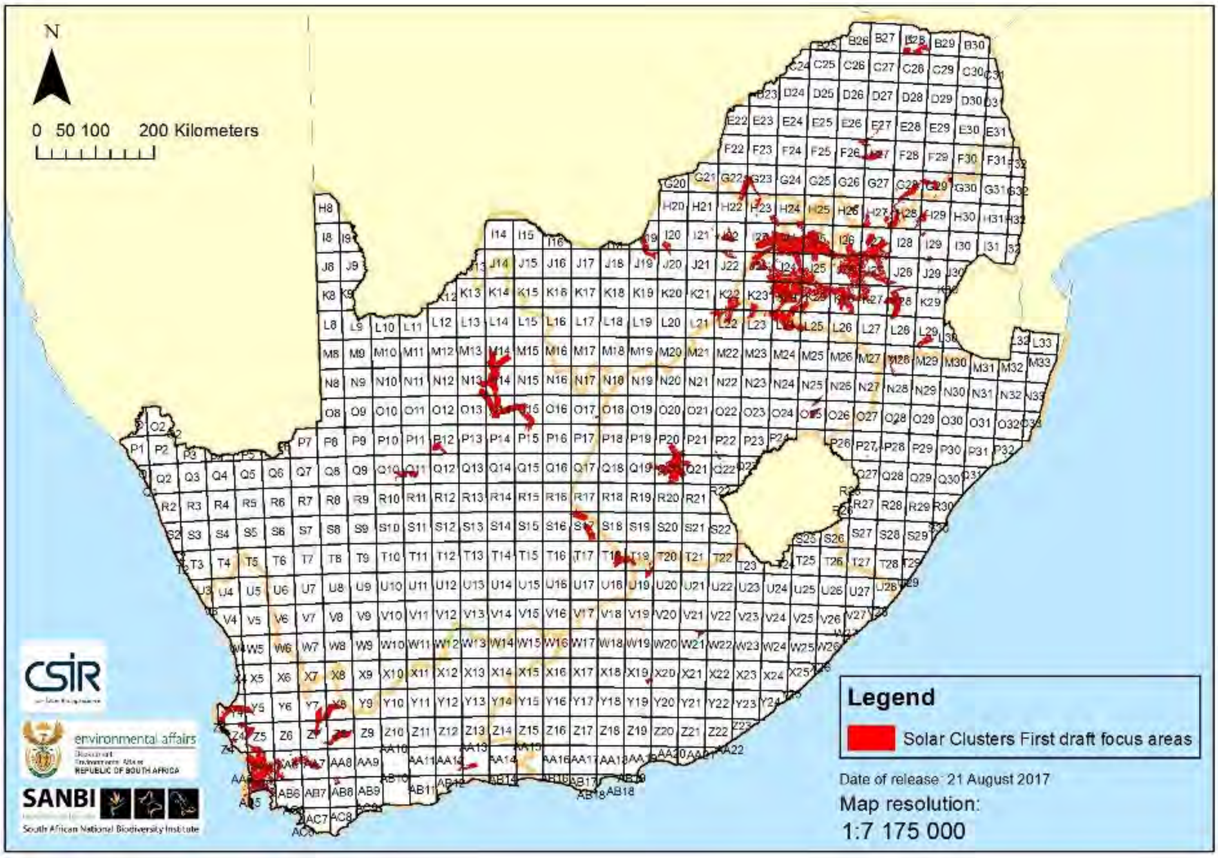


Figure 1: Phase 1 focus areas released for public comment

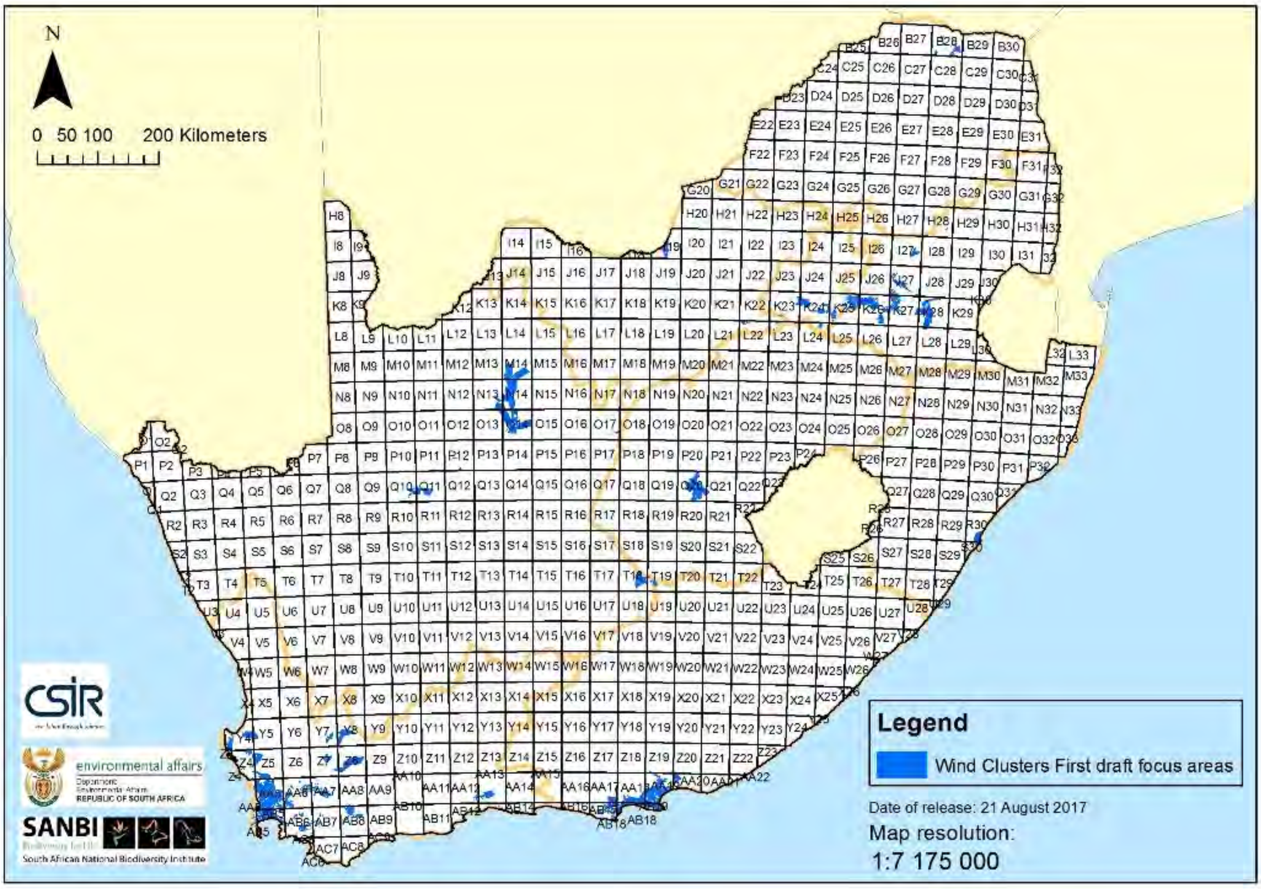


Figure 2: Phase 1 focus areas released for public comment

STAKEHOLDER	STATEMENT/COMMENT	SUGGESTION	RESPONSE/ACTION TAKEN
Andries Kruger	We have noticed from SAWS side that there is a mistake in the weather radar map in one of the presentations. The only radars we have at this stage are those listed below: **Station Name** — **Latitude** — **Longitude** CAPE TOWN RADAR — -34.05 — 18.39 GEORGE RADAR — -34.22 — 21.78 PORT ELIZABETH RADAR — -33.98 — 25.61 EAST LONDON RADAR — -32.76 — 27.66 MTHATHA RADAR — -31.54 — 28.76 DE AAR RADAR — -30.66 — 23.99 DURBAN RADAR — -29.71 — 31.08 BLOEMFONTEIN RADAR — -29.17 — 26.05 BETHLEHEM RADAR — -28.10 — 28.16 OTTOSDAL RADAR — -26.74 — 26.09 ERMELO RADAR — -26.50 — 29.98 IRENE RADAR — -25.91 — 28.21 SKUKUZA RADAR — -24.97 — 31.60 POLOKWANE RADAR — -23.89 — 29.51		This comment has been noted and the weather radars have been updated accordingly.
Eleanor Richardson	Could you just confirm that this map currently on the website below is the correct one for the wind clusters? I see you have marked one of the areas with the highest number of known bat roosts in South Africa (Durban CBD/Morningside/Umhlanga) as a potential wind area. It seems strange and will obviously call into question the methods used to come to this conclusion so I would like to confirm you think this is the right map before responding officially.		As this has been highlighted as a sensitive area for bats, the appropriate buffers have been applied and the map updated accordingly. The buffers prescribed by members of SABAA have been applied.
Nama Karoo Trust	Dear Abulele, Industrial scale wind farms should not be considered on top of the Great Escarpment, particularly the Sneeuberg Mountain range (where the 3 Cape provinces meet). The Sneeuberg is the last stronghold of Blue Cranes, our threatened national endemic bird, in the wild and the home of the world's largest population of breeding Vereaux (black) eagles. The Sneeuberg Mountains also hosts a number of endangered resident and migratory birds such as Cape Vulture, secretary birds, black storks and martial eagles. Scientists from various disciplines have described it as a pristine wilderness area.		Bird sensitivities have been considered in the delineation of the focus areas. In addition to this, a bird specialist high

	Photographic evidence of death to cranes, eagles and vultures by WEF's is widely available on the internet – it is no secret that WEF's are death traps to the wildlife and our natural heritage, let alone the ruination of the sense of place that belongs to all who live, visit and come from the Sneeuberg's ancient landscape. To knowingly or unknowingly place these protected species at risk is unconstitutional. Given what we now know about industrial WEF's, the CSIR would be knowingly promoting the death of legally protected species should it continue to promote WEF's on the Sneeuberg peaks. The Sneeuberg Mountains are a key South African biodiversity corridor for flora and fauna, both resident and migratory. Yours sincerely, Marina Beal Nama Karoo		level review will be conducted in the SEA. Please note the SEA does not replace the need for on the ground assessment and bird and bat monitoring.
Tshegofatso Monama (SKA)	Hi Abulele, Please find attached updated SKA corridors that should be taken into consideration during the second phase of the REDZs SEA process. The KCAAA1 is declared as a radio quiet zone and protected under the AGA act. Any development occurring within its boundaries poses a threat to not only the SKA radio telescope but also has the potential of degrading the radio quietness of the declared area in general hence it's given medium risk rating. The technology used to shield the EMI/RFI emissions of the PV plants that are being considered as possible alternative power sources to SKA spiral arm stations is only feasible at small scale PV plants. Regards, Tshego		This comment has been noted and the SKA areas and sensitivities have been updated accordingly.
Paulse G (The Department of Local Government)	Your letter referenced 12/7/3/1 dated 21 August 2017, refers. The Department of Local Government has no objection to the above mentioned environmental assessment.		This comment has been noted.
Coenraad Pretorius Anglo American	We are working on a concept mine closure project and we plan to incorporate some solar PV and biogas on site. Attached is the map, I believe it is I26. The REDZ inclusion should assist our project in the future. In terms of the boundaries of the areas, is there possibility to change them? There are also various sink holes in the general area due to undermining that was done years ago. Do you have that or is that info you would like to receive from us? Regards,		The SEA team shall await the shapefiles.
Ms. Sinethemba Madondo (GDARD)	1. Section 4.1: Environmental constraints Red List of threatened species 2. Section 7 Depending on their location, larger utility-scale solar Strict controls must be in place when mapping against facilities can raise concerns about land degradation and habitat loss 3. GIS Layers Solar first draft focus areas, intercept through It is recommended that areas defined as being irreplaceable Irreplaceable areas at some points in Gauteng 4. GIS Layers Focus areas identified close to Protected Areas in Gauteng.	1. Recommendation that this layer be considered as part of the mapping analysis	1. Red List of threatened species was used in the environmental constraints during the delineation of

	5. GIS Layer: Consideration of Infrastructure related plans within provinces. 6. GIS Layers: Consideration of Provincial Environmental Management Frameworks (EMF) **Background Information** 7. SIP 8, aims to facilitate the implementation of sustainable green energy initiatives: The Minister of Energy and Eskom do not seem to fully endorse and support the IPPs. This situation creates a stumbling block towards the investment in renewable energy. The competing interests in the seating government and the Eskom creates a disempowering/disabling environment for the generation and thriving of alternative energy from solar and wind. SIP 8, aims to facilitate the implementation of sustainable green energy initiatives: Availability of skills, technology and infrastructure required to implement this initiative. **Environmental, technical and socioeconomic overlays** 8 Coastal places are earmarked for wind generation under the SEA while solar is concentrated around the urban areas, which could be as a result of infrastructure to transmit to the grid? Why has the Indian Ocean area of SA been excluded from the delineation phase especially for wind generation? 9 The SEA does not cover most areas in the country, what was the criteria used to exclude some areas in the delineation process for both wind and solar. As a result, this SEA does not align to the National Green Transport Strategy currently being developed by the National Transport department. 10 There is no clarity on the threshold for activities that will be considered under SEA? 11. Shapefiles: Meta data non-existent. Difficult to comment on the data spatially without knowing what the data is about. Shape-file: Solar_first_draft_focus_area: No defining attributes. Without attributes that show where and where we do not want solar, it is difficult to comment on the layer 12. Mapping Page 8 section 2.3 Scale and resolution. How are the issues of scale and resolution in the data dealt with? If one dataset has a pixel resolution 1km and another 300m, they do not match. Also need to consider the provinces may have finer scale spatial data in comparison to National 13. Page 12 Protected areas data: The spatial dataset used is the SACAD data and provincial data from 2011. Based on the analysis, the updated 2013 PA for Gauteng has 11 new spatial records. There are 43 records on the Provincial PA layer that do not occur on the SACAD layer. This does not take into consideration areas where the spatial extent of the Provincial PA data does not match the spatial extent of the SACAD data layer. 14. Page 12 Critical Biodiversity areas: Does this include the CBA areas as defined in Municipal and Regional bioregional plans, or just provincial Conservation plans 15. Page 12 Water Features: The NFEPA river data covers only major rivers at 1:500 000 scale. This leaves out smaller rivers at 1:50 000 scale. Gauteng has river buffers of 32m within urban areas and 100m outside urban areas Gauteng has wetland buffers of 30m within urban areas and 50m outside urban areas	2. Strict controls must be in place when mapping against environmental concerns, especially the C-PLAN layer which And habitat loss. Promotes the protection of certain ecosystems based on what remains of them, In so ensuring the maintenance of linkages between habitats. 3 It is recommended that areas defined as being irreplaceable at some points in Gauteng are protected from any further degradation, therefore must be avoided. Where they cannot be avoided measures to promote habitat linkages must be implemented so that species from these habitats may still have the potential to	the first draft focus areas 2. All provincial biodiversity plans have been included in the CBA layer used in the SEA thus the GDARD C Plan has been accounted for 3. This has been included in the environmental factors 4. The following buffers around protected areas have been applied in the delineation of the first draft focus areas for the SEA: 10 KM buffer around National Parks and 5KM buffer around Nature Reserves 5. The infrastructure plans considered in the SEA were SEZs. 6. EMFs were not

	16. Page 12 Land Capability: Gauteng has developed its own agricultural potential atlas (currently GAPA4) The land capability was assessed slightly differently to the DAFF process (Mr. Mduduzi Ndlovu (GDARD), pers. comm.) and at a finer scale. 17. Page 12 Other data: The Gauteng Province has a ridges shape file and associated guideline. Ridges in certain classes are sensitive and should not have development on them. 18. Page 12 other data: The Gauteng Province has a protected areas expansion area map that is more detailed than the NPAES 19. Page 12: sensitive features: Ensure that National bodies have the most up to date environmental feature data (red listed species, etc.) 20. Page 16 proximity to roads In Phase 1 where the development zones were in more remote areas, this logic is sound. With the proximity of developments to main roads in place like Gauteng, how is the constraint of already developed area considered. 21. Presence of dolerite: what about dolomite. Might not be of concern given that the processes do not use water, but a wind turbine falling into a sinkhole might affects its efficiency. 22. Page 18- section 4.3 Trends indicating growth relies on existing data. Provincial growth strategies with spatial data would also assist in determining growth 23. Page25-Section 5: Also applies to solar. A process flow model of the processing of the spatial data as that given in model builder or drawn using Visio will enable the reader to “see” how the data was manipulated. 24. Page 37-national protected Areas expansion strategy: For Gauteng need to consider the Gauteng Protected Areas Expansion strategy 25. It is evident that the solar focus areas are more concentrated within the Gauteng Province. It is therefore pertinent that the land use issues in the province are taken into high regard as there is already an issue of space. Development is rapid and land use conflicts are becoming eminent. The implementation of PV solar must ensure that land identified does not compromise current provincial development trends as well as the remaining natural landscapes.	navigate between equally suitable habitats. 4. Consideration of the Protected Areas buffer is highly Gauteng recommended when undertaking the environmental sensitivity mapping. 5. The Gauteng Province is currently implementing the Infrastructure Master Plan. This has implications for planning and land use in the province. It is recommended that such plans are taken into consideration during analysis as this determines any existing land use conflicts and promotes alignment. Gauteng is developing at a rapid rate, therefore there are many development applications	considered in the SEA 7. The CSIR has been commissioned to undertake the SEA by the Department of Environmental Affairs. Commenting on the political climate of the REIPPP process is beyond our scope of work. 8. Based on the environmental constraints, technical considerations and socio economic analysis, the east coast of South Africa does not present favourable conditions for the location of focus areas for large scale renewable energy projects. 9. The delineation of

		currently in the pipelines, in addition to being supporting Infrastructure to this development, the solar and wind projects must not conflict with planned provincial priorities. (Dataset for Gauteng Infrastructure Master Plan can be requested from the Office of the Premier: Gauteng Planning Division) 6. The Environmental Management Zones (EMZ) of the EMF identify zones where certain development activities are compatible, with prescribed guidelines. It is recommended that this planning tool be given consideration in terms of ensuring that the focus areas identified are aligned to the	the first draft focus areas for the second phase of the wind and solar PV Strategic Environment al Assessment was based on three spatial mapping exercises namely environment al constraints mapping; technical constraints mapping; and Socio-economic activity index mapping. Detailed description of the process followed to delineate the first draft focus areas have been provided in Section 4 of the report released with the first draft doucs areas on 22 August 2017 which can be found on the CSR REDZs Phase 2 website. Please see

		guidelines of the zone under which it falls. Furthermore, GDARD is currently in the process of developing exclusions for activities falling with zone 1 and zone 5 as identified in the EMF. This means that some activities falling within these zones may be excluded from normal EIA Requirements. In essence it is advisable that development be focused within these areas. 7. The Minister of Environmental Affairs to engage the Minister of Energy to issue a determination to Eskom to procure energy from IPPs and promulgate Regulations to guide the industry on trading approach going forward regionally and nationally. The trading rates should	this section for an in-depth explanation on the focus areas and how they were derived. 10. The thresholds used and criteria have been include in the report released with the draft focus areas 11. The Shapefiles of the focus areas have no attributes as they are a combination of all environmental, technical and socio economic data which has been detailed in section 4 of the first draft focus areas report document made publically available on 22 August 2017 on the CSIR REDZs website. The Shapefiles which were

		encourage and attract investment in renewable energy to contribute to the mitigation of climate impacts. The country should be sending the right message to the citizens on the support and uptake of the renewable energy. The agenda of the SEA project will contribute to the country's National Determined Contributions in climate mitigation. 7.1. Push for in-country sourcing of necessary technology and equipment to create employment and sustain our economy, instead of importing equipment and expertise. This must be a condition for consideration of a project under the SEA.	used in the SEA will be handed over to the national Department of Environmental Affairs and will be used in the National Screening Tool. 12. Noted 13. This has been included in the updated environmental layers 14. The finest national scale data has been used 15. National scale agricultural data has been used 16. Ridges have been used in the visual impact assessment 17. GDARAD to provide the latest shapefiles. 18. GDARAD to provide the latest shapefiles. 19. The most up to date information

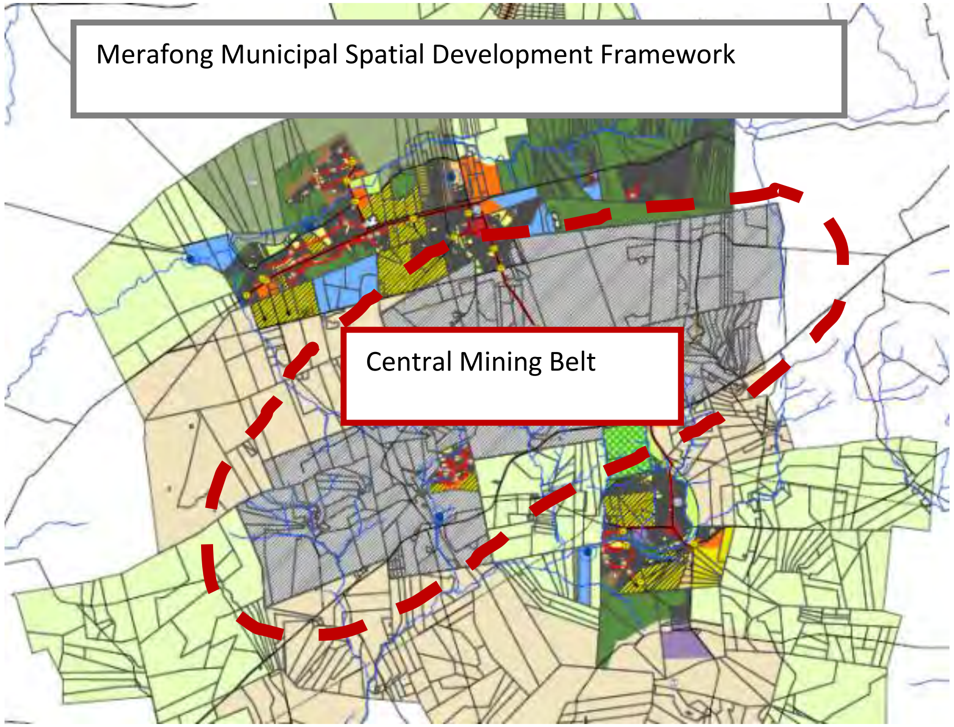
		8.1 The coastal areas should be included for wind generation in the SEA to facilitate provision of renewable energy to the local people. Solar power generation must be encouraged in most cities in the country especially with anticipated migration to the cities in the near future. 8.2 The SEA should cover wider areas in the country to enable representation and uptake of the renewable energy generation. 10 There need to be clarity on the threshold of activities both wind and solar that will be undertaken as per the SEA based on the generation output. 11. Please include metadata.	available o the SEA team was used for the delineation of focus areas. 20. This will be considered. 21. The presence of dolomite was included as a technical constraint when delineating the first draft focus areas. 22. Noted 23. The comment has been noted. 24. Provincial databases were used in the environment al constraint mapping of the SEA. 25. Urban areas from the SA Land cover data were used as a constraint when delineating focus areas. The solar areas are close to the Gauteng area as result of low environment

		Attributes need to be assessed and attributes need to be used that allow the user to interrogate the data. 12. Include relevant fine scale spatial data (potential data listed below). 13. Get updated Protected area layer 14. Use finer scale river data. 15. Recommend inclusion of GAPA4 land capability map. 16. Use Ridges data 17. Use GPAES. 18 Consider developed and developing areas in Municipalities using land cover and SDF's 19. Consider areas of dolomite as a constraint.	al constraints, favourable technical constraints and as the area has been identified as an area where energy demands will increase in the future.

		20. Look at Gauteng Spatial Development Framework and Growth and development strategies 21. Consider inclusion of a process model.	
Christiaan De Jager Merafong City Local Municipality	A very short synoptic overview of the policy, socio-economic and environmental considerations is given: Policy framework ▪ The National Development Plan has identified the “Far West Witwatersrand” as an area where the state should seek to stimulate the growth of new sectors and develop new skills. ▪ The Gauteng Economic Development Plan has identified the West Rand as an investment target area for the Green Economy. ▪ The West Rand Green I.Q. Strategy has identified the development of renewable energy projects including Solar PV as key economic infrastructure that will aid in the development of the economy and district alike. ▪ One of the main thrusts of the West Rand Economic & Industrial Development Plan is the creation of a solar economy. ▪ On the local front the Merafong Municipal Spatial Development Framework indicates that there are numerous opportunities for the development of a solar energy based economy as well as a Bioenergy Eco-industrial Park.		Your submission and supporting documentation have been taken into consideration in the refining of the first draft focus areas. Based on the supporting documentation, these areas have been included in the second draft focus areas. The SEA team is awaiting said shapefiles

Space economy perspective

- The West Rand and Merafong in particular is emerging as a very suitable locality for the development of solar farms and associated economic activities for the following reasons:
  - ✓ The area is located very close to the core of the Gauteng City Region, however it does not experience the same negative externalities such as high crime, traffic congestion, high land prices, etc. which, in terms of land rent, makes it ideal for the establishment of solar farms and associated industries.
  - ✓ Solar radiation. Merafong has the highest level of solar radiation in Gauteng.
  - ✓ Infrastructure. Merafong is located at a strategic point with 2 major ESKOM distribution stations linking up the entire western part of South Africa. In addition to this there is a vast amount of infrastructure related to the mining industry including a number of high tension lines and smaller distribution stations as well as access roads and water. This infrastructure will greatly reduce capital costs of setting up solar farms in the area.

	✓ Land availability. The area has tens of thousands of hectares of land that has been affected by mining and that is lying dormant. Vast areas of this land are suitable for solar farms and some of the mining companies are already looking into constructing their own solar farms. This land can be accessed at rates far below market value and in some instances could be made available at no cost in order to incentivize investment. ✓ The entire West Rand and especially Merafong is highly dependent on the mining sector which is in decline. Indications are that about 8 000 jobs will be lost before the end of the year in Merafong due to mine layoffs at AngloGold Ashanti and Sibanye Gold. It is of critical importance for the entire region to build new economic base sectors in order for our economy to survive.  Environmental suitability		

	▪ Large areas within the mining belt have been transformed by mining and contain no significant biodiversity. These areas are classified as "Other Natural" or "No Natural Remaining" by the West Rand Bioregional Plan which basically means that there are no impacts to be made by land use changes. ▪ Due to the nature of the available land the food versus fuel/energy debate is sidestepped. This land cannot be utilised for growing food because much of it is impacted by mining. ▪ Remaining areas of high biodiversity can be formally protected as part of the development process.  		

	It should be noted that another study is also currently underway to determine the feasibility of developing a Bioenergy Eco-Industrial Park in Merafong. The combination of these 2 projects would make Merafong the hub of renewable energy in Gauteng. If Merafong and the rest of the West Rand is excluded from the REDZ it could seriously hamper the development efforts of the municipality and Gauteng Province. It can clearly be demonstrated that Merafong and the rest of the West Rand should be included in the REDZ. As we are not sure what documentation could be required, documentation could be made available on request. Steven Szewczuck from the CSIR Built Environment Division and the Ernst & Young team have availed themselves if needed. I can be contacted at 018 788 9039, 079 128 6831 or at christiaan125@gmail.com for any enquiries.		
Lt Col Hannes (J.H.J.) Potgieter Pr.Sci.Nat Department of Defence	Department of Defence comments on Phase 2 of the SEA for REDZs will be forwarded in four separate emails due to the size of the layers. This email will be followed by a formal letter from the DOD. The letter will, among others, explain the parameters applied in the buffers around military facilities and attributes. The following is included in each email: • Email #1 (This Email). PDF files of the DOD buffers pertaining to Solar and Wind REDZs. • Email #2. Layer with **No Access** (Very High Sensitivity) at DOD facilities and attributes. • Email # 3. Layer with **Restricted Access** (High Sensitivity) at DOD facilities and attributes. • Email # 4. Layer with **Limited Access** (Medium Sensitivity) at DOD facilities and attributes.		The comments and the submission of documents and shapefiles has been noted and included in the refinement of the first draft focus areas.
KZN Ezemvelo by Boyd Escott and Felicity Elliot	General inputs for the Technical Report: 1. Is map 5 on Appendix 1 showing main roads only or does it include national roads? This needs to be clear as it can be rather confusing. Page 4 2. Boyd asked if the SEA used the latest version of provincial Protected Areas for KZN, new data was given to the team for inclusion into the analysis. 3. Boyd indicated that the team might want to obtain "Dispersive soils" from the Council for Geoscience, especially the Masocheni Formation near the Ladysmith area. These soils are very erosive and would need to be avoided for any wind energy or solar PV development. Greg Botha wrote a thesis on Masocheni Formation soils, this document might be worth looking at. 4. We might also want to avoid "Landslide areas" within the province; this data can be obtained from Council for Geoscience. 5. A suggestion to add a definition for CBA1, highlighting that these are Irreplaceable CBAs – definition can be found from the "Lexicon of Biodiversity Planning". And that we need to give clarity around when and where the data for the features of critical importance will be used in the documenting and which data will be used in the wall to wall sensitivity as part of the assessment. Suggested we clarify that better in the document. 6. The team should check if there is any data received from KZN Ezemvelo regarding Cape Vultures. Ian Rushmore is the suitable person to contact regarding this data, and would be happy to provide us with the data or the relevant links to the people who have this data 7. Ecological Support Areas for Solar PV should be given a high and not medium sensitivity as indicated in the table (page 31). 8. Ezemvelo KZN Wildlife has delineated a buffer around the Ukhahlamba Drakensberg Park and this might be useful to include in the criteria. Boyd also indicated that they delineated "Reciprocal Viewsheds"; these are areas/hills within the park where visitors can have a clear view of wilderness areas (cultural heritage). The areas might also be useful for visual impact assessments and can be used in the visual assessment. This is available for all KZN reserves, and will be completed by November 2017		1. National Roads have been included in the assessment 2. The latest data has been used in the SEA as provided by Ezemvelo to SANBI 3. This data from Geosciences was not available within the time frames of the SEA.

	9. KZN would also like to formally request access to the socio economic data use in the study, more for use in their planning, and wanted to know if this was possible? 10. KZN would also like us to take their Rhino expansion strategy areas into account, as these are areas that are identified for rhino expansion Areas of concern for First Draft Focus Areas: 1. Wind Clusters o The focus area in R30 and S30 is located right within Durban Central – so not ideal for renewable energy 2. Solar Clusters o Masocheni Formation located on M28 o KZN are planning on gazetting a Strategic Water Source Area in M29 and M28, that may have impacts on the types of development that can take place there		4. This data from Geosciences was not available within the time frames of the SEA. 5. Comment has been noted. 6. The latest cape vulture data was included in the environmental constraint mapping 7. Noted. This has been applied in the refinement of second draft focus areas 8. To access data from KZN for the visual assessment 9. All socioeconomic data used in the SEA is publically available and can be provided upon request. 10. The rhino expansion strategy was not taken into consideration.

			1. This is noted and the focus area has been removed 2. This has been noted and the focus area has been removed
Megan Murison, The Endangered Wildlife Trust	AA19 - Presence of Albany Adder (Bitis cornuta albanica). One of the world's most endangered snake species and is endemic to South Africa. O25 - Presence of Sungazers (Smaug giganteus).Endemic reptile classified as Vulnerable.		This comment has been noted and the focus area has been removed.
Andries Pienaar, Eastern Cape Department of Economic Development Environmental Affairs and Tourism	The proposed REDZ in the Kouga/PE and adjacent areas is characterized by an extensive network of protected areas, much of which is sensitive for visual impact. In addition to existing national protected area expansion areas the Department is finalizing a new Biodiversity Strategy and Action Plan which will identify Critical Biodiversity Areas and ecological support areas [including corridors]It also includes a new more comprehensive protected area layer. We are still in a consultative phase and mapping is expected to be finalized towards the end of October 2017.		Project team is awaiting shapefiles
Kate Webster Vulpro	Regarding the following M14 N13 and 14 O14 and 15 P12 Q10 and 11 I am not an African White-backed vulture specialist but am aware these are possible areas they do breed in. Has Beryl Wilson been consulted on this at all?		The latest nationally available vulture data was used in the environmental constraints layer.
Sheldon Vandrey	Comments on delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment Comment 1: Wind Capacity Factor > 35% Why place such a limiting factor on an area? Capacity Factor (CF) is directly linked to the financial feasibility of a project. Also, CF is usually only determined after at least 12 months of on-site monitoring and not by a desktop analysis, therefore including such a parameter as a determining factor in selecting a REDZ area is not warranted, and cannot be seen as sufficient enough to support including one area and excluding another area from a REDZ. Comment 2: Proximity to main transmission system (MTS) substations - Buffered areas within 35 km from MTS substations (in areas with Stability Limit >1000MW and existing or planned substations with Transformer limit >100MW). There are proposed MTS as per Eskom's Generation Connection Capacity Assessment of the 2022 Transmission Network (GCCA-2022) Document dated June 2015, which have not been included in the assessment used to prepare the inputs used to define the new REDZ from a grid connection point of view. Why is that? Secondly, why exclude development outside of the 35km radius from existing and future MTS? Since some areas that are more suitable to RE development might not always be within the 35km range of an Eskom MTS Substation. Why limit the distance to 35km and not 50 or 80?		1. The capacity factor was the best available dataset at the time of delineating the first draft focus areas. Since the release of the first draft, WASA has

	Comment 3: Proximity to main roads - Buffered areas within 10 km from main roads Having a main road as an input for selecting a good RE site has never been a criterion for developers. It is a bonus, but not a main criterion. What would be the rationale behind using 10km from a main road as a main input into selecting a good RE site? Wouldn't this prevent or make it more challenging to develop suitable sites that are located further than 10km from a main road? Comment 4: Presence of dolerite and hard rocks for geotechnical constraints. The presence of dolerite and hard rock formations as a constraint cannot be used to inform the selection of a RE site. These are geotechnical, and not necessarily a constraint that cannot be mitigated by a developer through proper foundations during construction. Also, these areas are so wide spread, that they would certainly wipe out large areas that would be otherwise suitable for RE development. Comment 5: Presence of steep slope for access to site - slope > 10% Slopes more than 10% should not be a limiting factor in selecting a good REDZ. Most good Wind sites are located on top of ridges and in order to get up on the ridge one has to navigate slopes more than 10%. This is therefore an engineering issue and should not be included into a desktop analysis for a good site. Comment 6: Socio Economic Activity Index Mapping This section's methodology and objectives are not clear. Towns and rural areas that fall outside of large urban cities and metropolitan areas are in desperate need of investment in order to discourage rural exodus. It is therefore requested that this whole section needs to be revised in order to stimulate areas of the country that are lacking in socio and economic development (e.g. high unemployment rate, very low income / household…). The population density should also play a factor so that RE projects are able to deliver tangible benefits to communities in close proximity without having IPP's ''competing'' to fund community upliftment projects in the same area that have a very low population density. Comment 7: This environmental constraint mapping is using data from Bird Life SA (BLSA) which, unlike all other environmental inputs, hasn't been validated by any institution or government department. It is assumed that the PSC, ERG and the conservation working group, simply took the buffers data provided by BLSA without trying to understand how they were defined and based on which methodology. BLSA is basing their inputs on the Pfeiffer (2016) study which analysed four years of tracking data, from nine vultures of various ages that were captured at four different locations in the Eastern Cape. Using this data BLSA developed a model to predict the probability of vultures flying in an area and the probability of vultures flying at risk height (i.e. where there may be a risk of turbine collisions) and these probabilities were plotted in relation to distance from roosts and breeding colonies. However this study is a very weak basis upon which to draw conclusions and impose significant buffers, which are essentially preventing any REDZ from being implemented in KZN of most of the Eastern Cape Province. The buffers inputs provided by BLSA stems from a GPS tracking study that was conducted on 9 birds out of a 9000 mature individuals populations (i.e. the study is based on 0,1% of the bird population.) Moreover out of the 9 birds which were tracked during the study, several died and it appears the study only really gathered quality data from 2/3 birds. As such from an academic point of view this study surely can't be accepted to make any solid scientific influences to justify such constraining buffers that are essentially preventing any REDZ from being implemented in two provinces. Essentially the CSIR is using information provided by an NPO which has adopted an overly cautious approach to wind energy development. The buffers haven't been validated by any government institution.		provided the SEA team with nationwide wind speed data which will be used to delineate the second draft focus area and the capacity factor mapping components will form an informative layer. 2. The distance from substation and all other technical criteria used in the SEA were determined with in consultation with an industry working group who advised that beyond this distance the cost would increase. 3. The distance from substation and all other technical criteria used in the SEA were

			determined with in consultation with an industry working group who advised that beyond this distance the cost would increase 4. This comment is noted and the specific criterion has been removed as a determining factor. 5. This comment is noted and the specific criterion has been removed as a determining factor. 6. This comment is noted and the socio economic criteria has been removed as a determining factor. 7. The buffers used are those that are from the widely accepted Bird

			pre and post construction monitoring guidelines.
SAPVIA	SAPVIA has studied the documents provided by CSIR regarding the steps taken to determine the new focus areas in Phase 2 of the Renewable Energy Development assessment process, and would like to propose the follow suggestions to assist in filtering process. Our comments have used the steps defined in Section 6 (Delineation of the first solar PV energy draft focus areas) of the report titled "Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment"1 released on 21 August 2017. Step 1: Areas with a photovoltaic yield with single axis tracking value superior to 1850 kWh/kWp /annum and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads were selected. The 'intersect" of the three criteria was processed in ArcgGIS10.4. PV developer decisions on minimum yields for sites has been distorted by the rules of the Renewable Energy IPP Procurement (REIPPP) programme. Historically the viability of any prospective site is determined by its "delta" from the equivalent yield in Upington or Prieska. Whilst this measure worked in Rounds 1-3 where grid connectivity was readily available, this is no longer the case. SAPVIA has a view that going forwards solar PV tariffs are declining at a pace which means policy support for solar PV will not be required from national government and there will be buyers of electricity other than Eskom. 1. City of Cape Town is already challenging the Minister of Energy on delays on its application for a s34(1) determination to contract directly with IPPs, City of Johannesburg and Tshwane wish to enter into PPAs with RE IPPs, 2. Ekurheleni metro municipality has recently awarded 260 MW of rooftop PV PPA to IPPs. The interest for these municipal entities to consider buying power from RE IPPs is that it is cheaper than Eskom's wholesale prices, and therefore the ability to select study areas close to load centres becomes increasingly important. Step 2: Areas with underlying rock formation of dolorites and other hard rocks (including gneiss, granite, and quartzite) which present various geotechnical challenges were erased from the layer created in Step 1. Nothing to add on this. Step 3: Areas with slope superior to 10%, which present a logistic challenge in terms of transporting the abnormal loads of the solar PV energy facility components to the construction site were erased from the layer created in Step 2. CSIR's slope criterion refers to the access route to the PV site rather than the site itself – SAPVIA believes that this is much more of a wind technology issue than PV related, would prefer to see the 10% slope limit for access routes increased to 15% for PV Step 4: The layer created in Step 3 was clipped to the extent of the municipalities' boundaries of classes 1, 2, 6 and 7, identified in Section 4.3 of this report, which include 124 municipalities across the nine provinces of South Africa classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining". Members of the subcommittee were unclear why CSIR only included the classes referenced. As such we have chosen to try and simplify the approach on that the original terms of reference for the REDZ2 process to look to identify old mining and industrial areas where large scale deployment of renewable energy could be deployed and be used to play a role in energy transitions and the socioeconomic consequences associated with mining sectors (eg coal and gold) coming to the end of their useful lives. SAPVIA recognizes that the IRP 2016 update described a number of scenarios where renewable energy and gas (and maybe nuclear) replaces the bulk of Eskom's existing coal-fired fleet by 2040. The closure of what has been a major industry for South Africa over the last 60 years will have a major effect on the economies of Mpumalanga, and places a duty on both the renewables and gas industries to establish industrialization plans to contributing to the offset of job losses from the coal industry that will be felt. Identification of these areas would	The only other comments/ recommendations proposed was that when refining the focus areas further was for Eskom to identify those areas where they experience the highest network losses. In addition the view from some members that the minimum solar yield barrier for single axis tracking should only be used for delineation of focus zones. SAPVIA feels that the MTS and road barriers are somewhat arbitrary but that the focus areas are large enough that they would not threaten the exclusion of compelling REDZs areas in the future.	This comment has been noted and will be discussed with Eskom The slope criteria has been removed in the updated focus areas. Location of minim town has been used as a criteria in the updated focus areas The flood data was not available.

	therefore be useful for refining the identification of focus areas and should used as a criteria. We understand that CSIR has already conducted interviews with a number mining companies in the affected areas and understand that their attitudes towards making development land available within their mining areas are critical to focus area selection. Step 5: The layer created in Step 4 was overlaid with the mask of environmental features of critical importance described in Section 4.1 of this report. All intersect of the refined solar PV clusters created in Step 4 with environmental features of critical importance were erased from the layer. SAPVIA has no problem with the criteria that CSIR have suggested in the Section 4.1 and concur with their use. One suggestion that may be considered is to revise the 32m exclusion for major rivers to the 50 year flood line which may have more relevance but it is up to the risk appetite of each developer. SAPVIA's view is that SKA is a technical rather than environmental constraint and therefore there are ways to mitigate this from a technical perspective. Whilst this may not be relevant from a REDZ2 refining process, we feel that for consistency sake it should be defined appropriately here in this process.		
Andre van der Spuy AVDS Environmental Consultants	A. <u>Introduction.</u> AVDS Environmental Consultants (AVDSEC) submits these comments on behalf of itself, as an entity concerned with the protection of the natural heritage and environment of South Africa, including the well-being of its citizens and their rights. AVDSEC submitted extensive comments and objections on the Phase 1 SEA and which SEA process and outcomes were and are fundamentally flawed and illegal. These objections were made on behalf of various entities, including "occupiers" properties that are located within or nearby the Phase 1-identified REDZs and land owners of similarly located rural properties (the latter of which are mostly involved, at least partially, in substantial game and ecotourism activities). The objections and comments submitted were effectively rejected and/ or ignored by the DEA and CSIR by means of meaningless responses (at best). 1. The issue of failure to directly notify land owners and "occupiers" of affected properties was a central and consistent theme of the submitted objections but which was consistently ignored by the drafters through the means of euphemistic and dishonest responses. In the Phase 1 SEA no effort was made to <u>directly</u> contact the (rural and often isolated and illiterate) landowners or the occupiers of properties located within or adjacent to REDZs - this despite the details of landowners being readily available via Municipal databases. In direct contrast to this, the CSIR and DEA, engaged extensively and meaningfully with the Renewable Energy (RE) development industry in order to arrive at a pre-determined outcome of REDZs so as to suit the previously identified and/ or secured commercial interests of the RE developers (the latter by means of land tenure agreements with selected land owners for purposes of RE development). The SEA process was thus significantly prejudicial and biased in the interest of private commercial RE interests as well as government's political infrastructural development agenda (via the DEA as its implementing agent of policy). In so doing, the interests and rights, including that of equal and fair participation and representation, of affected rural land owners and "occupiers" have been grossly violated. This injustice must be considered in light of the fact that the subject land owners and "occupiers" (those not courted, or being willing to be courted, by RE developers) are those that will directly bear the main environmental and socio-economic costs of this ill-considered development initiative. 2. Many of the environmental concerns that were explicitly raised during the Phase 1 SEA process have been realized, such as, for instance, the ongoing killing of Cape Vulture and other Endangered species within identified REDZs such as the Cookhouse REDZ. The Phase 1 SEA process has been roundly condemned by genuinely concerned environment and conservation parties such as Birdlife South Africa. <u>The Phase 1 SEA will accordingly promote RE development that does not meet with the sustainability criteria set out under NEMA</u>. It is therefore difficult to comprehend that the current "Phase 2" SEA process has embarked upon exactly the same flawed methodology as the Phase 1 SEA and can thus be expected to deliver the same flawed outcomes which will ultimately result in environmentally unsustainable development. This comment will emphasize its concern towards wind farms. They are significant confirmed contributors to global climate change on account of their manufacture, operation and requisite supporting fossil fuel base load which must be operated at lees than optimal efficiency (e.g. Germany where a large scale investment in RE has simply resulted in increased carbon dioxide emissions and the most		1. A project web-site which contained all the information relevant to the SEA was operational throughout the process. Through the development of a national scale policy or strategy, it is not possible or necessary to consult individual property owners. Site consultation will be undertaken through the BA process; therefore landowners will be individually consulted should a renewable

	expensive electricity in Europe). Wind farms are notoriously inefficient generators of useful electrical power, being intermittent and variable and having load capacity factors of only 35% at very best. They also do not create permanent local employment and are a financial drain on the South Africa economy and citizen, especially the poorest of the poor. **B. <u>Failure to consult the public and affected landowner and "occupiers" directly or meaningfully and Industry-biased approach.</u>** 3. The latest Phase 2 SEA fails to notify "the public" of the SEA and seek public comment. Contrary to the SEA's opinion, the Project Steering Committee (PSC) is NOT the public. The PSC is essentially government. The SEA also fails to notify landowners and "occupiers" within, or adjacent to, identified RE draft focus areas. Instead the SEA relies on a list of stakeholders from the previous Phase 1 SEA as a surrogate for the "public". It intentionally ignores the fact that such list of stakeholders does not constitute the public and such stakeholders are mainly hold stakes in the Phase 1 REDZs which are in different areas to the RE draft focus areas identified in the Phase 2 SEA (i.e. they are likely not to be stakeholders in the Phase 2 SEA). This failure to consult the public at large and relevant landowners and occupiers directly does not prevent the Phase 2 SEA from liberally referring to its current (this comment period) and future engagement with the "public". Such references are however intentionally deceitful and misleading and the reality is that the Phase 2 SEA fails materially to notify the "public" or even the relevant "stakeholders" (i.e. those with a stake in the Phase 2 RE draft focus areas). The propensity of the CSIR and DEA to ignore such fundamental rights of South Africa citizens sets the current Phase 2 SEA upon a difficult and justifiably contestable path in which the outcomes will not able to be proclaimed as being the will of the South African or affected rural local communities. Neither will any such outcomes be based upon a justifiable basis of sustainable development. The use of the term "occupiers" in this comment is based upon the same under NEMA and the EIA Rogations. AVDSEC has represented, and still does, several "occupiers" as rural individuals and communities in their objections against particular wind farms (some within draft REDZ (Spitskop) and others outside (Umsinde Emoyeni and Ishwati Emoyeni) of REDZs). Such "occupiers" generally have no access to any form of telephone or electronic communication due to their isolated rural locations and very often on account of their high level of illiteracy. Therefore this Phase 2 SEA process is entirely unavailable to most of the communities that will be severely affected by its consequences. These communities are being intentionally excluded by the CSIR and government (DEA) from participating in the SEA. In the experience of AVDSEC such "occupiers" are very interested and keen to engage in development matters that will affect them. The South Africa Constitution and NEMA itself make provision for the inclusion of such communities in decision that will affect them but such provisions are being denied under the current SEA. Also, many rural landowners similarly suffer from poor communication facilities or an inability to engage with electronic communication. Media publications are also often unavailable or outdated and are a very reliable form of notification in rural circumstances. Various claims by the SEA, such as, "*Please feel free to distribute this invitation*", and "*Comments can be submitted on the project website directly at https://redzs.csir.co.za/?page_id=625 and additional documents and datasets to be considered by the SEA team must be sent via email*", and "*If you wish to submit comments and additional documents and datasets to be considered by the SEA team, but do to have access to internet or a computer, please fax your inputs to 021 888 2693 ; or call the SEA team on 021-888-2408/2432.*", are accordingly disingenuous, intentionally misleading and meaningless in effect.		energy facility be proposed in close proximity to their location. 2. It is important to note that the SEA aims to provide areas for large scale wind and solar PV development. As such, environmental, technical and socioeconomic considerations must be analysed. All of which were done in the delineation of the first draft focus areas. The SEA team has and will continue to engage with a number of environmental organisations. 3. Through the development of a national scale policy or strategy it is not possible or

The Phase 2 SEA is being conducted using a high level electronic technology and which is even beyond the ability of some professionals who have a reasonable level of electronic facilities. It is entirely unavailable and inappropriate to the local rural communities that will be affected.

It must also be noted that it is a mistake to assume that urban-based community representatives are representative of rural communities. None of the "occupiers" previously or currently represented by AVDSEC have given their mandate to any other representative.

4. The socio-economic profile report (Appendix 2 to the SEA report) is fundamentally flawed in its incorrect assumption that municipal and town socio-economic characteristics are reflective of those of affected rural communities. It appears that this incorrect assumption is willingly being entertained by the CSIR, despite its obvious flaws, in order to expedite the SEA. The SEA fails to engage with important representative organizations such as the Food and Allied Workers Association or COSATU or more appropriate rural community organisations.

C. Failure to consider and engage private game reserves and farms honestly and consequent flawed assessment of mapping sensitivities.

5. Yet again it appears that the CSIR is unprepared to (genuinely) consider the critically important aspect of land use incompatibility. Wind farms are incompatible with ecotourism-based land uses such as game farms and reserves. There is extensive documentation in support of this as well as South African evidence.

The below extract (from page 42) is unacceptable in terms of the mapping sensitivities attributed to private reserves and game farms and indicates an ongoing willingness of the CSIR to deny the significant negative impact that wind farms have upon such land uses. The CSIR appears to allocate its ratings based upon solely biophysical threats instead of also factoring in the critically important aspects of visual impact and socio-economic impact (including resultant job loss in the affected ecotourism industry). Even the "Low sensitivity" mapping sensitivity allocation of 10-20km is entirely inappropriate and unrealistic and there now exists extensive supporting evidence from real case South Africa wind farm EIAs to refute the significant underestimate of the CSIR's ratings. As but one recent example, Bokdam Private Nature Reserve, within the Cookhouse REDZ, is situated 18km away from the nearest turbine site of the Golden Valley I approved wind farm but the negative visual impact of said wind farm upon the Nature Reserve has been assessed by a visual specialist to be significantly Highly negative and beyond mitigation in that wind farm's EIA. The below mapping sensitivities are therefore clearly at odds with (confirmed) reality in the South Africa situation and therefore need to be reassessed, in consultation with game reserve industry representatives (such as Indalo), and the mapping sensitivities must be significantly increased in order to reflect the real situation.

South African Conservation Areas Database (SACAD) - Q1,2017 and Provincial Conservation Areas	Private reserves and game farms	High sensitivity	0-5 km	Very high sensitivity	0-2.5 km
		Medium sensitivity	5-10 km	High sensitivity	2.5-5 km
		Low sensitivity	10-20 km	Medium sensitivity	5-10 km

It is pointed out that private game reserves and farms are significant employers of rural communities and that the creation (and maintenance) of jobs is a much-emphasized government policy. It is therefore important that the sensitivity of private game reserves and farms be accurately and honestly represented in order for rural employment to be protected and indeed grown. For instance, Ezulu Private Game Reserve, located with the Cookhouse REDZ, is the largest private land owner in the Eastern Cape at 29 000ha. It employs 56 fulltime employees and supports their families (an additional approximate 250 persons) who live on the reserve. It annually attracts tens of millions of rands of foreign income to South Africa through its international tourism market and which is spread through the local community via numerous "spin-off" industries such as game meat processing businesses and taxidermy industry. Its long-term and proven social and

necessary to consult individual property owners. Site consultation will be undertaken through the BA process, therefore landowners will be individually consulted should a renewable energy facility be proposed in close proximity to their location.

4. This comment has been noted. The CSIR has in no way wilfully entertained any false information.
5. The site specific BA process in the REDZs will address issues of incompatible land-use. It would be in the interests of the game farm industry to provide the location of

	economic benefits are severely jeopardized by the threat of further incentivized but ill-considered wind farm development. **The number of employees and supported persons by this single operation exponentially outnumber the (real) number of full-time employees sustained by ALL of the wind farms located within the Cookhouse REDZ!** Game- and ecotourism-orientated land uses deserve significantly more credit than is being afforded by the Phase 2 SEA and there can be no doubt that the vested interests of the RE industry, clearly favoured as such are by the CSIR and DEA, have again corrupted this SEA. There is no identification of which specific parties were responsible for determining and presented mapping sensitivities for private game reserves and farms in the SEA report. Neither are the specific determinants indentified (such as, biophysical issues, visual impacts, socio-economic impacts etc.) that have been used to inform the presented mapping sensitivities. Thus the rational for the mapping sensitivities is undeclared (we suspect it to be intentionally so). Wind farms, particularly, include massive and tall turbines and environmentally-sterilize extensive tracts of land (i.e. they have a significantly large 3-dimensional "footprint") with the requisite road networks, turbine layout, buildings, power lines and substation infrastructure, as well as the additional associated pollution such as quarries. The socio-economic and environmental benefits of such ecotourism operations are undeniable and will have to be genuinely accounted for. Given the available evidence, the mapping sensitivity distance for "High sensitivity" must be increased to at least 30km and those lower sensitivities will need to accommodate even greater distances in order to be justifiable. Further more, the SEA must include a absolute "no-go" zone for RE development within 30km (this subject to consultation with the game/ ecotourism industry) of existing private game reserves, game farms and eco-tourism operations, unless the potentially affected property (not just specific locations thereon) is <u>entirely</u> screened from the RE development, and its infrastructure, and consent of the potentially affected operation is provided. It must be noted that the SEA has made no effort to include any private game reserve/ farm organizations in order to properly inform the SEA. The same issue was repeatedly raised with the CSIR and DEA in the Phase 1 SEA but to no avail. Indalo, an organization representative of a significant number of large private game reserves in the Eastern Cape, has never been approached for input (pers. com.) despite being well known to the CSIR (through its previous comments and objections). No effort is made to address the very significant issue of <u>cumulative impacts</u> upon private game reserves, farms and ecotourism operations. Such is a fundamental factor in integrated environmental management. D. **<u>Required legal framework incomplete</u>.** 6. To the best of our knowledge, there exists no proper legal framework in terms of the National Environmental Management Act (NEMA) Section 24(5)(bA)(ii) according to which the "***laying down (of) the procedure to be followed for the preparation, evaluation, adoption and review of prescribed…strategic environmental assessments***" is necessary before an SEA process can be undertaken. The above-quoted phrase, "***to be followed***", is instructive as it gives effect to the rights of those citizens who wish to <u>follow</u> the SEA procedure according to a legislated procedure. The subject SEA does not give effect to these legal rights and the absence thereof has been used by the CSIT and DEA to drive an industry-biased and flawed process which is prejudicial against those affected citizens. In the absence of necessary legal procedures to be followed the "top-down" approach of the SEA is at odds with South African law which allows for local communities to determine their own future within the limits of existing and clearly defined laws. E. **<u>No consideration of alternatives</u>.**		game farms for inclusion in the screening tool to identify possible sensitivities. The game farmers will have the opportunity to appeal the decision issued and/or to make input at the site level process should a project be proposed in an area they will be affected in. The outcome of the SEA process was not intended to identify exclusions or "no-go" areas or to prohibit any or certain development types. contact 6. This notice deals with the adoption of the outcomes of the SEA, namely the zones identified and

	7. In terms of NEMA the proper and meaningful consideration and assessment of alternative development options (including the "no go" option) is a fundamental requirement of integrated environmental management. This SEA has failed to consider, or assess, any alternatives in terms of; - other land uses and **development types** within the identified draft focus areas, and - other alternative draft focus areas (in order that the least environmentally suitable ones may ultimately be discarded). It is stated in the "Integrated Environmental Management Information Series: Strategic Environmental Assessment (2004)" that "*The role of SEA, however, is to allow for the decision-maker to proactively determine the* ***most suitable development type*** *for a particular area,* ***before*** *development proposals are formulated.* " The subject SEA accordingly does not constitute a proper SEA and cannot give rise to sustainable development as it did not consider other **development type(s),** such as, for instance, eco-tourism. Finally, a proper comparative assessment with the "no go" options has not been factored into the SEA. Such is required to ensure that sustainable development or the "***best practical environmental option***" (as required by NEMA) is achieved. The SEA is therefore fundamentally flawed on this basis as it has not sought to identify and achieve the "***best practical environmental option***". F. **Impacts on birds (and the Endangered Cape Vulture)** 8. The Phase 1 SEA has proposed REDZs (such as the Cookhouse REDZ) wherein existing wind farms have, and continue to, kill Cape Vultures, and other Endangered species . The CSIR and DEA ignored the warnings given that Cape Vulture (and other sensitive birds) were using specific REDZ areas. It is quite feasible, and accurate to suggest then, that the Phase 1 SEA is facilitating the path to extinction of the Cape Vulture and other sensitive bird species. The Phase 2 SEA must consult with knowledgeable bird experts on the ground (not only academic specialists). Based upon its superior knowledge of vulture movements (especially in the Eastern Cape) it is essential that VULPRO be engaged in order to ensure that Cape Vultures are not further impacted by the RE industry. To the best of our knowledge that Vulpro has not been extensively consulted as claimed by the CSIR. The SEA Phase 2 provides no details on information regarding the inputs of avifaunal specialists (or any others for that matter). However, there appears to be a pre-occupation with colony and roosting sites for vultures while ignoring the critical habitat component of **foraging** range used by such birds. The aspect was tabled in an early SEA 2013 input by Mark Anderson of Birdlife SA (quote: "*Critical habitats (e.g. roost and nest sites,* ***foraging areas)*** ") but appears to have been side-lined in the preoccupation with colony and roost sites and associated buffers. The below extract (page 36) reveals that foraging habitat for Cape Vulture, and other species, is ignored. This is unacceptable.		the rules applicable to the development type within these areas. It does not attempt to adopt the SEA itself. The outcome of the SEA informs the EIA process and will be regulated as such. In the absence of regulations for SEAs, the argument cannot be made that no SEA can be undertaken. The public participation will still be conducted on a project by project basis during the BA process. The appeal process will still be applicable to individual EA applications. 7. The SEA process began with the consideration of the available

	(500m)				
VULPRO	VULPRO cape vulture colonies	Very high sensitivity	40km	High sensitivity	5km
	VULPRO cape vulture roosts	Very high sensitivity	35 km	High sensitivity	3km
	VULPRO cape vulture restaurants	Very high sensitivity	10km	High sensitivity	feature
NMMU	NMMU cape vulture roost sites	Very high sensitivity	35km	High sensitivity	3km
KZN wildlife	Bearded vulture collision risk model	Very high sensitivity	feature	High sensitivity	feature
	Critical Habitat for				

A record of Vulture sightings in the Cookhouse REDZ area by Vulpro and AVDSEC indicate clearly that the area (but probably more) covered by this particular REDZ is serving as foraging habitat for Cape Vulture and the numerous vulture kills by the wind farms in this area are obviously having a significant negative impact on this Endangered species population.

It must be pointed out that the technical and practical application of radar as mitigation for wind farms against bird collisions is unrealistic and should be abandoned. It is commonly used as an “excuse” by compromised avifaunal specialists to permit inappropriate wind farm locations.

G. <u>Conclusion</u>

The Phase 2 SEA is significantly biased in favour of the RE industry , and governments policy interests, at the expense of the general public and affected land owners and “occupiers”. The SEA and its ultimate outcomes will not be representative of the public’s views.

The mapping sensitivities for private game reserves and game farms and ecotourism operations are significantly under-stated. They do not reflect the reality as such is confirmed now by a number of wind farm EIAs in South Africa. The mapping sensitivities need to be increased significantly in meaningful consultation with relevant ecotourism and game reserve industry representatives, as well as other affected land owners (and “occupiers”).

The SEA process is fundamentally flawed on several basis including that it has not considered alternatives and that it is not guided by any controlling legislation (as required under NEMA).

The SEA does not consider the critical foraging habitat of Cape Vulture, and some other sensitive bird species, but instead relies only on roost and colony criteria.

This comment must be regarded as an objection to the Phase 2 SEA for the reasons stated herein.

Sincerely,

resource as this is the driving force for viable wind and solar PV developments. Areas which were unsuitable for development based on environmental criteria were then identified. The criteria used for this layer of areas unsuitable for development was developed in consultation with the Expert Reference Group and Project Steering Committee. There were a number of focus areas which were identified. These study areas were further refined based on consultation and environmental sensitivities.

			Please be aware that the BA process will also consider alternatives on a project by project basis. The intention of this SEA was not to look at different development types but rather to simplify the EIA process for renewable energy facilities in specific geographical areas 8. Data from Vulpro and other sources has been used in the delineation of the first draft focus areas and will continue to be sued for the duration of the mapping aspects of the SEA. An avifaunal specialist will assess the data used to determine the second

			draft focus areas.
Rhett Smart CapeNature	CapeNature would like to thank you for the opportunity to comment on the project and would like to make the following comments. Please note that our comments only pertain to the biodiversity related impacts of the project. Phase 2 of the Strategic Environmental Assessment (SEA) for Wind and Solar Photovoltaic (PV) energy in South Africa aims to identify a second set of renewable energy development zones (REDZs) to supplement the REDZs which were identified in Phase 1. The first draft focus areas were derived through mapping of environmental and technical constraints and socio-economic activity. This essentially entails a similar exercise as was undertaken for Phase 1 of the SEA under the terminology of positive and negative mapping. The environmental constraints are of primary interest to CapeNature within our mandate, however the other constraints need to be considered in terms of the primary shaping of the proposed REDZs. **First Draft Focus Areas** As a first draft, only the critical environmental constraints were included in order to provide a general identification of the key areas on a national scale, following which the intention is for more detailed delineation with a more comprehensive list of environmental constraints. The technical constraints includes the wind and solar energy resources, as well as the technical constraints to the construction of wind and solar PV energy facilities. For both environmental and technical constraints, the list of criteria can be compared with the criteria used in developing the REDZs in Phase 1 of the SEA. A list of the environmental constraints for the first draft REDZ has been provided in Table 2 of the report. In general the list shares many of the criteria which were used in Phase 1, however there are a few differences. For protected areas, it has also included provincial protected area data, as well as formal National Environmental Management: Protected Areas Act (NEM:PAA) protected areas, which is supported. The private reserves referred to are assumed to be areas which are managed and termed nature reserves but not declared under any legislation, as these would then automatically be deemed to be nature reserves under NEM:PAA (under deeming clause 12). 1. The inclusion of CBA 1 is supported, and it must be ensured that the Western Cape Biodiversity Spatial Plan (WCBSP, March 2017) is used in delineating this data. The final product is available on the SANBI BGIS website, therefore if this was the data utilized it would be the correct data and applicable for the entire province. The CBAs in the WCBSP incorporate a wide range of data in determining the most important areas for biodiversity in the province, and can hence be considered the most important layer in terms of biodiversity constraints, which would have already taken into consideration many of the other variables/criteria listed which are related to biodiversity. 2. The one major impact on biodiversity from renewable energy facilities, in particular wind energy, that cannot be inferred from the WCBSP alone is the impact on bats and birds. The list of constraints for birds includes Birdlife Important Bird Areas (IBAs) and constraints for three specific species. Cape Vultures (*Gyps coprotheres*) have been identified as the highest priority in the priority species list for birds at risk from wind energy (Ralston-Paton *et al*, 2017)1, therefore inclusion of colonies, roosts and vulture restaurants for this species is supported. It was identified as one of the species of concern in Phase 1 and there are declared Phase 1 REDZ which are of major concern for this species, although at least in the Western Cape the only colony for this species has been adequately buffered (according to data thus far). The other two species included are black harrier (*Circus maurus*) and Barlow's Lark (*Calendulauda barlowi*), which are rated as 6th and 70th on the priority list. The inclusion of the latter in particular is queried. The scoring of the priority species takes a number of criteria into consideration including factors which increase collision risk and the conservation status of the species. Further justification is required for the criteria used for identifying the critical constraints for birds. 3. The environmental constraints are mapped in figures 4 and 5 for wind and solar PV respectively. According to the report, the only difference between the wind and solar PV constraints maps are buffers applied to bird and bat features. It should however be noted that Table 2 does not indicate the buffers that are applied to each feature, only in the case of the wetlands and major rivers. The constraints are assumed to be the areas mapped in darker shades on the maps. The report implies however that for the first draft REDZ, only two categories of environmental constraints are applied to the REDZ, namely a composite of all the features		1. The provincial CBA data was used in the environmental constraints mapping 2. A bird specialist wil be appointed to conduct a high level scoping exercise to determine sensitive bird areas in the proposed focus areas. 3. Further details of environmental constraints are found in the accompanying report released with the maps. 4. Noted. 5. The environmental and technical consideration were not weight but considered to be of equal importance. 6. This comment has been noted and the latest planning

	which are selected and then excluded from the REDZ and areas not selected. The maps show various shadings however, for example for the Richtersveld and Cederberg show a lighter shading. Further clarity is therefore required in this regard. 4. One of the main differences between Phase 2 and Phase 1 is the consideration of the socio-economic factors. In Phase 1, only two criteria were used in for socio-economic factors, namely priority industrial areas (4 identified) and areas with highest need for social investment. Phase 2 has used socio-economic index mapping which incorporates many other criteria, with municipalities across the country mapped according to a socio-economic index. Although not within CapeNature's core function, this is likely to be one of the factors which has influenced the difference in the selection of the Phase 2 REDZ compared to Phase 1, with an increased focus on economic hubs such as major cities. 5. The steps undertaken in defining the REDZ need to be considered in evaluating the areas identified. The first step which incorporates the energy resource and 35 km from a transmission substation and 10 km from a main road are likely to be the most prominent determining factors in the location of the REDZ. 6. The constraint of the substations is queried. The data used is for all substations which are planned to be completed by 2022 according to the footnote for Table 3. However, the REDZ are proposed for a longer timeframe than this. In terms of development driving factors, the presence of renewable energy facilities should be a determining factor for the location of electricity transmission infrastructure more so than the presence of transmission infrastructure for the presence of renewable energy facilities. The electricity grid Infrastructure SEA is aimed at addressing this, and therefore further motivation should be provided regarding the limited timeframes for the electricity substation constraint. 7. The other technical constraints were then applied. In terms of the socio-economic index, the rationale behind the selection of municipalities of the four categories of very high intensity and growing, high intensity and growing, low intensity and growing and low intensity and declining should be explained. 8. The final step (Step 6) in the process is the application of the environmental constraints, which includes the factors relevant to CapeNature's mandate. All areas defined as of critical importance in terms of the environmental criteria are excluded. In this regard the queries regarding Figures 4 and 5 indicating environmental constraints are of relevance, in which there should only be two categories of mapping. The first draft focus areas are derived purely from overlaying the listed mapping constraints and have not included a process of rationalizing the results. The overlay of all the constraints has resulted in a highly fragmented array of areas, which are however broadly clustered into primary areas. Based on interpretation of the results, it would appear that two of the major driving factors are the proximity to transmission substations and areas of high economic activity, which are both discussed above. The above factors has resulted in a number of the selected areas occurring within the open spaces of urban areas, with the most prominent in the Western Cape being Cape Town. These are unlikely to be viable areas for large scale wind or solar PV energy facilities. It is assumed that an approach will be taken whereby the clusters of polygons will be amalgamated and a minimum size permitted for a polygon. It is noted that the Phase 1 REDZ consisted of large continuous areas which differs from the current REDZ. However, in the final product, within those large continuous areas there were areas of very high, high, medium and low sensitivity according to the various constraints criteria. The areas of very high sensitivity are not acceptable for development and therefore in essence exclusions from the REDZ. The same approach can be used here, provided that the description of the REDZ is clearly defined including the sensitivities and no-go areas within the REDZ. 9. The incentives offered for wind and solar PV facilities within the REDZ include a reduced NEMA process and are generally only applicable to large scale facilities, which further motivates for larger continuous areas to be considered for the REDZ, and is unlikely to be appropriate for urban areas and the immediate surrounding area. However, renewable energy should be encouraged within urban areas, and in general can be considered to have a much lower impact on biodiversity than large scale facilities in rural areas. Incentives should be investigated for furthering renewable energy within urban areas on brownfields sites, for which the focus will be more towards self-sufficiency and less reliance on external service providers. While this may be beyond the scope of this SEA, the potential for investigation of incentives should be taken forward, particularly since there is no incentive for electricity service providers (e.g. municipalities, Eskom) to reduce the demand. 10. Based on a general scan of the polygons, it appears that the WCBSP has been accurately applied, with all CBAs (equivalent to CBA 1) excluded (but not CBA: Degraded – which would be equivalent to CBA 2).However, the polygons identified for the REDZ are not easily reconcilable with the mapping of the list of constraints provided in many cases, particularly in areas of agricultural land use,		from Eskom was used in the SEA. 7. This rationale was captured in the report released with the maps. 8. Correct. An amalgamation of areas with dense number of pixels will be sued to determine focus areas for assessment. 9. This comment is noted and will be considered in the update of the focus areas. 10. A detailed list of constraints used was included in the report that accompanies the report. Further assessment by specialist will be conducted and will identify additional high sensitivity areas.

	although these constraints do not appear to be related to biodiversity. There is overlap in some cases with REDZ from Phase 1 which presumably will be removed From a biodiversity perspective, areas of specific concern include, the Dassenberg Coastal Catchment Partnership where a network of nature reserves and conservation areas is being established between Atlantis, Riverlands and the coastline. In this case, coastal dune systems should be included as another exclusion layer for the refinement of the REDZ. Other areas of concern include the Saldanha Peninsula and mountainous areas around the Boland and Touws River which are likely to be vulnerable to raptor collisions. However, the REDZ can be refined following the undertaking of the specialist studies which are likely to eliminate a large proportion of the areas currently selected. As such there may be a need to redefine the technical and socio-economic constraints, should the REDZ be significantly reduced following this process. 11. Another aspect that must be explored further is cumulative impacts, taking into consideration existing facilities and applications, as well as the Phase 1 REDZ **Second Draft Focus Areas** 1. Appendix 1 of the report provides a list of constraints for the second phase of the mapping of the REDZ. This list is more comprehensive than the list for the first draft of the REDZ, and includes all of the criteria used for Phase 1 with additional criteria. A request is provided that these criteria are reviewed and comment provided regarding the proposed sensitivity ratings for each of the criteria. 2. In general CapeNature supports the proposed sensitivity ratings, however we do have a few suggested amendments. Under conservation areas, we recommend that the medium sensitivity rating for Biosphere Reserves should apply to the buffer zone. The transition zone consists of areas which are primarily transformed with a range of land uses including urban uses. The core would already be formally conserved and hence be designated as very high sensitivity under the protected area criteria. 3. We recommend that stewardship sites should be added under conservation areas, which would include those which are not declared nature reserves (top tier of stewardship) but are lower tier agreements, namely Biodiversity Agreement and Biodiversity Partnership. The assumption is therefore made that very high sensitivity for nature reserves includes all nature reserves under NEM:PAA, namely provincial, local and private (stewardship contract) nature reserves. 4. The one aspect where knowledge has increased significantly since the inception of the Phase 1 SEA is the potential impacts on birds and bats from wind energy facilities and increasingly solar PV facilities. Whereas previously the constraints provided were purely speculative based on international experience, there is now both pre-construction and post-construction monitoring data which is available to substantiate the proposed constraints criteria. Therefore there is the opportunity to refine these criteria from Phase 1. 5. One of the criteria for birds is protected areas in Important Bird Areas (IBAs). Many IBAs do not contain many protected areas, such as the Overberg Wheatbelt IBA. Protected areas would in any case be classified as very high sensitivity under the protected area category, therefore the IBA needs to be considered in its entirety. Ideally all IBAs should be classified as high sensitivity, with consideration for very high sensitivity for certain IBAs, as has been included for the Transkei vulture IBA. The category of IBA exclusion should be clarified. Buffers have been provided for some of the bird features, but not all. Taking into consideration the Western Cape only, buffers must be provided from priority colonies (this does not specify the relevant species and needs more clarification) and Potberg vulture colony (40 km for wind, 4 km for solar PV – based on Phase 1). It is assumed that the The Western Cape Nature Conservation Board trading as CapeNature Board Members: Ms Merle McOmbring-Hodges (Chairperson), Dr Colin Johnson (Vice Chairperson), Mr Mervyn Burton, Prof Denver Hendricks, Dr Bruce McKenzie, Adv Mandla Mdludlu, Mr Danie Nel, Prof Aubrey Redlinghuis, Mr Paul Slack **criterion listed meant to be** Black Harrier nest sites and not roost sites, as this is not a roosting species. Further specialist input is required regarding the buffers for Black Harrier and Verreaux Eagle nest sites. 6. In terms of the data used, it must be ensured that reference is made to the latest South African Red List for threatened species dated 2015. The Birdlife priority species (Ralston-Paton *et al*, 2017) should also be used in assessing priority species for determining constraints. Species within the top twenty priority list from the Western Cape include Martial Eagle, Great White Pelican, Blue Crane, Secretarybird and Cape Cormorant, which have not been included in the constraints list. 7. The constraints listed for bats appear to be appropriate and is supported. CapeNature would need to engage further with this data in order to provide more comment. The data relates mainly to presence of colonies and colony size as well as the threat status.		11. Specialist assessment will deal with the issue of cumulative impacts as best possible for this national scale study. Second draft focus areas 1. Comments could be submitted during this commenting period on criteria used. 2. This has been noted and will be considered in the updated focus areas. 3. These have been added. 5. IBAs have been considered in the delineation of focus areas. Further, high level specialist assessment will map all high sensitivity areas and buffers in focus areas.

	CapeNature reserves the right to revise initial comments and request further information based on any additional information that may be received. Yours sincerely		6. These have been used in the environmental constraints data in the SEA 7. Noted. Further engagement with the bat fraternity will occur.
Marshall Mabin Mainstream	Please find below South Africa Mainstream Renewable Power Developments (Pty) Ltd ("Mainstream") position statement with regards to the Draft Focus Areas for Phase II of the national Department of Environmental Affairs ("DEA") Wind and Solar Strategic Environmental Affairs ("SEA") identified and released for stakeholder comment by the Council for Scientific and Industrial Affairs ("CSIR") on the 21 August 2017. Mainstream has more than 3500 MW of wind and solar energy in development located across five South African provinces. Over the course of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), Mainstream has submitted 22 bids amounting to 2200 MWs and been successfully awarded 848MWs, with the results of the Expedited Round of REIPPPP still pending. Mainstream has 318 MW in operation. In addition, Mainstream is expecting an additional 280 MW to reach Commercial Operation Date before the end of 2017. Mainstream is an actively involved member of the South African Wind Energy Association (SAWEA), with representation on the SAWEA board and a number SAWEA Working Groups. Mainstream has a long term vision in South Africa and wants to ensure South Africa builds wind and solar farms in the best locations to maximize benefits, minimise potential environmental impacts and ensure continuing renewable energy affordability. Mainstream would like to thank the DEA and CSIR for the opportunity to comment on the draft release of the Phase II SEA Focus Areas. Mainstream recognises there may be potential positive impacts for establishing REDZ. Despite these advantages, Mainstream has several concerns with regards to the SEA process and establishment of Renewable Energy Development Zones (REDZ). We are of the opinion these concerns may result in disadvantages which outweigh the potential benefits. Mainstream appreciates that the objective of this commenting process is to provide inputs to the delineation of the Draft Focus Areas. As such, the emphasis of this response will be on these aspects. **1. CSIR Energy Centre 2016 Aggregation Study** ● The CSIR Aggregation Study is an improvement on the approach used to inform the identification of Wind Focus Area in Phase I of the SEA. However, a fundamental flaw in utilising the results of this study to inform the identification of future strategic areas for mass roll out of renewable energy is that the results are modelled using turbines technology that are already outdated. The implementation of the Phase II Focus Area is likely to only occur in >3 years from now (assuming timeframes of previous study), by which stage the turbines utilised to inform this study will already be redundant. For the results of the study to remain relevant in the future, the study must model scenarios assuming the use of future technology. ● The thresholds for identifying suitable wind areas based on resource with average wind speeds >5.5m/s is too low. Although lower wind speed sites will become more feasible in the future when matched with the correct technology, the wind resource characterising the majority of the Phase II Focus Areas is insufficient for the development of a successful REIPPPP project. As long as the current REIPPPP procurement rules favour the development of projects with the lowest tariff at the point of connection, areas with the best wind resource will always been most critical for developers when selecting a suitable site for development. As such, developers will not be encouraged to develop in these		1. The CSIR has received a number of comments regarding the use of the capacity factor data. The SEA team has decided to use the recently released WASA wind data, which is available for the entire country. Wind speeds above 6m/s have been considered and the wind focus areas thus appropriately updated 2. As this is a national scale study, known area of bird and

	areas unless legislated to do so or encouraged to through a change in the REIPPPP procurement process. Given the glut of suitable wind resource in South Africa, it is strongly encouraged that only sites >6 m/s are selected for development. ● Mainstream notes that little or no data and experience, gathered by the multibillion Rand renewable energy industry, has been used to determine the latest draft Focus Areas, and that this is a missed opportunity. From Mainstream's experience, renewable energy development in South Africa is currently quite dynamic and characterised by constant change in requirements and much uncertainty. This ever-changing dynamic process is something experienced in any new industry in any country. Mainstream is convinced our country does not have enough accurate data and experience available across the SEA focus areas at this moment in time to establish viable REDZ which could achieve the potential benefits envisioned by its proponents. As one of the longest established developers of renewable energy in South Africa with excellent public and proprietary information at our disposal, we still consider it a risk to be fixed on determining the outcomes and success of project locations until actual onsite data and investigations has been measured and collected. Development is by nature high risk because of the many uncertainties. ● Although the Wind Aggregation Study concludes no significant difference between the WASA modelled measurement results vs. the on-site measurement results obtained through the 10 WASA met masts, has concerns about the accuracy of the WASA map. Mainstream have commissioned two mesoscale models, one uses WRF and the second uses a proprietary model. Both models have been validated against the Mainstream's extensive network of meteorological masts. Four masts owned by Mainstream have been used as a simple demonstration of the WASA wind map error, shown in the figure below. The masts used in the comparison below have been quality controlled and long term adjusted as required by our financiers and the REIPPPP process. The average wind speed error for these four masts is over 20%. This equates to around 30% in energy resource. Furthermore, although some validation was undertaken by the study using the WASA met masts, given that only 10 met masts are installed across the country (limited to five provinces only), this is not considered sufficient enough for the purposes of validating the WASA resource data at a national scale. ● Given the high uncertainty with the WASA map, Mainstream proposes extending the validation of the wind map. All sites submitted into the four REIPPP rounds had to have high quality measurements and estimates of long term mean wind speeds as minimum requirement, thus the DOE has access to high quality 3rd party approved wind data for several projects across the country. The REIPPPP independent technical reviewer should assemble the wind speeds at each measurement point and perform an independent validation against that WASA map. This review should be independent of DTU and confidential. It will provide an independent review of performance and allow informed decisions to be made on the suitability of the WASA map for defining future strategy. In addition to reviewing the wind data submitted in the REIPPP process Mainstream suggests that the DEA commission additional high quality measurements in areas included in the proposed REDZ areas before it gets gazetted. South Africa needs to be certain of the quality of resource in the proposed REDZ. Also, DEA should embark on a programme to measure high quality wind data in strategic areas outside proposed REDZ where independent analysis of the data submitted through the REIPPP process do suggest potential. **2. Birds and Bats** ● Experience has shown that the sensitivity of areas can only be determined by detailed studies. There are examples of projects that have been abandoned or amended significantly due to bird or bat sensitivity that was not picked up by during the scoping studies. This confirms that the existing desktop/mapping data for birds and bats in South Africa is not sufficient to determine area where development can or cannot be permitted. Mainstream strongly disagrees with excluding the development of areas on the basis of prescribed radial parameters informed often informed desktop/mapping data. For example, the classification of certain areas as very high sensitivity on the basis of vegetation type alone (forests and cropland), and therefore precluding these areas as future REDZs is inductive reasoning. Mainstream is a strong advocate of using evidence gathering through 12 months of bird or bat monitoring to inform a decision on development in an area. Developing in high risk birds and bat areas is not in the interests of the wind industry and therefore supports the decision to not develop in such areas. However, the decision needs to be informed by recent evidence gathering in the form of 12 months of monitoring. The decision on where to not to develop (i.e. the delineation of future REDZs) cannot be informed by desktop assessment alone. 12 months of bird monitoring is an important contributor to the understanding of birds and bats in the context of wind farming and useful to the scientific community. Therefore, it is a surprise that areas are being precluded from development at a desk top level before the opportunity to investigate these areas more thoroughly through 12 months of bird monitoring has been undertaken.		bat sensitivity must be taken into consideration . The SEA does not negate the need for on the ground impact assessment. The buffers used are based on the latest and widely accepted bird pre and post construction monitoring guidelines. This was the best available information at the time of the SEA. 12 month monitoring repots for existing or proposed wind farms, data in not publically available thus and is site specific thus was not available for use in the SEA. 3. The DEA has made their position clear that all areas

	● Mainstream does not support the 40km exclusion zone (very high sensitivity) adopted for Cape Vulture colonies and roost sites. This parameter is in direct conflict with the Cape Vulture and Wind Farm Guidelines produced by Sam Rolston-Paton and Morgan Pfeiffer of March 2017, which states "a buffer of between 14 km (roosts) and 16 km (breeding colonies) should be considered to be of very high sensitivity and the development of wind farms within these buffers is strongly discouraged". As such, Mainstream recommends that the buffering of the SEA for Cape Vultures be adapted to this recommended distance. Other buffers which seem exaggerated considering no official guidelines are in place for these species include the Sacred Ibis and Black Harrier. The occurrence of species and development in the context of these species should not be informed by desktop results but rather 12 months of bird monitoring. **Protection of development rights** ● Mainstream's concern is that current and future projects falling outside the proposed REDZ areas will not be assessed on merit and will simply be rejected because it is outside a predetermined area. Depending on the complexity and location of a project there are between 38 and up to 50 permits required for a project to achieve financial close. These permits and/or consents are issued by all three levels of government and the private sector. There is a risk, and this has already happened, that officials may just take the easy route to make their decisions by using a REDZ map and not make decisions based on merit. ● Mainstream's concern is that projects being bid to the current or any other future government renewable energy procurement processes will be disadvantaged. This could mean that great value for money, environmentally acceptable and affordable projects which has passed all criteria based on merit will not be successful. This will be to the detriment of the industry and to the country. DEA will need to guarantee developers that the process is not in conflict with the REIPPPP objectives and processes, and has full support from the National Treasury and DoE, and will not place a project outside REDZ areas in a less favourable position with respect to being considered in the procurement process. ● Mainstream understands from comments made by DEA at the recent REDZ Phase II Expert Reference Group Meeting, held on 25 July 2017, that a commitment has been made by DEA to include a statement in the gazette clarifying that development outside of REDZs must be considered on merit and shall not be disadvantaged based on its position outside of a REDZ. Mainstream supports the inclusion of this statement and emphasises that the statement must be included the gazette drafted for subsequent REDZs identified in the Phase II SEA process. ● Even if the DEA does ensure this statement is captured in the Government Gazette, Mainstream is still of the opinion that strong, environmental sound and great value for money projects are at risk of being disadvantaged outside REDZ areas. **Too Many REDZs** ● The creation of additional REDZ areas without the exclusion of any of the existing REDZs undervalues the objective of the REDZs concept i.e. sustainable role out of renewable energy. This is based on the fact that already 80 000 km2 of REDZ areas have been gazetted. ● Mainstream suggests reconsidering the location of existing REDZs which have been proven through four rounds of REIPPPP to be undesirable areas for development. Mainstream is of the opinion that the Overberg, Springbok and Queenstown REDZs should be reconsidered as only three Preferred Bidders have been selected in these areas, one in each area. This would create opportunity for new and better positioned REDZs to be identified. ● One of the primary objectives of the REDZs is to identify areas where the roll of Transmission Grid in the support of the renewable energy industry should be prioritised. With eight REDZs already gazetted and additional REDZs to be identified on the back of the Phase II process, it will be very difficult for Eskom to unlock all of these areas and prioritise accordingly. It also creates an impression amongst developers that there is adequate alignment between Eskom and other governments departments of where development should be focussed.		will be assessed based on merit. 4. This has been noted and the approach has been updated in the phase 2 focus areas. Consideration of Phase 1 REDZs falls outside the scope of this SEA. 5. This has been noted and updated WASA data has been used for the updated focus areas. This changes the location of focus areas and addresses this comment. 6. This comment has been noted and the socio-economic criteria has been removed from the consideration of focus areas.

	Northern Cape REDZs ● Currently four REDZs are positioned (or partially positioned) in the Northern Cape yet only three Preferred Bidders out of a possible 11 (27%) Preferred Bidders selected over the four rounds of REIPPPP in the Northern Cape are located in REDZs. Two of these Preferred Bidders are located in the Sutherland REDZs on the boundary of the Western Cape. This means only One Preferred Bidders is located in a REDZ in the central to northern part of the Northern Cape, despite this area offering some of the best wind resource in the country. The position of REDZs and proposed Focus Areas in the Northern Cape for the purposes of wind development are significantly more inaccurate in terms of REIPPPP success when compared with other provinces. For example, six out of seven (86%) wind Preferred Bidder projects in the Western Cape are located in existing REDZs or proposed Focus Areas. In addition, 10 out of 16 (68%) preferred bidder projects in the Eastern Cape are located in existing REDZs or proposed Focus Areas. The recent decision by DEA to exclude streamlined wind development in the Kimberley, Upington and Vryburg REDZs, further disadvantages wind development in the Northern Cape in the context of REDZs. Therefore, it is critical, that the Phase II process gets the positioning of wind REDZs in the Northern Cape right. Unfortunately, the position of the Focus Areas in the Northern Cape are equally inaccurate, with no Preferred Bidders located in or adjacent to the proposed Focus Areas. The identification of a potential Wind Focus Area nearby to the Sishen area (Grid reference M14- O14) in the Northern Cape is of concern to Mainstream as this area is characterised by low wind resource when compared with other areas in the Province. Further illustrating this point is the fact that no EAs for wind technology have been approved in a 20km radius of the Sishen Focus Area. Mainstream suspects that many of the better wind resource areas have been omitted from the Focus Area delineation process in the Northern Cape based on the results of the socio - economic study, which is discussed below. **Socio Economic Study** ● The socio economic study is comprehensive and well developed however, it has a very divisive impact on the identification of potential Focus Areas. The underlying assumption of the Socio Economic study is that only municipalities and towns which exhibit high population growth and economic activity should be considered for potential future REDZs. This assumption strongly favours metropolitan areas and other existing economic centres, excluding almost all other municipalities' throughout the country. ● Although Mainstream agrees with the basic premise that high population areas/ growing economic areas also have high levels of poverty, youth and dependency, the study fails to acknowledge that poverty exists throughout the country, regardless of population size, and these areas are therefore disadvantaged on this basis. ● The basic premise of the socio economic elimination criteria assume that population growth and existing economic activity are pre-requisites for REDZs. This assumption ignores the fact that the location of other industries are selected on the basis of resource first e.g. mining, after which socio-economic development in these areas follows. The identification of the Kathu/ Sishen area as a potential Focus Area highlights this point given the strong mining presence in the area. Therefore, REDZs should be seen as potential opportunity to stimulate socio economic development in areas characterised by declining populations i.e. counteract rural depopulation and decentralise economic activity in South Africa. ● Mainstream has seen first-hand the positive impact that development has brought to areas considered unsuitable for future REDZs based on the elimination criteria proposed in the socio economic study. ● The socio economic study is based on census data from 2001 to 2011 and is therefore very outdated for informing decision making on this basis. ● Mainstream therefore believes that Socio Economic study has an excessively strong command in the positioning of future REDZs. Municipalities falling into categories 3, 4 and 5 are immediately excluded i.e. given the same constraint weighting as National Parks, which is extremely contentious, especially considering that the methodology document made available for review explicitly states that "it should be		

	noted that these Classes are **not unsuitable** for development of large scale wind and solar development but rather that detailed and fine scale planning tolls are required to guide development within these areas". ● Mainstream strongly advises that the criteria for eliminating municipalities on the basis of socio economic activity needs to be urgently revisited. Mainstream would like to thank the DEA and CSIR for providing Mainstream with the opportunity to comment on the Draft Focus Areas. Please feel welcome to contact the undersigned should you have any queries regarding the information contained within this letter.		
Samantha Ralston-Paton BirdLife	Dear Abulele **Re: Comment on the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment** Thank you for the opportunity to comment on the delineation of the first draft focus areas for Phase 2 of the Wind and Solar (PV) Strategic Environmental Assessment (SEA). We would like to thank you for taking stakeholders comments and concerns into consideration following the first phase of the SEA (BirdLife remains very concerned about some of the gazetted Renewable Energy Development Zones (REDZ). The new approach to identifying focus areas/REDZ does appear to be more balanced and more likely to identify areas where the risks to the environment can be minimised whilst still meeting targets for renewable energy generation. However, it the limitations of the bird layers used thus far must be acknowledged. One of the challenges is that relevant data was not available, or was not available at the required scale or certainty to input into as layers of environmental features of critical importance. We therefore support the proposed iterative approach to assessing focus areas. However, we are concerned with the proposed reliance on existing data and expert consultation (surveys) to assess the focus areas during the next stages of this process, particularly if the intention is to fast-track environmental approvals within REDZ. BirdLife South Africa is of the firm opinion that well-timed and well-structured site visits too many of the focus areas by appropriately qualified avifaunal specialists would be of enormous benefit. Negative impacts of renewable energy facilities can be avoided or minimised though the considered location of infrastructure. This approach to mitigation should take place at different scales, starting with broad-scale location of the facility within a region, down to the location and layout of the facility at a landscape scale. The latter phase of mitigation often requires identification of features that have not been previously mapped (e.g. breeding and foraging areas, potential bird movement corridors, and/or habitat that may host threatened species), yet avoidance of these features could have significant implications for the nature and scale of development. It should be possible to identify many of these (potential) features though a site visit (akin to a site screening visit proposed by BirdLife South Africa and EWT's Best Practice Guidelines). This would facilitate the identification of high and importantly also low risk areas with far more certainly than is possible with the data currently available, and help minimise reliance on the precautionary principle. We would like to reiterate our view that strategic environmental assessment is a potentially important and valuable tool (if correctly done). However, SEA should complement EIA processes, not replace the need for rigorous assessment. We support and strongly encourage that areas where natural habitat has already been lost or severely degraded (e.g. as per 2014 land cover data), be prioritised for development. The development of renewable energy on derelict / abandoned mines is also strongly encouraged. We refer you to a report by Promethium (2016) - http://promethium.co.za/wpcontent/uploads/2016/03/Research-Report-Community-based-RE-project.pdf Below are BirdLife South Africa comments and recommendations on some of the draft focus areas. We have drawn on a number of information sources, including South African Bird Atlas Project, the Important Bird and Biodiversity Area directory (www.birdlife.org.za) and expert opinion. Please note that this is not an exhaustive list as we understand that all areas will be subject to more detailed assessment by appointed specialist (s). **Wind** The draft focus area includes a number of areas where wind energy is likely to pose a significant risk to birds. Of particular concern is the proximity to the Swartkops Estuary-Redhouse and Chatty Salt Pans Important Bird and Biodiversity Area (IBA). (Note that the name of IBAs has changed from Important Bird Area, to Important Bird and Biodiversity Area). This estuary regularly holds a large number of	It is likely that the boundaries of the focus area will require Significant amendment. This should be based on a detailed specialist assessment. The estuary will require buffering and any potential movement corridors (e.g. along coast, to and from estuary and islands) must be identified and avoided. A conservation plan has been published for the for the Kouga area for the Greater Kromme Stewardship collective (contact Wentzel Coetzer, stewardship officer and Chris van Rooyen bird	The boundaries of the focus area have changed based on comments received and new WASA data. High level specialist assessments will be conducted in focus areas.

	Palearctic migrants and threatened species. Birds moving to and from this area may at risk of collisions. There is a locally significant breeding population of Cape Cormorant Phalacrocorax capensis (Endangered) at St Croix Island. Wind farms in the area, particularly in the vicinity of Jefferey's Bay, Humansdorp, may also present significant risk to Black Harrier Circus maurus (Endangered). Harriers roost communally in the area and. Ecological niche modelling by the African Raptors Database (2017) suggests a high likelihood Black Harrier occurring in much of the area. Black Harrier collisions have already been recorded at wind farms. Impacts on other threatened species (e.g. Endangered Martial Eagle Polemaetus bellicosus, Vulnerable Denham's Bustard Neotis denhami, Vulnerable White-bellied Korhaan Eupodotis senegalensis) also likely arise from interactions with turbines and powerlines. A large number of wind farms in the area have already been approved and there is therefore a risk of cumulative negative impacts.	specialist for the conservation plan). Also consult local conservation group Kromme Trust and Black Harrier expert, Dr. Rob Simmons.	
	There are no obvious red-flags to development here, but there are Lesser Kestrel (Falco naumanni) and Amur Falcon (Falco amurensis) roosts within the town of site Bloemfontein. These migratory species forage in large flocks and are regularly recorded as turbine fatalities. There are a number of other species that may be affected by turbines and associated infrastructure including Secretarybird Sagittarius serpentarius (Vulnerable) Ludwig's Bustard Neotis ludwigii (Endangered), Martial Eagle (Endangered), Lesser and Greater Flamingo. This draft focus areas lies north of Richards Bay Estuary, with Mzingazi and Nseleni Rivers nearby. Species vulnerable to the impacts of wind energy and associated infrastructure recorded in the area include Lappetfaced Vulture Torgos tracheliotos (Endangered), Grey Crowned Crane Balearica regulorum (Endangered), Southern Ground Hornbill Bucorvus leadbeateri (Endangered) and Pinkbacked Pelican Pelecanus rufescens (Vulnerable) Focus areas lie north of the Soutpansberg IBA, an important area for Cape Vulture Gyps coprotheresare (Endangered). Vultures are likely to be (at least) an occasional visitor to the draft focus area. Both wind turbines and associated infrastructure might present a risk. The draft focus area may also fall within Biosphere Reserve. This area overlaps with Devon Grasslands IBA, which is important for a number of threatened species, including large numbers of Blue Crane Anthropoides paradiseus, Secreatrybird, Blue Korhaan, Blue Crane and possibly Wattle Crane. Collisions with wind turbines and associated infrastructure are likely.	A site visit by a suitable qualified specialist would help identify areas of high sensitivity that should be avoided. Options to mitigate impacts on migratory species (e.g. layout, or curtailment) should be carefully assessed.	Site visits do not form part of the scope of the national scale SEA. Site visits and bird monitoring will occur at the impact assessment stage of a project within a REDZ.
	This area overlaps with Amersfoort- Bethal-Carolina District IBA. This IBA was understood to contain a the core proportion of the global population of Botha's Lark Spizocorys fringillaris (Endangered), although it is not clear if this is still the case as much of the habitat within the IBA has been lost. Their preferred habitat for Botha's Lark is short, dense, natural grassland found on plateaus and upper hill slopes. Botha's Lark has been recorded in the area, but in reduced numbers. Ecological niche modelling (BirdLIfe South Africa) for Rudd's Lark has also suggested the species may be present in a few isolated plateaus. Other species potentially affected include Denham's Bustard Neotis denhami, White-bellied Korhaan Eupodotis senegalensis, Blue Korhaan E. caerulescens, African Grass Owl Tyto capensis, Buff-streaked Chat Campicoloides bifasciata, Southern Bald Ibis Geronticus calvus, Black-winged Pratincole Glareola nordmanni, Greycrowned crane and Secretarybird and Yellow-breasted Pipit. Area has been had limited atlasing, but SABAP reporting rates suggest that Lappet-faced Vulture (Endangered), and Cape Vulture (Endangered) are likely to be occasional visitors.	Consider excluding this focus area. Wind energy is likely to present a significant risk to birds in the area. Rigorous specialist assessment essential before any development should be	This area has been excluded in the updated focus areas.

	There are no particular red flags to development, but the area has been poorly atlassed and would benefit from a site survey.	considered and the likelihood of a positive outcome is slim.	
	Possible interactions with Martial Eagle, Verreauxs Eagle, White-Backed Vulture, Secretarybird, Ludwig's Bustard and Kori Bustard. Large-scale development of wind energy within most of these draft focus areas is likely to present a significant threat to birds. The draft focus area borders the Berg River Estuary IBA, an area that is important for large number of waterbirds and raptors including Great White Pelican, Flamingo, Fish Eagle, Osprey, African Marsh Harrier and Endangered Black Harrier. Key biodiversity in the area, including important floodplain habitat, extend beyond the IBA boundary. Waterfowl, pelican and flamingo make use of this floodplain and there is a large heronry in the upper reaches of the estuary. There are a number of (known and suspected) bird movement corridors (e.g. between Berg River estuary mouth and the coastline, between Langabaan Lagoon and estuary, along coastline and from the floodplain to open pans in surrounding area). The area also falls within the core breeding area of the Endangered Black Harrier; Dr Rob Simmons has recommended largescale wind farm development be avoided in this area. The natural habitat is already severely fragmented and further loss and fragmentation is a further concern, as is the risk of cumulative impacts from existing approved wind farm developments and associated infrastructure. Impacts on Black Harrier possibly the biggest concern, but may be possible to avoid key areas subject to specialist assessment. Other species vulnerable to impacts include Martial Eagle, Blue Crane, Southern Black Korhaan and more common raptors (e.g. Jackal Buzzard, Yellow-billed Kite etc).	Consult existing tracking data on vulture movements (VulPro and Cape Vulture Task Force) before deciding how to proceed. Also consult Biosphere Reserve to discuss commutability of development with the reserve.	Vulture data from NMU and Vulpro has been considered in the assessment.
	Proximity to coastal corridor and False Bay Park IBA a concern. The focus areas also appear to include wetlands and rivers? The risk of collisions with Verreaux's Eagle is likely the biggest challenge in this area. **<u>Solar PV</u>** The draft focus area overlaps with the Rooiberge-Riemland IBA. The primary concern is the potential impact of powerlines on threatened species including Southern Bald Ibis, Blue Crane, Grey Crowned Crane, Blue Korhaan, Cape Vulture and Bearded Vulture. There are also a number of known Southern Bald Ibis colonies within and surrounding the IBA. This focus area borders and overlaps with Suikerbosrand IBA. A protected area and important for African Grass Owl Tyto capensis (Vulnerable) and Secretarybird.	A site visit would be assist in identifying suitable habitat for priority species that must be avoided. Consult EWT Crane working group.	Site visits do not form part of the scope of the national scale SEA. Site visits and bird monitoring will occur at the impact assessment stage of a project within a REDZ.
	The draft focus area overlaps with large parts of the Northern Turf Thornveld regional IBA. This IBA represents the core of the remaining population of Yellowthroated Sandgrouse Pterocles gutturalis (Near Threatened) in South African. Yellow-throated Sandgrouse inhabit short, open grasslands, fallow fields and recently burnt veld, especially on black clay soils near water. This species is adapted to foraging in fallow field and might tolerate solar energy development, provided feeding areas are avoided. Other important birds in the IBA that may be affected by associated infrastructure Secretarybird and Kori Bustard. This focus areas overlaps with part of the Wolkberg Forest Belt IBA, an important area for forest species and species that inhabit the forest margins. The area in the IBA affected by the focus area is already quite transformed and PV development may therefore be acceptable subject to further specialist assessment.	It is recommended that focus areas within Y4 be excluded from further consideration. There may be some scope for development	This area has been removed from the updated focus areas.

	These draft focus areas overlap with the Steenkampsberg IBA - recently declared a protected natural environment. This IBA is important for a number of threatened species vulnerable to habitat alteration and/or collisions with powerlines including, but not limited to, the critically endangered White-winged Flufftail Sarothrura ayresi, Vulnerable Striped Flufftail Sarothrura affinis, Wattled Crane Bugeranus carunculatus, Blue Crane Anthropoides paradiseus, Southern Bald Ibis Geronticus calvus, Rudd's Lark Heteromirafra ruddi, Buff-streaked Chat Campicoloides bifasciatus and Yellow-breasted Pipit Hemimacronyx chloris. Although the focus area overlaps with a small area of the IBA, the proximity to the Greater Lakenvlei Protected Natural Environment and the Middelpunt wetland is a potential concern. While may be possible to avoid impacting important habitat and and possibly ecological functioning with careful location and management, Whitewinged Flufftails have been recorded as victims of powerline collisions and it is unclear if these impacts can be mitigated. It is also unclear if the “lake-effect” might also present a risk to this species. This focus area overlaps with the Amersfoort-Bethal-Carolina District Global IBA. See discussion above for wind energy. This area overlaps with the Grassland IBA. This is top priority IBA and will possibly become to be one the most important IUCN Key Biodiversity Areas in South Africa. The grasslands to the south of the current IBA are also important biodiversity features and there are plans to declare much of the area a protected area. The IBA includes many perennial rivers and wetlands and impacts on ecosystem services and ecological function is a concern. Threatened IBA triggers species that may be impacted by habitat alteration as well as powerline collisions and electrocutions include Southern Bald Ibis, Wattled Crane, Blue Crane, Martial Eagle, Grey Crowned Crane, Denham's Bustard, White-winged Flufftail, Rudd's Lark, Botha's Lark, Yellowbreasted Pipit, Pallid Harrier, Black Harrier, Blue Korhaan Eupodotis caerulescens, Black-winged Pratincole, Maccoa Duck Oxyura maccoa, Bush Blackcap, Chestnutbanded Plover Charadrius pallidus and Secretarybird to name just a few. This focus area overlaps with a large part of the Devon Grasslands IBA. Large areas of this IBA area already transformed, but powerlines are likely to present the greatest risk to IBA trigger species such as Blue Crane, Secreatrybird, Blue Korhaan. A number of dead Secretarybirds have already been recorded beneath powerlines in this area. This area overlaps with the Magalisberg IBA. And the Magaliesberg Biosphere Reserve (buffer). The most important trigger species in the IBA is the globally threatened Cape Vulture. The cumulative effects of loss of habitat and reduced food availability could present a risk, but poorly designed and located powerlines are likely to be a larger threat. This area overlap with the Platberg Karoo IBA. Interactions with powerline infrastructure is likely the biggest issue. This area overlap with Berg River Estuary IBA. See comments above for wind energy. While impacts associated with solar energy are likely may be less significant than those of wind energy, provided important habitats (e.g. floodplains, natural habitat) are avoided, interactions with transmission lines remains a concern. Impacts on ecological functioning of estuary also a risk that must be assessed.	Y5, subject to specialist assessment. Transformed areas within the IBA and surrounds are probably suitable for development as these are unlikely to be used by Botha’s Lark and Rudds Lark. Any grassland habitat that has the potentail for hosting these Endanagred and near-endemic species must be avoided. The risk of powerline collisions and risk to other species must be assessed and mitigated. Site visit, combined with consultation with experts and local knowledge required to determine if the focus area is suitable for wind farm	The risk of powerline will be assessed in the high level specialist assessment as well as in the Electricity Grid Infrastructure SEA. Site visits do not form part of the scope of the national scale SEA. Site visits and bird monitoring will occur at the

		development. In the event the preliminary (screening) assessment is positive, rigorous assessment (e.g. use of radar and/or extended monitoring and operational phase mitigation may be necessary. Consultation with conservation bodies in neighbouring Botswana is recommended as Cape and Lapped-faced Vultures are considered to be migratory species under Convention of Migratory Species Raptor MOU May be possible to relax guidelines following a site survey. Surveys of potential breeding sites and foraging areas would	impact assessment stage of a project within a REDZ. Noted Site visits do not form part of the scope of the

		help identify areas of high and low sensitivity. Note: this applies to many other draft focus areas not included in these comments Specialist consultation and site visit to identify sensitive areas. It should be possible to avoid impacts on most priority species through avoidance at the scale of a wind farm. It will be important for raptor nests to confirm the suitability of the area for development. Consult local experts as Andrew Jenkins and Lucia Rodriquez. Note: this applies to many other draft focus	national scale SEA. Site visits and bird monitoring will occur at the impact assessment stage of a project within a REDZ. Site visits do not form part of the scope of the national scale SEA. Site visits and bird monitoring will occur at the impact assessment stage of a project within a REDZ. Noted. High-level specialist assessment will be conducted as part of this SEA.

		areas not included in these comments	
		Solar PV Location and structure powerlines must be carefully assessed to avoid interactions with birds. BirdLife South Africa can supply the location of known Southern Bald Ibis colonies.	Powerline impacts will be assessed when high level specialist assessment are conducted in the SEA.
		Large-scale solar energy development is not compatible with the protected area status, the protected area should be excluded from the focus area. The suitability of the surrounding habitat for the IBA trigger species should be assessed before development is promoted.	Protected areas are considered to be very high sensitive areas and have been excluded from consideration in the update focus areas.

		Specialist assessment to identify important foraging areas for the Sandgrouse would be of value. Impacts of associated infrastructure on other IBA trigger species should be assessed.	High-level specialist assessment will be conducted as part of this SEA.
		Further specialist assessment.	Noted. High-level specialist assessment wil be conducted as part of this SEA.
		Given that alternative locations exist for solar energy, we recommend a precautionary approach – areas within the IBA should be excluded from further consideration.	IBAs will be taken into consideration during the specialist assessment phase of the SEA.
		Further assessment is required to assess suitability of area for solar energy development. Impacts of powerlines on	High-level specialist assessment wil be conducted as part of this SEA. Powerline impacts will be assessed when high level specialist

		IBA trigger species must be considered. Ideally the IBA should be excluded from further consideration given the high risk of negative impacts, including on ecological functioning. Should this recommendation not be implemented, additional specialist surveys are essential to assess risk of habitat alteration, impacts on ecological functioning and the impacts of associated infrastructure. It may be possible to limit impacts if the length of new powerlines is minimised and suitable habitat for IBA trigger species is avoided (site visit is	assessment are conducted in the SEA. High-level specialist assessment will be conducted as part of this SEA. Powerline impacts will be assessed when high level specialist assessment are conducted in the SEA. Noted.

		recommended)	
		Consult VulPro and Biosphere Reserve and BirdLife Harties and assess risk to Cape Vulture. Ensure there is no overlap with formal protected areas, that important habitats for birds are avoided and that ecological connectivity is not compromised.	Vulpro data has been used in the updated focus area determination.
		Specialist assessment, including consideration of powerline impacts.	High-level specialist assessment will be conducted as part of this SEA. Powerline impacts will be assessed when high level specialist assessment are conducted in the SEA.
		Specialist assessment, including consideration of powerline impacts is required.	High-level specialist assessment will be conducted as part of this SEA. Powerline impacts will be assessed when high level specialist

			assessment are conducted in the SEA.

Following this consultation phase, the SEA team had to reconsider the criteria using the latest WASA data released October 2018. With this rerun, some technical criteria were also updated based on industry consultation. For more, details on criteria used see Part 2 of the main SEA report. 8 focus areas were a result of the Phase 2 stage of the SEA. These 8 focus areas were released for public comment on the SEA website and to PSC and ERG members and the commenting period ran from 1 March – 1 April 2019. The comments received during this commenting period can be seen in the Table below

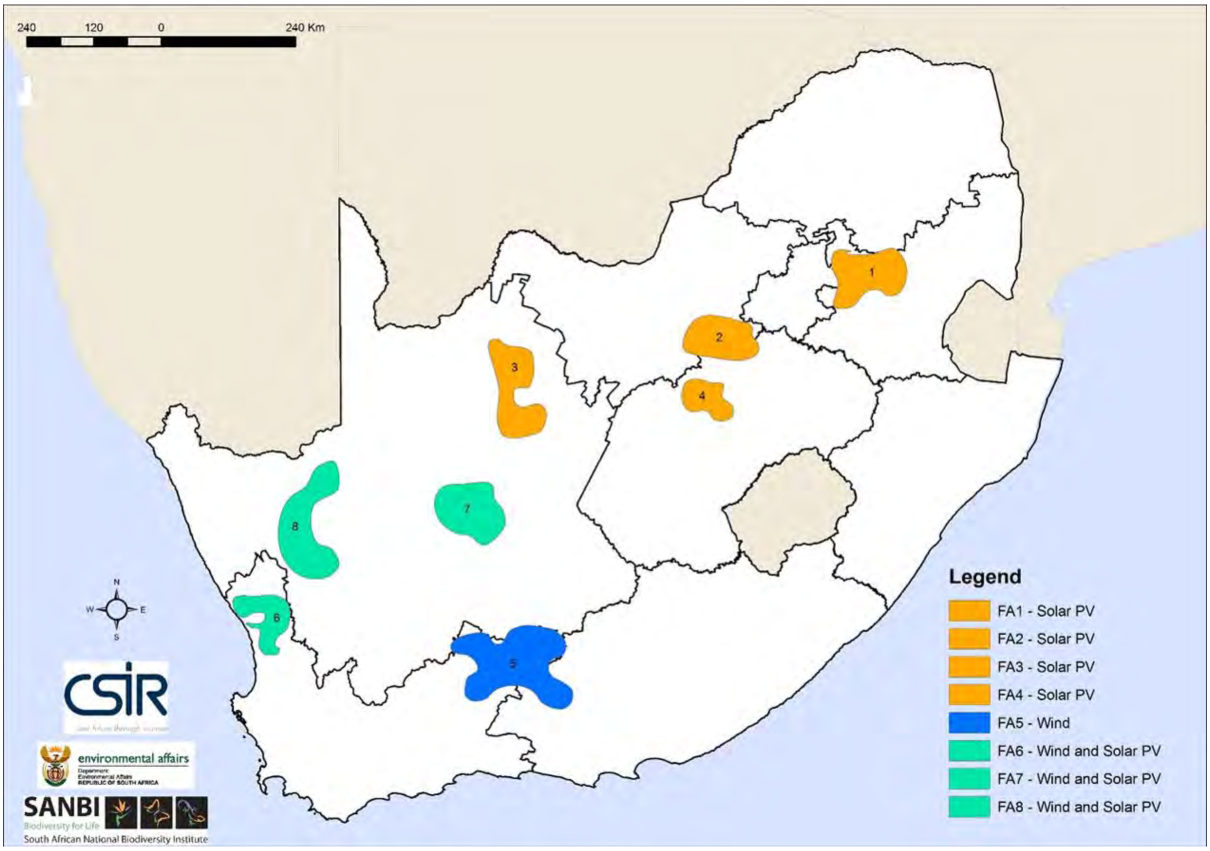


Figure 3: Updated focus areas for public comment

STAKEHOLDER	STATEMENT/COMMENT	SUGGESTION	RESPONSE/ACTION TAKEN
Jonathan Aronson	Hi there I would like to add to the record that FA3 is situated in an area with at least 7 bat roosts, including several large and very large roosts such as Koegelbeen Cave. The impacts of solar energy on bats is little understood and while it is clear that wind energy may have more direct impacts to bats through mortality, establishing several utility scale solar farms in very close proximity to sensitive and important bat roosts is against the precautionary principle. Thanks Jon Hi there Please add to the record of comments that FA6 contains a high sensitivity bat roost. It is also located 18 km at its edge from a very high sensitivity bat roost. Under the first SEA phase, these types of bat roosts would have had a 20 km buffer. The buffer distances for bat roosts were not indicated in the report on page 4 of the draft report. Was the South African Bat Assessment Advisory Panel consulted during the creation of these draft areas? Thanks Jon		Following the specialist assessments, this focus area was removed from consideration for becoming a REDZ. The specialist assessment conducted by the bat specialist included data from the South African Bat Assessment Advisory Panel. This focus area was removed from consideration of becoming a REDZ based on other sensitivities.
Samantha Ralston-Paton	Hi Abulele I hope this finds you well? I'm a little confused by the email below. I was under the impression that the specilaist studies for Phase 2 of the SEA were still underway? Please can you clarify the processes from here on. Will there be another round of stakeholder comment once the specialist studies have been completed? Will there still be an opportunity to amend the focus area/REDZ boundaries? Many thanks in advance, Sam		Specialist studies on the 8 focus areas as can be seen in Figure 3 were conducted. Following this, the selection of proposed REDZs will occur and these will be gazetted for implementation.
Mulalo Sundani	Good day	Hi Mulalo,	Thes documens were forwarded to DAFF.

	The Department of Agriculture , Forestry and Fisheries received a notification on the release of the first draft focus areas for Phase 2 of the Strategies Environmental Assessment (SEA) to identify renewable Energy Development Zone (REDZs) for efficient and effective. Please note that the documents is not attached in the email. Could you please forwards the documents to mulalosu@daff.gov.za for Department to produce a comments. Regards	Thank you for contacting the Redzs team, please note there was no attachment just a link to the methodology and the Focus areas https://redzs.csir.co.za/?page_id=625. Kind regards	
Karen Vosloo	I trust the report and maps will show both the original REDZs as well as this draft new areas. On p8 and p9, Third Draft maps (PV and Wind) - legend states Fourth Draft. Would like more clarity how the maps progress from the Critical importance maps to the Draft focus Areas maps.		The SEA report will show a map of the 8 gazetted REDZs as well as the new proposed REDZs. An explanation on the process and steps to determine the focus areas can be found in the accompanying report released with the focus areas.
Tracy Brunings	Good day, Please ensure that this email is also sent to MM@langeberg.gov.za (Municipal Manager: Langeberg Municipality), and cvorster@langeberg.gov.za (Manager: Electrical Engineering) if not already listed as Stakeholders. Many thanks,	Good day Thank you we have forwarded the Email to the persons suggested. Kind regards	Noted and person suggested was forwarded the relevant documents.
Geagte Mnr / Dame	Dear Sir / Madam Please be advised that your correspondence has been received by the Langeberg Municipality. The matter will receive the necessary attention. Yours faithfully Geagte Mnr / Dame Neem asb kennis dat u korrespondensie deur die Langeberg Munisipaliteit ontvang is. U skrywe sal die nodige aandag geniet. Die uwe		Noted.
Briaan Smit	Good morning, Thank you for providing the Municipality the opportunity to comment on the above-mentioned project. Can you please forward the GIS shapefiles for"FA6 –wind and solar PV"to be able to overlay it on our existing GIS data and to provide meaningful comments.		This shapefile was submitted to the municipality. 1. Noted 2. Noted 3. This comment has been noted and data from DAFF has been used in the assessment to identify areas of high agricultural sensitivity.

	Good day, The email below, refers. Thank you for the opportunity to provide comment on the above-mentioned subject and specifically to focus area “FA6 – wind and solar PV” as it consumes most of the Matzikama municipal area. Although some of the following comments will already be included within the “features of critical importance” the following must still be taken into account: 1. The Spatial Development Framework for the Matzikama Municipality, 2014 read together with the Amendment, 2018 (SDF, 2018) are applicable within the Matzikama municipal area. 2. Although the Municipality does not have any policies with regards to renewable energy technologies the SDF, 2018 supports renewable energy generation as it contributes to job opportunities and an economic injection in an already poor economic area. 3. The Olifants River corridor is very important as it is where most, if not all, the fertile agricultural land is located and vineyards are cultivated which is the main contributor to the gross domestic product of the municipal area. 4. The following is located within the above-mentioned focus area and needs to be addressed: a. N7 National Road b. Various higher order roads managed by the Western Cape Government: Road Network Management department c. Knersvlakte Nature Conservation Area and also the proposed extension areas managed by Cape Nature d. Olifants River e. Greater Cederberg Biodiversity Corridor f. Various airstrips of which the two located in Vredendal is the most active g. Existing wind and solar farms		4. This comment on land claims have been noted. 5. Noted. Developers will need to take local conditions into consideration when projects in the area are proposed. 6. High level visual impact assessment will be conducted during the specialist assessment phase of the SEA 7. Noted.

	h. Existing and active mining areas i. Privately owned land j. Sishen-Saldanha railway line operated by TRANSNET k. Eskom and municipal electricity grid distribution lines l. There are still areas which under a land claim is registered or the necessary process have not even started. 5. Notice must be taken of the severe drought which had a very negative impact on the natural environment and further designs and layouts of renewable energy facilities must take this and also climate change into account. 6. The Municipal area is also visit by many a tourist during the year and especially holiday periods and therefor the visual impact of the renewable energy facilities must be considered. 7. Renewable energy structures is provided for as a consent use within the Zoning Scheme Regulations applicable in the municipal area and therefore a consent use application in terms of the "Matizikama Municipality: Land Use Planning By-Law, 2015" which is informed by the Western Cape Land Use Planning Act, 2014 (No 3 of 2014) and the Spatial land Use Management Act, 2013 (No 16 of 2013), must be submitted for consideration by the municipality. Taking the above-mentioned in to account the Municipality supports renewable energy development and green technologies. Please note that this office reserves the right to provide contradictory and/or amended comment and to request any additional or new information based on any additional or new information that is received. Regards		
Ashantia Nerissa Pillay	Dear Sir/ Madam, Thank you for the email notification below. Please may I request hardcopies of the relevant documentation regarding the proposal, for further consideration. The postal details for the IEM Planning Division are as follows:		These documents were posted as requested.

	Addressee: Mr Andy Blackmore – Head IEM and Protected Area Planning (alternatively, Nerissa Pillay- Scientific Technician, Conservation Planning: IEM) Postal: P O Box 13053 Courier: Queen Elizabeth Park Cascades Cascades 3202 1 Peter Brown Drive Montrose 3201		
Jason Cope	Hello, I trust that you are well. We are busy reviewing the proposed Phase 2 REDZ proposals, and were wondering if you would be able to supply the areas as a kmz / kml file, or shape file, for review? This would be of great help. Many thanks. Best Regards, Jason	Dear Jason, Please let me know if you have any problems with the download. Regards Abulele	The kmz files can be downloaded from the SEA website under 'Data for stakeholders' review and comments': https://redzs.csir.co.za/?page_id=625. An email to Jason was sent communicating this.
Yasmina Dada	Good afternoon, ENERTRAG South Africa acknowledges the Strategic Environmental Assessment (SEA) as a valuable contribution for identifying renewable energy development zones (REDZ) towards renewable energy development and achieving the broader goals set out in the National Development Plan (NDP). There are, however, areas of concern specifically with the methodology of the wind and solar PV SEA, which could potentially limit the long-term potential to facilitate a 'just energy transition' in South Africa. The attached document is a summary of responses from ENERTRAG South Africa to the environmental, technical and socio-economic constraint mapping methodology used to identify REDZ areas. Please feel free to contact me should you have any questions or require any more information. Best,		A This comment is noted. The DEFF created a website where developers upload bird ad bat monitoring data that could be used to shorten time frames within a REDZs, however there were confidentiality issues with uploading data to the public website. The DEFF will engage developers further on this matter. B This comment on capacity factor has been noted and the data was no longer used as a basis to determine wind resource in the updated focus areas. Noted. This comment has been noted; however, specialist assessments were not conducted in areas outside the current proposed boundary of the Mpumalanga REDZ. C

	Yasmina ENERTRAG South Africa (Pty) Ltd. | 101B Heritage House, 20 Dreyer St, Claremont, Cape Town, South Africa, 7708 29 March 2019 Reference Response to: First draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment ENERTRAG South Africa acknowledges the Strategic Environmental Assessment (SEA) as a valuable contribution for identifying renewable energy development zones (REDZ) towards renewable energy development and achieving the broader goals set out in the National Development Plan (NDP). There are, however, areas of concern specifically with the methodology of the wind and solar PV SEA, which could potentially limit the long-term potential to facilitate a 'just energy transition' in South Africa. The following is a summary of responses to the environmental, technical and socio-economic constraint mapping methodology used to identify REDZ areas. **A. Environmental constraint mapping** One of the contributions of the REDZ is the reduced costs and timelines for environmental assessments during the development phase. There is an opportunity to further reduce the cost and timelines during the project development phase in the REDZ by making use of the detailed primary data gathered by Bird Life South Africa about bird and BAT patterns in the previously monitored REDZ. With this approach the current 12 months of primary data required could be replaced by a shorter desktop analysis based on this secondary data sufficient for environmental authorization (EA). Once the EA is awarded, other requirements for financial close of a project (such as the site layout plan) can be completed. With the finance available at financial close, a full pre-construction phase bird and bat monitoring requirement can be introduced to avoid front-loading the development phase with a very costly monitoring program and increased risk. **B. Technical constraint mapping** i. <u>The need for 'multi-use REDZ'</u>		Noted. The socioeconomic index has been used as an informative layer and not used to determine the location of REDZs. Mining towns have been used as one of the criteria for solar PV REDZs.

	The proposed REDZ are organized into wind, solar and mixed-use categories according to the assessment criteria for each technology. In the absence of relaxing requirements for detailed avifauna and bat studies in wind zones, the proposal is to categorize all zones into mixed-use zones and apply the streamlined Public Participation Process (PPP) associated with the Basic Assessment (BA) process. ii. <u>The role of technological developments in determining power density and capacity factors</u> The 35% wind capacity factor and power density of 250W/m2 defined for "favourable wind energy areas" in the dated CSIR "aggregation study" (2016) does not account for technology developments. Given technology developments such as increased hub height and rotor diameter in wind turbine technology, there is potential for energy yield improvements in areas with lower wind resources. It is recommended that the minimum capacity factor and power density be applied to the latest turbine technology. Examples of updated turbine models, with new technology, can be seen in the Vestas V162 with 5.6MW or the GE 158 with 5.3MW. The rotor diameter of these turbines is approximately 160m and the turbine nacelles can be mounted at 160m above ground level. iii. Benefits of Strategic Transmission Corridors vs the Transmission Development Plan The GCCA and the TDP may not account for the development of proposed or planned MTS on the Strategic Transmission Corridors that were identified through the Electricity Grid Infrastructure (EGI) SEA. The proposal is to amend the technical criteria (1) as follows: From "Areas with power density above 250 W/m² and within 35km of MTS substations identified in the TDP and GCCA2017 datasets. " To: 1) Areas with power density above 250 W/m² (**<u>to be adjusted to suit modern turbine technology hub heights and rotor diameters)</u>** and within 35km of existing and planned/proposed MTS substations.		

	iv. Utilizing existing grid infrastructure in the coal areas of the country The 50 year-life decommissioning plan for Eskom's coal-fired power stations outlined in the Updated Draft IRP 2019 shows that there will be a significant reduction in coal generation capacity over the next 5 years. Although Gauteng and Mpumalanga provinces do not have the best solar and/or wind resources, the Northern and international power corridors span through the Mpumalanga and Gauteng provinces where there currently exists grid infrastructure that will be left behind when the coal generation power stations are decommissioned. From a system perspective, it is possible for the higher generation costs as a result of lower solar and wind resource to be partially, or even entirely, offset by the lower grid-integration costs associated with situating plants in close proximity to well established transmission infrastructure and load centers. It is proposed that the high voltage switch yards currently used to evacuate power are used to connect renewable energy generators to the transmission grid. Moreover, it is proposed that the REDZ areas in the coal regions be expanded with the looming availability of grid infrastructure. **C. Socio-economic activity index mapping** i. Potential to facilitate a 'just energy transition' in the coal regions The socio-economic activity index for towns and municipalities is based on trends from 2001 to 2011; and 2011 to 2016 respectively. Although this is a reflection of the current landscape it does not account for the expected decline in economic activity in the coal regions of South Africa as a result of the decommissioning of coal power stations according to the Updated Draft IRP (2019). Unless plans are implemented to ease what is internationally known as 'just energy transition,' coal workers as well as entire communities in regions such as Mpumalanga, will understandably resist the economic decline in these areas. Through the expansion of REDZ into coal areas such as Mpumalanga, the South African government could take a proactive policy decision to encourage and incentivize the construction of new energy infrastructure to areas where old energy infrastructure will be slowly decommissioned. Renewable energy		

	generators could be built in mining areas, with the objective that the total number of permanent jobs in the region stay the same. ii. <u>An understanding of potential impact on communities living within the REDZ</u> The socio-economic activity index mapping focuses on economic output, but does not make reference to the [developmental and basic] needs of often underdeveloped communities or the potential impact this has for people living within the REDZ. With reference to the REIPPPP SED, ED and local ownership requirement, it is important to highlight the additional social and economic benefits communities may receive when building RE facilities in these areas, especially in provinces like Limpopo and Mpumalanga. This aspect compliments Strategic Integrated Projects (SIP) 9.		
Towfie Nazley	Good Day, How will a single project be dealt with if it is split 50% inside a REDZ and 50% not within the REDZ? Kind Regards Ms Nazley Towfie M.Sc.(Phys) Project Development Manager · Wind & Solar		If any part of a project falls outside of a REDZs, a full Scoping and Environmental Assessment procedure must be followed.
Andries Kruger	The main concern from the South African Weather Service is that the REDZ should be at least 60 km from the SAWS weather radar installations. This is indeed the case and therefore comply to SAWS requirements. However, It should be noted that any wind farm planned within 250 km from a SAWS weather radar would have to go through a process of consultation with SAWS.		Developers will consult with SAWS during impact assessment phase. Weather radars have been considered in the determination of REDZs.
Karen de Bruyn	Council for Scientific and Industrial Research (CSIR) 1 April 2019 SEA Team Submitted via email: redzs@csir.co.za COMMENT ON THE RELEASE OF THE DRAFT FOCUS AREAS FOR PHASE 2 OF THE STRATEGIC ENVIRONMENTAL ASSESSMENT TO IDENTIFY RENEWABLE ENERGY DEVELOPMENT ZONES FOR THE EFFICIENT AND EFFECTIVE ROLLOUT OF WIND AND SOLAR The email notification dated 1 March 2019, informing G7 Renewable Energies (Pty) Ltd (hereafter referred to as "G7") as an interested and affected party of the proposed 2nd phase of the strategic environmental assessment ("SEA") to identify renewable energy development zones ("REDZs"), bears reference.		This comment has been noted.

	It is our understanding that the CSIR, on the instruction of the Department of Environmental Affairs, identified four solar REDZs, one wind specific REDZs and three zones catering for both wind and solar PV projects. G7 fully supports the endeavour to identify further geographical areas best suited for the roll-out of wind and solar PV projects. We have a strong preference for the wind specific REDZ as well as the three REDZs catering for both wind and solar PV projects. Overall, we offer our support as the REDZ promote and ease development of utility scale renewable energy developments in South Africa. Yours sincerely, ____________________________ Karen de Bruyn Head of Development		
Mulalo SU	Department. Agriculture. Forestry and Fisheries REPUBLIC OF SOUTH AFRICA Forestry and Natural Resources Management, Department of Agriculture, Forestry and Fisheries Private Bag X93, Pretoria 0001 Enqueries: Sundae Mutate Tel: (012)309 5865. Fax: (012) 309 5840. CSIR SEA TEAM Department of Environmental Affairs Private Bag X447 PRETORIA 0001 COMMENT ON NATIONAL STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE EFFICIENT AND EFFECTIVE ROLLOUT OF WIND AND SOLAR PHOTOVOLTAIC ENERGY PHASE 2 I hereby acknowledge the opportunity to provide input on the abovementioned report. We thus comment as follows: The mandate of the Department of Agriculture, Forestry and Fisheries (DAFF) as a commenting authority, is mainly to ensure control over development affecting natural forests, woodlands and listed protected tree species under the National Forests Act of 1998 (Act 84 of 1998). a. Parts of the second phase wind and solar PV areas cover woodlands where protected tree species occur. Application has to be made to DAFF for licences under Section 15 of the National Forests Act, 1998 (Act No. 84 of 1998) to destroy and damage such trees wherever they are affected. Some of these species such as *Vachellia eriloba*, *Boscia albitrunca* and Sclerocarya birrea occur in large numbers, and depending on the numbers of trees and the		1. This comment has been noted and data from DAFF has been used in the SEA. High sensitive areas have been identified. 2. Noted. Forest areas were removed from consideration for REDZs. 3. Noted

	veld types affected biodiversity offsets may have to be set as a condition to development. b. Within the second phase areas there are also small patches of natural forest in very restricted localities, which are not expected to be affected. Destruction of natural forest also requires a licence under Section 7 of the National Forests Act, but such forest patches should be avoided altogether. c. Given the large areas covered by the strategic assessment, it is not possible to provide more specific guidance, but when DAFF has to comment on specific proposals, they will be handled on a case by case basis. Should you wish to make further engagements on the matter, please do not hesitate to contact either Shumani Dzivhani at ShumaniDadaff.hov.za or MS Mulalo Sundani at Mulalosu©daff.gov.za: 012 309 5865. Yours sincerely		

At the final stage of the SEA a district municipality roadshow was undertaken by the SEA team at the final 3 proposed REDZs and the 8 gazetted REDZs from the Phase 1 SEA. The purpose of the meetings with the district and local municipalities was to inform regional and local government on the SEA process, verify the issues and benefits, and finally discuss the inclusion of the SEA findings into the Spatial Development Frameworks (SDFs) and Integrated Development Plans (IDPs).

The roadshow meetings were held at the following towns on these dates;

- REDZ 1 – Bredarsdorp – 17 September 2019
- REDZ 2 – Laingsburg – 18 September 2019
- REDZ 3 – Grahamstown – 19 September 2019
- REDZ 4 – Queenstown – 20 September 2019
- REDZ 5 – Kimberley – Scheduled for 1 October 2019
- REDZ 6 – Vryburg – Scheduled for 1 October 2019
- REDZ 7 – Upington – 30 September 2019
- REDZ 8 – Springbok – 30 September 2019
- REDZs 9 – Emalahleni – 25 September 2019
- REDZ 10 – Klerksdorp– 27 September 2019
- REDZ 11 – Beaufort West - 18 September 2019

Registers of all who attended the meetings are available upon request and included in the Final deliverables of the SEA.

B 2-4. COMMENTS ON THE DRAFT REPORT FROM ERG AND PSC

The draft report was released to the PSC and ERG for comment. Formal comment submission were submitted by Birdlife SA, Bat specialist and SAHRA. Other comments from the PSC and ERG were given at the final meeting and are captured in the meeting notes.

B 2-5. COMMENTS ON THE GAZETTING OF THE PROPOSED REDZS

The three new proposed REDZs will be subject to a 30 day public commenting period and a formal Comments and Responses Register will be kept by the DEFF.