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

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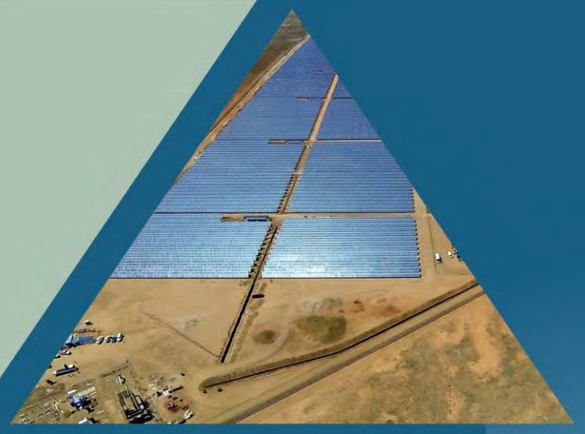

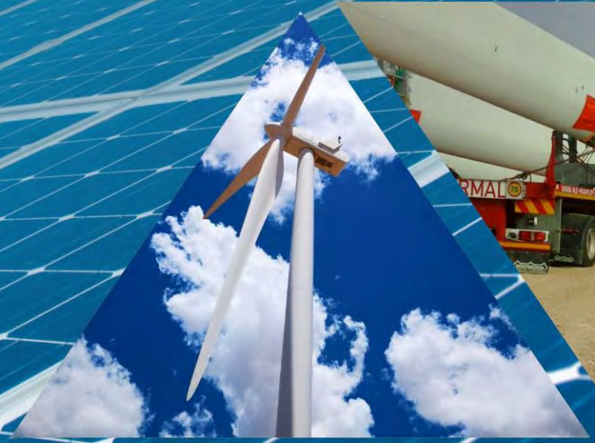

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PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

SEA REPORT

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Large scale wind and solar photovoltaic projects that contribute to the National Development Plan are supported by strategic planning, endorsed by government, embraced by stakeholders, and attractive to investors.
To identify Renewable Energy Development Zones (REDZs) that are of strategic importance for large scale wind and solar photovoltaic development in terms of Strategic Integrated Project 8, and in which significant negative impacts on the natural environment are limited and socio-economic benefits to the country are enhanced.

SUMMARY

The National Department of Environmental Affairs (subsequently renamed to be the Department of Environment, Forestry and Fisheries, DEFF) appointed the Council for Scientific and Industrial Research (CSIR), to undertake the Phase 2 Strategic Environmental Assessment (SEA) for the effective and efficient roll-out of large scale wind and solar photovoltaic (PV) development in South Africa. The Phase 2 SEA follows on from the Phase 1 Wind and Solar SEA (completed in 2015), which identified eight Renewable Energy Development Zones (REDZs) in South Africa which were gazetted for implementation in February 2018.

Much like its predecessor, the Phase 2 Wind and Solar PV SEA aims to identify geographical areas best suited for the roll-out of wind and solar PV energy projects. In addition, one of the main aims of the SEA was to identify previously mined areas close to areas of the country with highest energy demand, where large-scale renewable projects can occur in order to contribute towards rehabilitation of mined areas and in support of job creation in the areas.

The objectives of the Phase 2 Wind and Solar PV SEA build on those identified by the first phase SEA. These include: facilitating sustainable development, enabling stakeholder participation, integration of science-based information, and building an enabling environment for informed decision-making. In addition to these objectives, the Phase 2 Wind and Solar PV SEA aims to identify REDZs in previously mined areas to enable the rehabilitation of abandoned mines and to contribute towards the planning of the Just Energy Transition framework by strategically planning large scale wind and solar PV developments in areas where job losses may occur from closure of mines such as coal, diamond and gold mines.

There are three energy related SIPs, namely; SIP 8 – Green energy in support of the South African economy; SIP 9 – Electricity generation to support socio-economic development; and SIP 10 – Electricity transmission and distribution for all (Figure 2). SIP 8 and SIP 9 related directly to this SEA. SIP 8 aims at facilitating the implementation of sustainable green energy initiatives as envisaged in the NDP and Integrated Resource Plan (IRP2010), SIP 9 aims at accelerating new electricity generation to meet the needs of the economy and address historical imbalances and SIP 10 aims to expand the transmission and distribution network in order to ensure access for all

The REDZs represent priority areas for investment into the electricity grid. Currently, one of the greatest challenges for the continued success of the renewable energy industry in South Africa is the depletion of existing grid infrastructure in areas with high wind and solar resource and the hurdles in upgrading and expanding the grid. Proactive investment in grid infrastructure is thus an important factor in the success of REDZs and the renewable energy industry in South Africa. It must be noted that although it is intended for the SEA to prioritise proactive grid investment in REDZs, such investment should not be limited to these areas. Suitable wind and solar PV development is still promoted across the country and any proposed development must be considered on its own merits.

The additional REDZs proposed in this SEA are based on an integrated spatial analyses and wide stakeholder consultation. The process to identify these REDZs (Figure 1) consisted firstly of positive mapping that included factors such as the abundance of existing resource (i.e. wind and solar PV energy), access to the strategic power corridors, and other technical criteria required for renewable energy facilities. This was followed by negative mapping that included environmental features and areas not suitable for consideration of placement for large scale wind and solar PV facilities. Thereafter an industry prioritisation exercise was conducted. This led to eight focus areas being identified with suitable technical criteria and low environmental impact. Some were for wind only, some for solar PV only, and others represented a mix of technologies. These focus areas were subjected to high level scoping level assessments and further industry consultation, leading to three additional REDZs being proposed. These are referred to as FA9 Emalahleni (solar PV), FA10 Klerksdorp and. (solar PV) and FA11 Beaufort West (wind). The numbers are a continuation from the already gazetted eight REDZs from the Phase 1 wind and solar PV SEA.

The gazetting of REDZs as areas of strategic importance for large scale wind and Solar PV development will give effect to provisions in terms of section 24(5)(a) and (b) of the National Environmental Management Act, 1998, regarding procedures to be followed when developments occur in geographical areas of strategic importance, and Regulation 15 of the Environmental Impact Assessment Regulations, 2014, where any applications falling within these gazetted areas will have the benefit of reduced time frames i.e. conducting a Basic Assessment instead of a full Scoping and Environmental Impact Assessment. The reduction in these timeframes is due to the reduction of the decision making timeframes to 57 days. Through these provisions the authorities and other decision-makers will able to ensure that wind and solar PV development in REDZs is given priority in planning, approval and implementation.

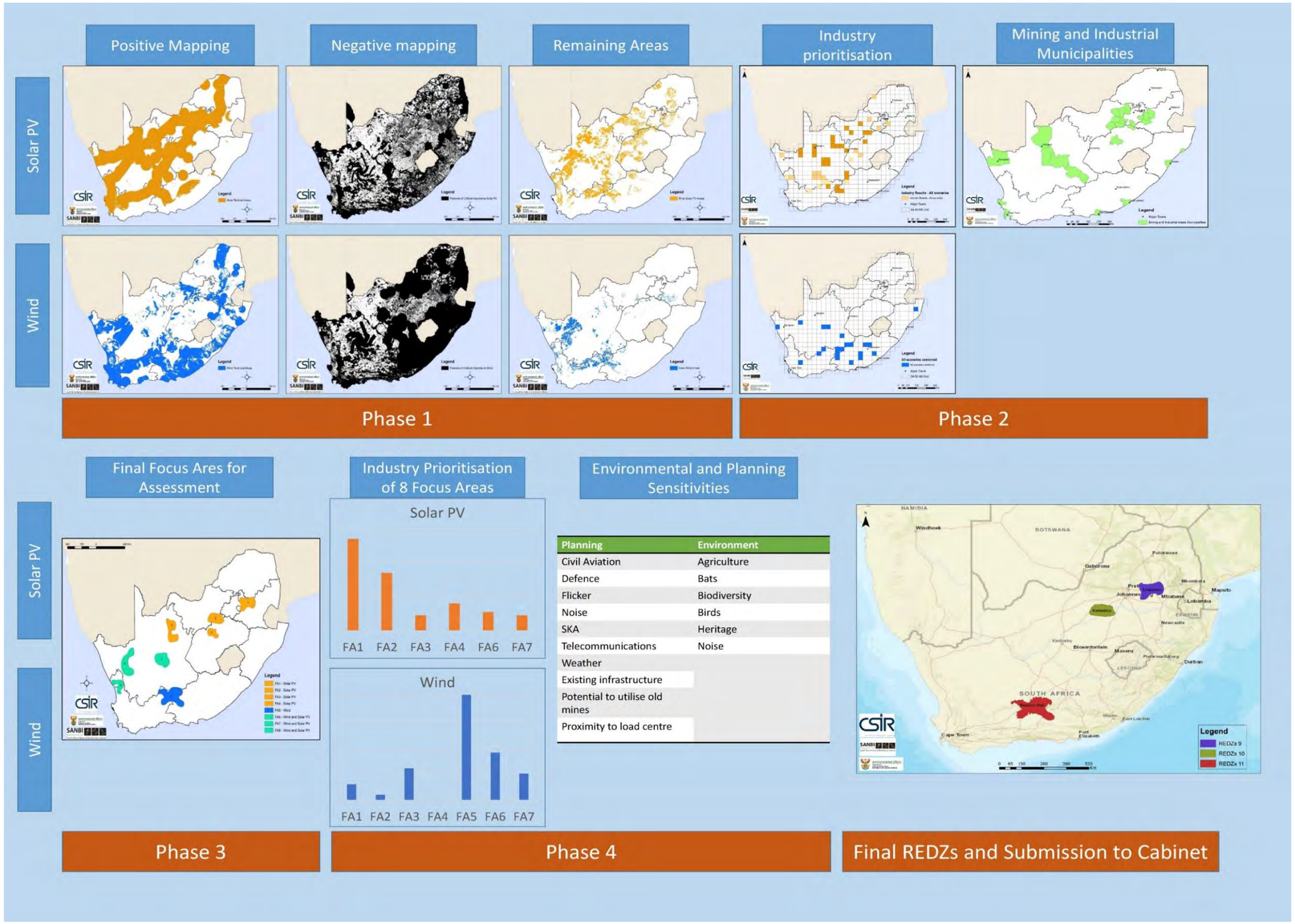

Figure 1: Illustration of REDZs identification process

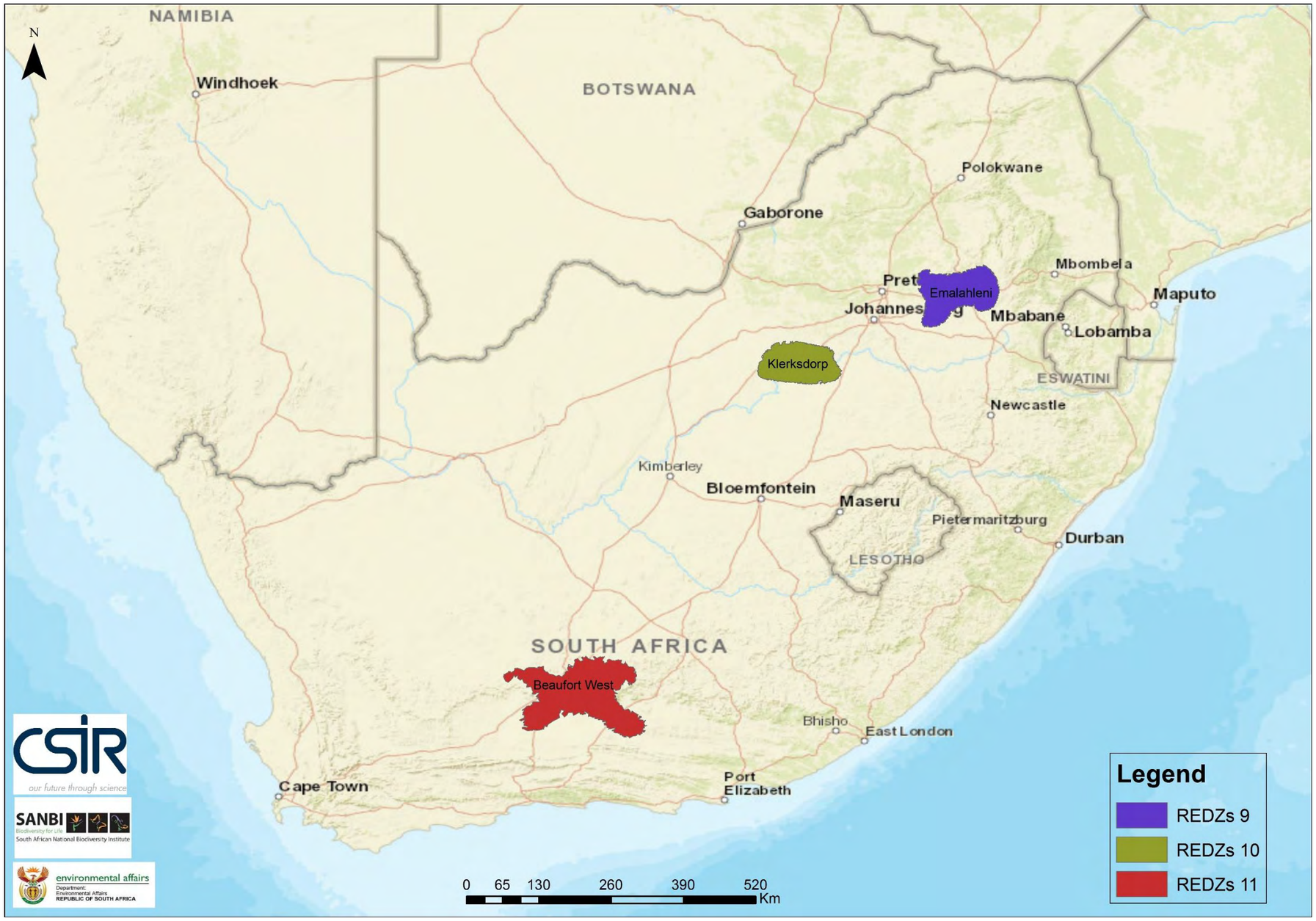

Figure 2: Proposed additional Renewable Energy Development Zones (REDZs)

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APPENDICES

ABBREVIATIONS & ACRONYMS

ADU	Animal Demography Unit
AIA	Archaeological Impact Assessment
AM	Amplitude Modulation
ATNS	Air Traffic and Navigation Control Service
BA	Basic Assessment
BAWESG	Birds and Wind Energy Specialist Group
BID	Background Information Document
BLSA	Birdlife South Africa
BRICS	Major emerging national economies of Brazil, Russia, India, China, and South Africa
CBA	Critical Biodiversity Areas
C-BASS	C-Band All Sky Survey
CD-NGI	Chief Directorate: National Geographic Information
CEF	Central Energy Fund
CGS	Council for Geoscience
CoGHSTA	Department of Co-operative Governance, Human Settlements and Traditional Affairs
CRSES	Centre for Renewable and Sustainable Energy Studies
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Waterbird Counts
DAFF	Department of Agriculture, Fisheries and Forestry
dB(A)	A-weighted Decibels
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DEADP	Western Cape Department of Environmental Affairs and Development Planning
DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
DEDECT	North West Department of Economic Development, Environment, Conservation and Tourism
DEM	Digital Elevation Model
DENC	Northern Cape Department of Environmental Affairs and Nature Conservation
DM	District Municipality
DMR	Department of Mineral Resources
DoD	Department of Defence
DoE	Department of Energy
DoT	Department of Transport
DRDLR	Department of Rural Development and Land Reform
DST	Department of Sciences and Technology
DTEEA	Free State Department of Tourism, Environmental and Economic Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioners
EAPASA	Environmental Assessment Practitioners Association of South Africa
ED	Enterprise Development
EGI	Electrical Grid Infrastructure
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMI	Electromagnetic Interference
EMPr	Environmental Management Programme
ERG	Expert Reference Group
ESA	Ecological Support Areas
ESMAP	World Bank Energy Sector Management Assistance Program
eTOD	Electronic Terrain and Obstacle Database
EWT	Endangered Wildlife Trust
Exco	Executive Committee
FA	Focus Area
FAQ	Frequently Asked Question
FM	Frequency Modulation
GA	General Authorisation
GCCA-2016	Generation Connection Capacity Assessment of the 2016 Transmission Network
GDP	Gross Domestic Product
GG	Government Gazette
GHI	Global Horizontal Irradiation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit / German Federal Enterprise for International Cooperation
GN	Government Notice
GW	Gigawatt
ha	Hectare
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IAIA	International Association for Impact Assessment
IBA	Important Bird Areas
ICAO	International Civil Aviation Organisation
IDC	Industrial Development Corporation
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IPP	Independent Power Producer
IRP	Integrated Resource Plan
J OP HQ	Joint Operational Headquarters
KCAAA	Karoo Central Astronomy Advantage Area
km	Kilometre
LEDS	Local Economic Development Strategy
LM	Local Municipality
m	Metres
MPRDA	Mineral and Petroleum Resources Development Act
MW	Megawatt
NASA	National Aeronautics and Space Administration
NBA	National Biodiversity Assessment
NCOP	National Council of Provinces
NDP	National Development Plan
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NERSA	National Energy Regulator of South Africa
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-Governmental Organization
NHRA	National Heritage Resources AcT
NID	Notification of Intent to Develop

NIP	National Infrastructure Plan
NPAES	National Protected Areas Expansion Strategy
NSDP	National Spatial Development Perspective
NWA	National Water Act
OEC	Obstacle Evaluation Committee
PAPER	Precision Array for Probing the Epoch of Re-ionisation
PES	Present Ecological State
PIA	Paleontological Impact Assessment
PICC	Presidential Infrastructure Coordination Committee
POI	Points of Interest
PPA	Power Purchase Agreement
PPP	Public Participation Process
PSC	Project Steering Committee
PV	Photovoltaic
RDB	Red Data Book
REDZ	Renewable Energy Development Zone
REFIT	Renewable Energy Feed-In Tariff
REI4P (or REIPPPP)	Renewable Energy Independent Power Producer Procurement Programme
RFI	Radio Frequency Interference
S&EIA	Scoping and Environmental Impact Assessment
SAA	South African Army
SAAF	South African Air Force
SABAAP	South African Bat Assessment Advisory Panel

SABAP	South African Bird Atlas Project
SABC	South African Broadcasting Corporation
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulation
SACATS	South African Civil Aviation Technical Standard
SACNASP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SALA	Subdivision of Agricultural Land Act
SALGA	South African Local Government Association
SALT	South African Large Telescope
SAMHS	South African Military Health Services
SANBI	South African National Biodiversity Institute
SANDF	South African National Defence Force
SANEDI	South African National Energy Development Institute
SANParks	South African National Parks
SANS	South African National Standards
SAPAD	South African Protected Areas Database
SAPVIA	South African Photovoltaic Industry Association
SAREC	South African Renewable Energy Council
SARPs	Standards and Recommended Practices
SASTELA	Southern Africa Solar Thermal and Electricity Association
SAWEA	South African Wind Energy Association
SAWS	South African Weather Services
SDF	Spatial Development Framework

SEA	Strategic Environmental Assessment
SED	Socio-Economic Development
SEF	Solar Energy Facility
SEZ	Special Economic Zone
SIP	Strategic Integrated Project
SKA	Square Kilometre Array
SKEP	Succulent-Karoo Ecosystem Programme
SMME	Small, Medium and Micro Enterprise
SOE	State Owned Enterprise
SPLUMA	Spatial Planning and Land Use Management Act
SRTM	Shuttle Radar Topographic Mission
TV	Television
UCT	University of Cape Town
USA	United States of America
VIA	Visual Impact Assessment
WASA	Wind Atlas for South Africa
WAsP	Wind Atlas Analysis and Application Programme
WEF	Wind Energy Facility
WESSA	Wind Energy Summit South Africa
WRF	Weather and Research Forecasting
WULA	Water Use License Application

PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
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PART 1

INTRODUCTION










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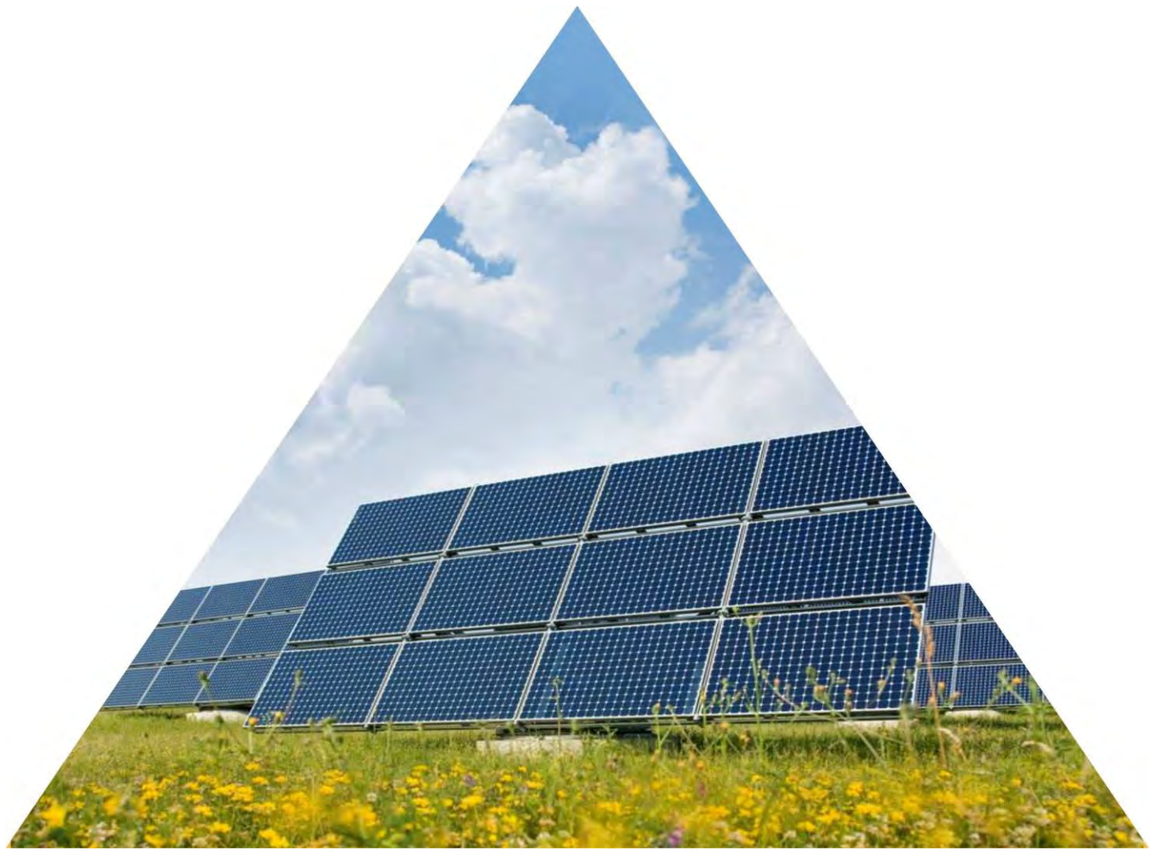


PART 1. INTRODUCTION

The national Department of Environmental Affairs, which is since renamed the national Department of Environment, Forestry and Fisheries (DEFF), appointed the Council for Scientific and Industrial Research (CSIR) in 2016, to undertake the Phase 2 Strategic Environmental Assessment (SEA) for the effective and efficient roll-out of large scale wind and solar PV development in South Africa. The Phase 2 SEA follows on from the completed Phase 1 Wind and Solar SEA[1], which identified eight Renewable Energy Development Zones (REDZs) in South Africa which were gazetted for implementation in February 2018 (Figure 1).

Figure 1: Final gazetted Phase 1 REDZs

Much like its predecessor, the Phase 2 Wind and Solar PV SEA aims to identify geographical areas best suited for the roll-out of wind and solar PV energy projects. In addition, one of the main aims of the SEA was to identify previously mined areas close to areas of the country with highest energy demand, where large-scale renewable projects can occur in order to contribute towards rehabilitation of mined areas and in support of job creation in the areas.

The National Development Plan (NDP) was officially adopted in 2012 and sets targets for eliminating poverty and reducing inequality in South Africa by 2030. The plan was adopted based on the recommendations stipulated in the New Growth Path Framework which was released in 2010 and identified key areas/sectors in the country that need investment to facilitate an increase in job creation and aid with meeting the development goals set out in the NDP. The framework identified five areas; energy, transport, communication, water and housing where investment should be focused. With the intention of addressing the challenges identified in the New Growth Path, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). The main function of the PICC is to

- "coordinate, integrate and accelerate implementation
- develop a single common National Infrastructure Plan that will be monitored and centrally driven
- identify who is responsible and hold them to account
- develop a 20-year planning framework beyond one administration to avoid a stop-start pattern to the infrastructure roll-out." [2]

With this mandate, 18 Strategic Integrated Projects (SIPs) were developed to fast-track development and growth of social and economic infrastructure in the country.

There are three energy related SIPs, namely; SIP 8 – Green energy in support of the South African economy; SIP 9 – Electricity generation to support socio-economic development; and SIP 10 – Electricity transmission and distribution for all (Figure 2: 18 Strategic Integrated Projects (SIPs). SIP 8 and SIP 9 related directly to this SEA. SIP 8 aims at facilitating the implementation of sustainable green energy initiatives as envisaged in the NDP and Integrated Resource Plan (IRP2010), SIP 9 aims at accelerating new electricity generation to meet the needs of the economy and address historical imbalances and SIP 10 aims to expand the transmission and distribution network in order to ensure access for all[3].

[1] https://redzs.csir.co.za/?page_id=611
[2] http://www.economic.gov.za/picc/sips-chairpersons
[3] https://www.gov.za/issues/national-infrastructure-plan

Strategic Integrated Projects (SIPs)	
1 Unlocking the Northern Mineral Belt with Waterberg as the Catalyst	2 Durban- Free State 3Gauteng Logistics and Industrial Corridor
3 South Eastern node & corridor development	4 Unlocking the economic opportunities in North West Province
5 Saldanha-Northern Cape Development Corridor6	6 Integrated Municipal Infrastructure Project
7 Integrated Urban Space and Public Transport Programme	8 Green Energy in support of the South African economy
9 Electricity Generation to support socio-economic development	10 Electricity Transmission and Distribution for all
11 Agri-Logistics and Rural Infrastructure	12 Revitalisation of public hospitals and other health facilities
13 National school build programme	14 Higher Education Infrastructure
15 Expanding access to communication technology	16 SKA & MeerKat
17 Regional Integration for African cooperation and development	18Water and Sanitation Infrastructure Master Plan

Figure 2: 18 Strategic Integrated Projects (SIPs)

This Phase 2 Wind and Solar PV SEA was commissioned by DEFF in support of the SIPs. Wind and solar PV development will be incentivised and streamlined in the REDZs by reducing the decision making timeframes in the Environmental Authorisation process. The study identifies areas where large scale wind and solar PV energy facilities can be developed in a manner that limits the potential for significant negative impact on the natural environment, while yielding the highest possible social and economic benefits to the country. It must be noted that although the prioritisation of development will be focused in REDZs, it will not be limited to these areas.

The gazetting of REDZs as areas of strategic importance for large scale wind and Solar PV development will give effect to provisions in terms of section 24(5)(a) and (b) of the National Environmental Management Act, 1998, regarding procedures to be followed when developments occur in geographical areas of strategic importance, and Regulation 15 of the Environmental Impact Assessment Regulations, 2014, where any applications falling within these gazetted areas will have the benefit of reduced time frames i.e. conducting a Basic Assessment instead of a full Scoping and Environmental Impact Assessment. The reduction in these timeframes is due to the reduction of the decision making timeframes to 57 days. Through these provisions the authorities and other decision-makers will able to ensure that wind and solar PV development in REDZs is given priority in planning, approval and implementation. Through these provisions, the PICC, authorities and other stakeholders will able to ensure that wind and solar PV development in REDZs is given priority in planning, approval and implementation.

1.1 Renewable Energy in South Africa

The NDP highlights the need for socio-economic growth in South Africa and identifies the need for investment in infrastructure, including electricity infrastructure, in order to achieve socio-economic growth. Key to meeting the goals set in the NDP is for South Africa to have reliable and efficient energy generation at competitive rates and electricity that is environmentally sustainable. In order to achieve this the IRP 2010 -2030 was promulgated in 2011 and at the time of development and promulgation, it was envisioned that this plan would be updated and adapted to meet any changes in the country's energy scenarios (DoE, 2018). This IRP is a long term electricity generation plan for South Africa.

In August 2018, DoE published an updated draft IRP document for public comment (Table 1 and Figure 3). The updates aimed to ensure supply of electricity, minimise costs and ensure sustainable energy generation through minimal environmental impacts and water usage. The updated Plan included the development of input scenarios, credible base scale and scenario analysis, development of balanced plan and policy adjustment. The Plan also has a forecast up to 2050 as opposed to the 2010 IRP which had a forecast plan up to 2030 (DoE, 2018).

Table 1: Draft IRP 2018: Proposed Updated Plan for the Period Ending 2030 (DoE, 2018)

	Coal	Nuclear	Hydro	Storage (Pumped Storage)	PV	Wind	CSP	Gas / Diesel	Other (CoGen, Biomass, Landfill)	Embedded Generation
2018	39 126	1 860	2 196	2 912	1 474	1 980	300	3 830	499	Unknown
2019	2 155					244	300			200
2020	1 433				114	300				200
2021	1 433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1 000	1 500		2 250		200
2027					1 000	1 600		1 200		200
2028					1 000	1 600		1 800		200
2029					1 000	1 600		2 850		200
2030			2 500		1 000	1 600				200
TOTAL INSTALLED	33 847	1 860	4 696	2 912	7 958	11 442	600	11 930	499	2600
Installed Capacity Mix (%)	44.6	2.5	6.2	3.8	10.5	15.1	0.9	15.7	0.7	

Installed Capacity
Committed / Already Contracted Capacity
New Additional Capacity (IRP Update)
Embedded Generation Capacity (Generation for own use allocation)

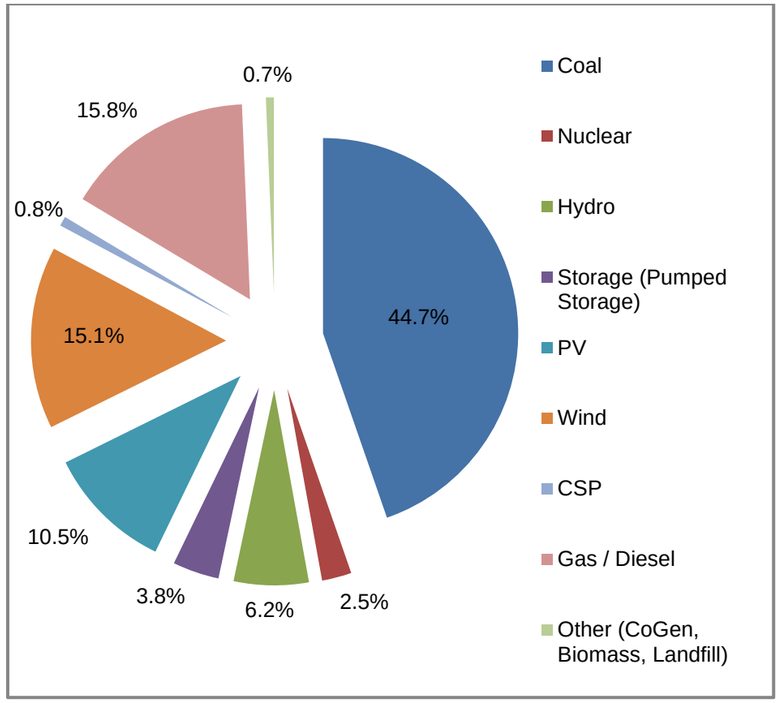


Figure 3: Graph indicating percentages of the future installed capacity mix (taking into consideration Installed Capacity as at 2018; Committed/Already Contracted Capacity; and New Additional Capacity (IRP Update)) based on the Draft IRP (DoE, 2018).

As renewables are part of the energy mix envisioned in the 2010 IRP and in the 2018 draft IRP, programmes for the procurement of new electric generation from Independent Power Producers (IPP) were drafted in 2008. These programmes allowed for the procurement of electricity from a range of generation sources, including renewables, but never resulted in any Power Purchase Agreements (PPAs) with IPPs.

The current Renewable Energy Independent Power Producer Procurement Programme (REI4P) was introduced by the Department of Energy and National Treasury in August 2011 to encourage private sector investment into renewables in South Africa. It aims to have transparent procurement that will assist with the diversification of energy as required in the IRP, 2010, while contributing to South Africa's infrastructure and socio-economic development. Under this programme, renewable energy is procured from IPPs through a competitive bidding process and total procurement targets are set in line with the IRP2010. There have been four bidding rounds between 2011 and 2015 and an Expedited Bid Window was held in November 2015. Capacities are allocated per technology type and bidding window. According to this process, IPPs submit bids to develop renewable energy projects that are evaluated 70% on price competitiveness and 30% on economic development criteria (e.g. job creation, use of locally produced goods, community ownership, and social development initiatives). The successful projects receive what is termed 'Preferred Bidder' status, and once financial closure has been reached, enter a 20 year PPA with Eskom.

South Africa's REI4P has been a successful example of transparent, competitive renewable energy procurement. To date, 6 329 MW of renewable energy has been procured in these four Bid Windows. These projects contribute to the reduction of carbon emissions by an estimated 33.2 million tons and a saving of 39.2 kilolitres of water by December 2018 (Future Growth, 2019) which is in line with meeting the target set in the NDP. To date since the

inception of the REIPPP Programme, 112 IPP projects[4] have been procured. These projects are mainly onshore wind and solar PV. A total of approximately 2.8 GW has been procured from IPPs connected to the grid (Future Growth, 2019)[5], with project investment amounting to USD 20.5bn[6].

There have been over 1500 application for EA for different RE technologies in South Africa as at July 2019 (Figure 4)

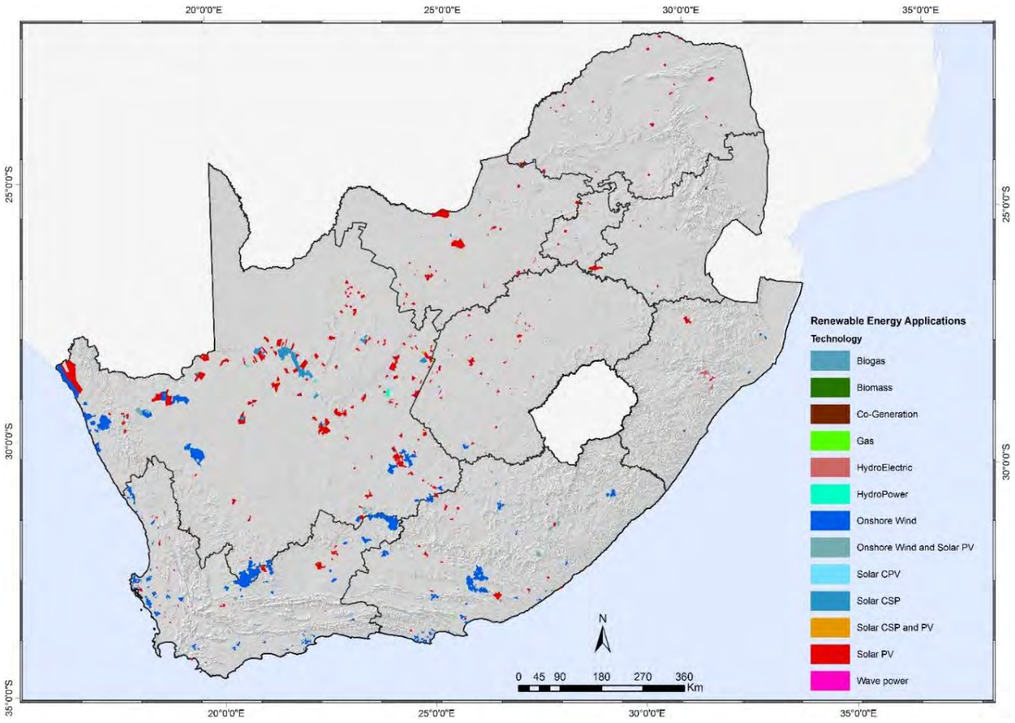


Figure 4: All submitted Renewable Energy Applications for EA as of July 2019

As a result of the competitive bidding procurement and a testament of the success of the REIPPP Programme, bid window prices have decreased. Wind technology in Bid Window 4 was priced at 68c/kWh which is a reduction from 151c/kWh in Round 1. Similarly, solar PV bid prices decreased from 329c/kWh in Round 1 to 82c/kWh in Round 4[7].

The South African Government's commitment to the roll-out of renewable energy, in combination with the overriding success of the first four rounds of the REIPPP Programme raises questions as to how the growing spatial extent of renewable energy development in South Africa can be managed strategically and sustainably. The IRP2010, draft IRP 2018 and REIPPPP do not define spatially the generation capacity allocations, which makes strategic spatial planning challenging. As illustrated in Figure 4, proposed renewable energy projects are widely distributed over most of the country. 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 programme. 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 addition, with a number of mining areas experiencing job losses as a result of mine closures, it is important to plan renewable energy development in these areas to contribute to the Just Transition to a low carbon economy. The proposed Phase 2 REDZs identify geographical areas in which large scale wind and solar PV development is considered most appropriate from a national strategic perspective.

1.2 Study Objectives

The objectives of the Phase 2 Wind and Solar PV SEA build on those identified by the first phase SEA. These include: facilitating sustainable development, enabling stakeholder participation, integration of science-based information and building an enabling environment for informed decision-making. In addition to these objectives, the Phase 2 Wind and Solar PV SEA aims to identify REDZs in previously mined areas to enable the rehabilitation of abandoned mines and to contribute towards the planning of the Just Energy Transition framework by strategically planning large scale wind and solar PV developments in areas where job losses may occur from closure of mines such as coal, diamond and gold mines.

The vision of this SEA is that more large scale wind and solar PV projects that contribute to the goals of the NDP are supported by strategic planning, endorsed by government, embraced by stakeholders, and attractive to investors. In order to create the enabling environment required to reach the envisioned future, the mission of this SEA is to identify REDZs that are of strategic importance for large scale wind and solar PV development in terms of SIP 8 and 9, and in which the significant negative impacts on the natural environment are limited and social and economic benefits to the country are enhanced. With this vision and mission in mind, the following key objectives were developed to guide both the Phase 1 and 2 SEAs.

1.2.1 Sustainable Development

A balance between environmental, social and economic factors is required for effective and sustainable development. The SEA takes a strategic and integrated approach to identifying geographical areas in which large scale wind and solar PV development would be most appropriate. Integration is achieved through utilising the best available spatial data to identify large clusters of land with the highest economic potential (i.e. highest resource potential and infrastructure availability) and lowest environmental sensitivity (i.e. fewest environmental constraints).

1.2.2 Participation

The successful continuation of renewable energy development in South Africa to a great deal depends on the level of agreement that can be reached between individual government departments, the three spheres of government, the private sector, and the public. The implementation of strategic planning and proactive initiatives to create an enabling environment for appropriate renewable energy development will require the buy-in and commitment from the key role players. Early consultation and formal agreement are thus of vital importance to the success of the SEA process. From the onset of the process, extensive consultation was undertaken with the relevant government departments, key stakeholders and the general public.

[4] Independent Power Producers Procurement Programme (IPPPP) - An Overview, 2018.
[5] https://www.ipp-renewables.co.za/
[6] Eberhard, A and Naude, R, 2017. Recommendations for the Design of Successful renewable Energy Auctions or Competitive Tenders in Africa. Lessons from South Africa.
[7] https://www.futuregrowth.co.za/newsroom/reippp-comes-of-age/

1.2.3 Integration and alignment

Once agreement has been reached, the alignment of national, provincial and local plans and policies is necessary to allow for the efficient implementation of REDZs. The alignment allowed for by the SEA starts with the designation of the REDZs as geographical areas associated with SIP 8 and 9 through a publication in the *Government Gazette*. Subsequent to the gazetting of the REDZs, provincial and local governments will be required to consider these areas for inclusion in the relevant spatial plans and policies. Further alignment in terms of national and local infrastructure development plans, especially the electricity grid, will create an enabling environment for development in these areas.

The alignment of all SEAs undertaken in support of the SIPs also caters for the integration of large scale strategic infrastructure development at a national level, as is intended by the SIP programme. An example of such alignment is the incorporation of the proposed REDZs as an output of this SEA into the Electrical Grid Infrastructure (EGI) SEA[8], commissioned by the DEA in support of SIP 10, to make provision for the development of the transmission infrastructure required for the success of the REDZs.

1.2.4 Enabling Environment

Without compromising environmental protection, the integrated approach followed to identify the REDZs, official agreement to these areas, and the alignment of policies and plans to create an enabling environment, ultimately allowing for the streamlining of development and approval processes. The scoping level pre-assessments undertaken in the REDZs are sufficient to meet the requirements of the scoping phase of a Scoping and Environmental Impact Assessment (S&EIA) process and to focus project level environmental assessments on those potential impacts that are of significant importance. With the scoping requirements being met, all future proposed wind and solar PV projects that require environmental authorisation in an adopted REDZ only require a Basic Assessment. The potential significant impacts that require assessment, as well as the level to which they need to be assessed during the BA process, will be informed by the identified sensitivities and associated protocols developed through the SEA process.

1.2.5 Contributing to planning for a Just Transition towards a low carbon, climate resilient economy and society

Meeting the country's climate change objectives and transitioning to a low carbon economy will present challenges. In addition, the South African economy is highly dependent on minerals and fossil fuels. The term Just Transition is a framework developed by trade unions which identifies key interventions needed to ensure job security for workers in carbon heavy and declining economies. This Just Transition must identify key sectors and outline a vision which places eradicating poverty at the helm of this vision. This SEA aims to contribute toward the discussion on a Just Transition by identifying REDZs in areas where there is previously mined land. The rationale behind this is that in these areas, RE developments would contribute towards job creation and assist with rehabilitation of previously mined areas. Furthermore, many of these areas are close to the Gauteng area which has the highest electricity demand. It is important to note that these REDZs in mining areas might not present areas with the best wind and solar resource, but present the areas with an optimal combination of factors such as competitive resource, low environmental sensitivities and areas where renewable energy could contribute in the creation of jobs lost in the coal and other mineral mining sectors.

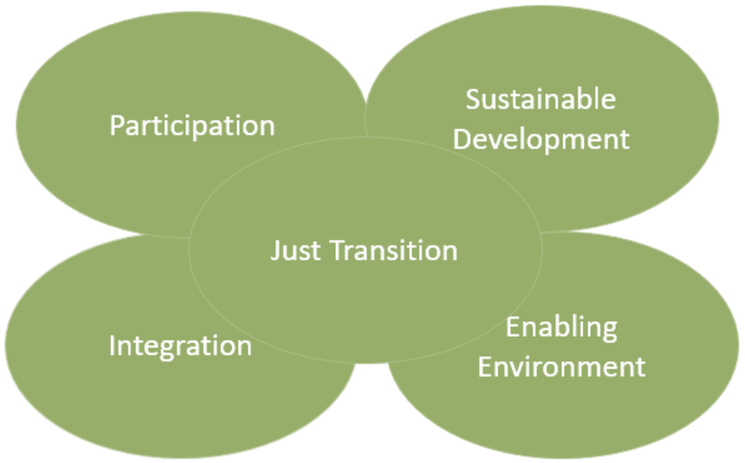
1.3 Legal Framework

The three key pieces of legislation that enable the identification and implementation of REDZs are summarised below:

1.3.1 National Environmental Management Act (NEMA), Act no. 107 of 1998

NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance, and procedures for co-ordinating environmental functions exercised by organs of state.

The SEA is undertaken under section 24(2) of NEMA which allows for the identification of geographical areas (e.g. REDZs) based on environmental attributes, and specified in a spatial development tool adopted in the prescribed manner by the competent authority, in which specified activities may not commence without environmental authorisation from the competent authority. Sensitivity maps prepared as part of the SEA process give effect to Section 24(3) of NEMA that allows for the compilation of information and maps that specify the attributes of the environment that need to be taken into consideration by all competent authorities.



1.3.2 Infrastructure Development Act, Act no. 23 of 2014

This act provides for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the country. It ensures that infrastructure development in the country is given priority in planning, approval and implementation. It furthermore ensures that the development goals of the state are promoted through infrastructure development and improves the management of such infrastructure during all life-cycle phases. The act designates the development of green energy in support of the South African economy as SIP 8 and gives the PICC the mandate to ensure that infrastructure development in respect of any SIP is prioritised.

[8] https://egi.csir.co.za/

The official adoption of the Phase 2 REDZs as geographical areas associated with SIP 8 and 9 will give effect to Sections 7 and 8 of this act and give the PICC the mandate to give priority to the planning, approval and implementation of wind and solar PV development in REDZs.

1.3.3 Spatial Planning and Land Use Management Act (SPLUMA), Act no. 16 of 2013

SPLUMA as a framework act for all spatial planning and land use management legislation in South Africa seeks to promote consistency and uniformity in procedures and decision-making in this field. The other objectives of the act include addressing historical spatial imbalances and the integration of the principles of sustainable development into land use planning, regulatory tools and legislative instruments.

Chapter 8 of the 2017 draft SPLUMA regulations prescribes the institutional, spatial planning, and land use management requirements for municipalities in whose jurisdiction a SIP has been designated. If this section remains in the final regulations the designation of the REDZs as areas associated with SIP 8 and 10 will give effect thereto and require local government to take these areas into consideration in terms of local planning.

1.4 Process Overview

This section provides a brief summary of the process followed to identity the three Phase 2 Wind and Solar PV SEA REDZs. This will be discussed in detail in Parts 2 and 3 of the SEA report.

1.4.1 Context

The SEA process attempts to add spatial context to national level policies, plans and programmes. In particular, it can be considered as a link between the objectives of the NDP, NIP and IRP 2010, draft IRP 2018 and individual projects. As a result of the spatial guidance on placement of renewable energy projects (identification of REDZs), the SEA will allow for proactive investment in areas of low environmental sensitivity as well as faster and more coordinated permitting procedures. It must be noted that the SEA process is undertaken at a strategic level and cannot replace the requirement for project level environmental assessment.

1.4.2 Extent

The extent of assessment for both wind and solar PV for the SEA was at a national level. The WASA3 interim wind resource data dataset was used as the base wind resource data and the Geosolar dataset was used as the Solar PV base solar resource data (Figure 5 and Figure 6).

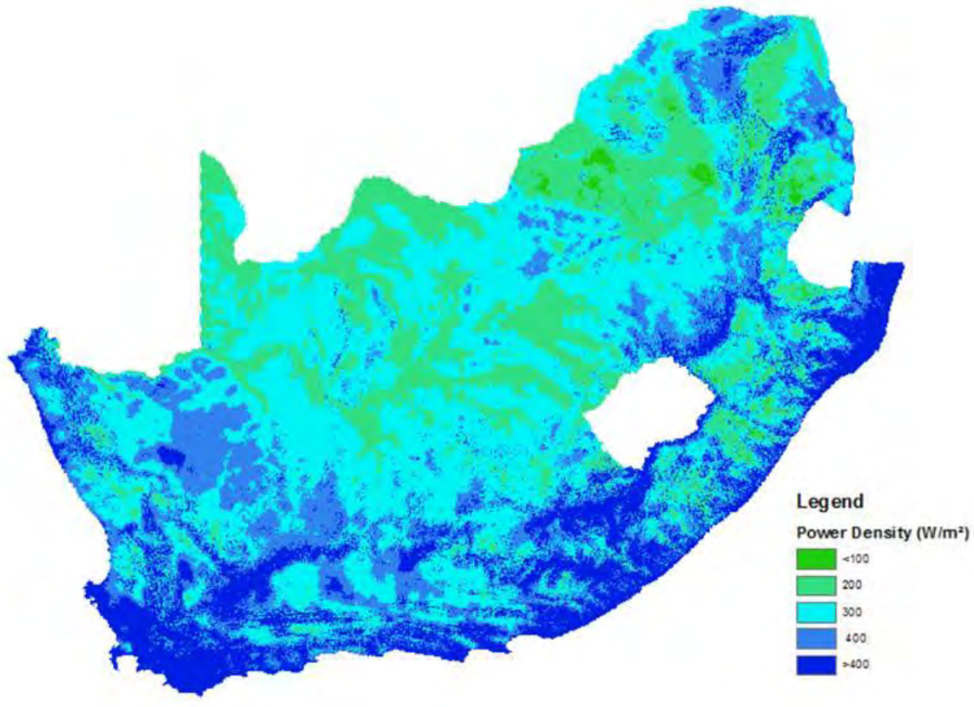


Figure 5: Extent of wind assessment

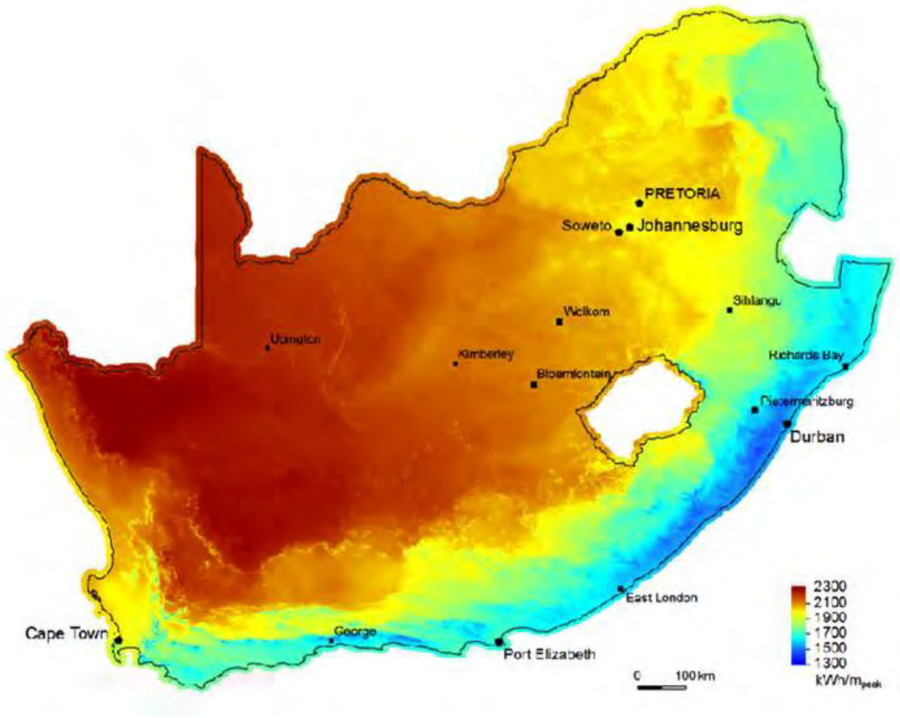


Figure 6: Extent of Solar PV assessment

1.4.3 Phase 1

The first phase of the SEA involved the mapping of high resource areas and a combination of other technical areas discussed with members of SAWEA and SAPVIA which determine good locations for renewable energy projects. The key technical criteria used for identifying these areas were:

Solar PV technical criteria:

- areas with PV yield (single axis tracking) above 1850 kWh/kWp and within municipalities with clusters of previously mined land
- areas with PV yield (single axis tracking) above 1850 kWh/kWp and within 50km of the solar PV projects selected in round 1 to round 4b of the REIPPPP
- areas with PV yield (single axis tracking) above 1850 kWh/kWp and within 50km of the solar PV projects with an approved EA from DEA
- areas with PV yield (single axis tracking) above 1850 kWh/kWp and within the EGI corridors.

Wind technical criteria:

- areas with power density above 250 W/m² and within 50km of the projects selected in round 1 to round 4b of the REIPPPP
- areas with power density above 250 W/m² and within 50km of the projects with an approved EA from DEA
- areas with power density above 250 W/m²and within the power corridors identified for the expansion of the strategic grid infrastructure
- areas with power density above 250 W/m² and within 35km of MTS substations identified in the TDP and GCCA2017 datasets.

The second task in phase 1 involved mapping out the environmental features of critical importance which represent key environmental features with relevant buffers that are considered not available for wind and/or solar PV development were mapped. These included National Parks, known Cape Vulture Colonies and associated buffers, and key bat roosts (An exhaustive list of features can be found in Part 2 and 3 of this SEA report).

The outcomes of the phase 1 analysis was remaining areas with best resource and key environmental sensitive areas excluded (Figures 7 and 8).

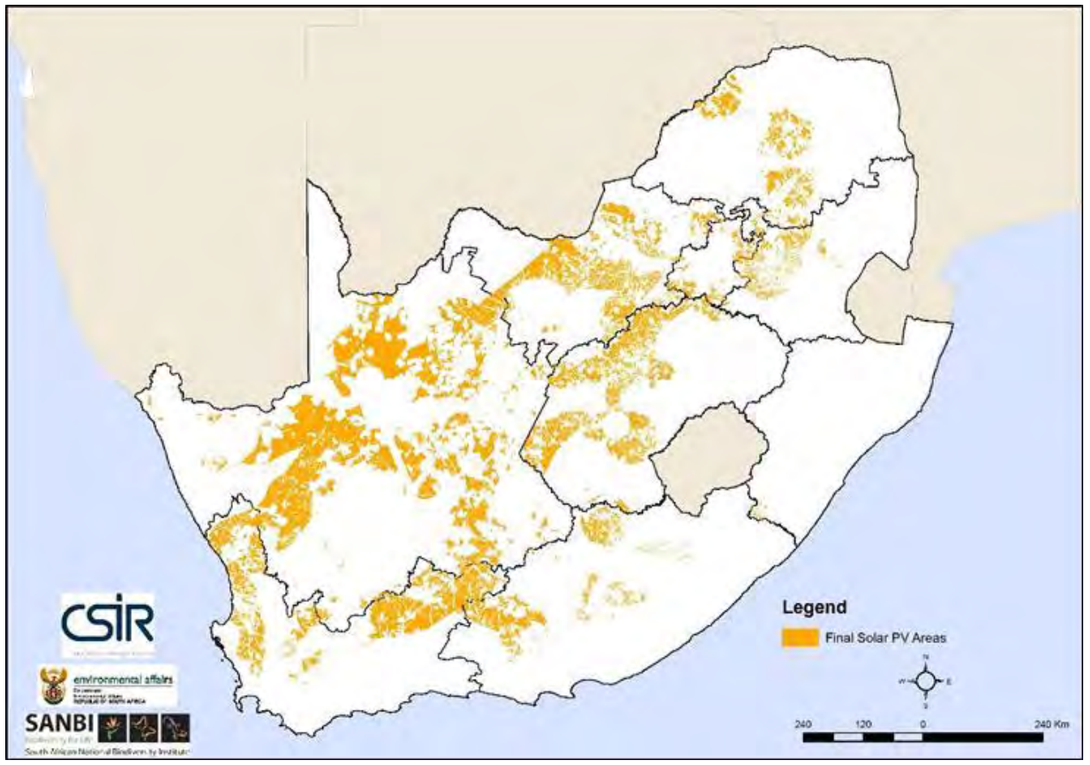


Figure 7: Outcomes of Solar PV Phase 1 Mapping

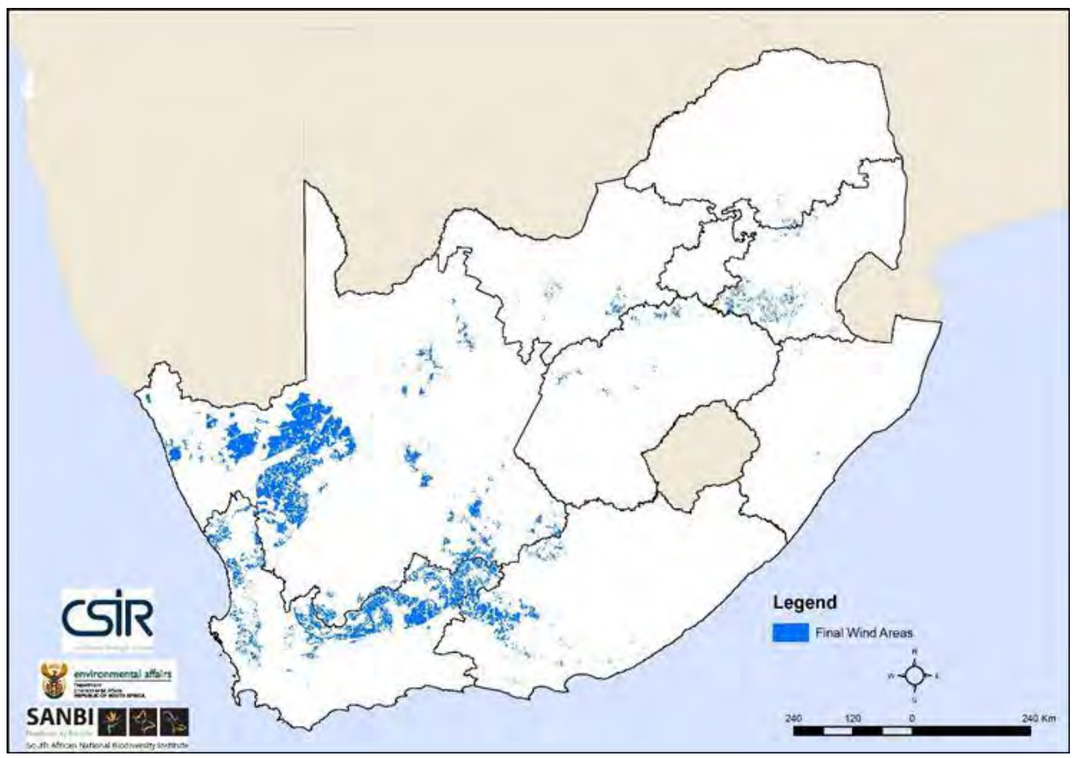


Figure 8: Outcomes of Wind Phase 1 Mapping

1.4.4 Phase 2

Phase 2 of the SEA involved consultation with industry on input via a survey of where future development, from the industries' perspectives, should be prioritised. The priority areas identified were aggregated and overlayed with the outcomes of Phase 1 and used to identify the eight focus areas.

The second task under phase 2 was to map all key mining and industrial municipalities. These were overlayed with the outcomes of Phase 1, inputs from public comments and results of the industry survey to create the focus areas for assessment in the Phase 2 Wind and Solar PV SEA (Figure 9). Some focus areas are for solar only, some for wind only, and one is for wind and solar.

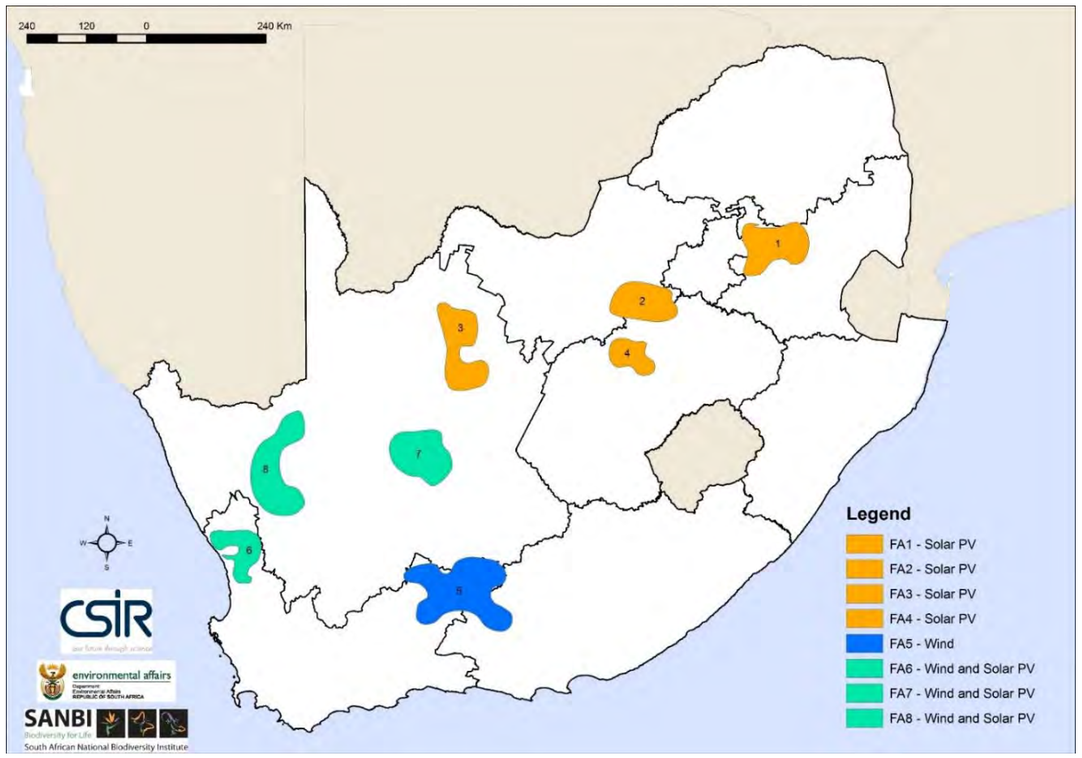


Figure 9: Phase 2 Wind and Solar PV SEA Focus areas for assessment

1.4.5 Phase 3

Phase 3 of the study involved scoping level pre-assessments and sensitivity mapping in each of the eight focus areas. Scoping level assessments were undertaken using latest available datasets. These assessments were undertaken for agriculture, landscape, heritage, terrestrial and aquatic biodiversity, birds, and bats. Further aspects of sensitivity in terms of aviation, defence, telecommunication, weather services, SKA, noise and flicker effects with their respective buffers were determined based on the phase 1 SEA and in consultation with the relevant authorities for updated datasets and buffers.

1.4.6 Phase 4

This Phase of the SEA involved collating industry comments on which of the 8 REDZs is most suitable for use based on their monitoring data and RE plans. Industry submitted rankings of the focus areas from most to least preferred. In addition to this, the SEA team reviewed the outcomes of the scoping level specialist assessments and highlighted key environmental impacts of all the focus areas. Based on industry prioritisation, outcomes of specialist studies and the need to centre the REDZs in previously mined areas, three new REDZs are recommended. The intention is that these REDZs are taken to Cabinet for gazetting. The final step was to use cadastral land boundaries to delineate the exact boundary of the three additional REDZs (Figure 10). These are referred to as FA9 Emalahleni (solar PV), FA10 Klerksdorp (solar PV) and FA5 Beaufort West (wind).

1.4.7 Additional information

1.4.7.1 Consultation Process

The SEA process was governed by a Project Steering Committee (PSC) consisting of key authorities relevant to renewable energy development in South Africa. The process was also informed by an Expert Reference Group (ERG) consisting of key stakeholder groups with an interest in renewable energy development. Further, in the initial process of the SEA when determining key technical and environmental criteria, the SEA had technical and environmental working group meetings. There was a dedicated website where stakeholders could engage with any information uploaded.

District and local municipalities in the focus areas were also consulted through a government roadshow which aimed to inform authorities of the SEA process and the results the REDZs will have on relevant municipalities. In total three such workshops with local governments were undertaken by the SEA team and in collaboration with provincial government. In addition, the SEA had two rounds of public consultation on draft focus areas through the SEA website which was used to house all relevant information on the SEA process. The SEA has been presented at seven conference/workshops over the period 2017 to 2019.

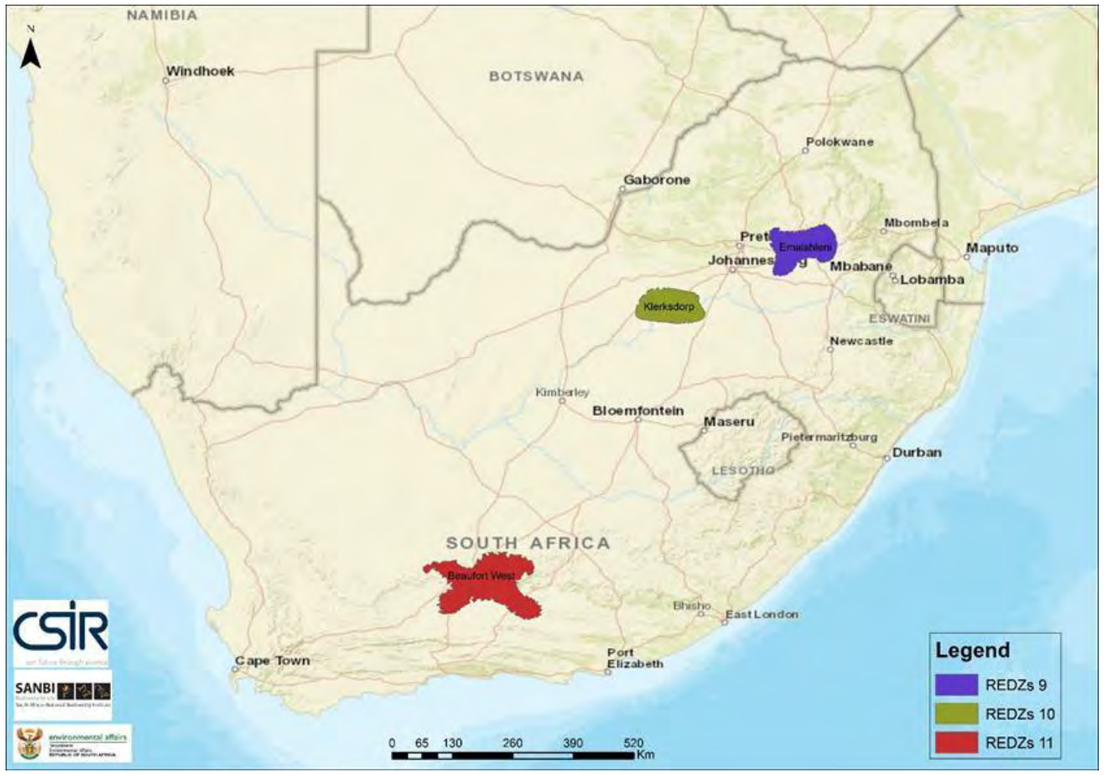


Figure 10: Final proposed REDZs

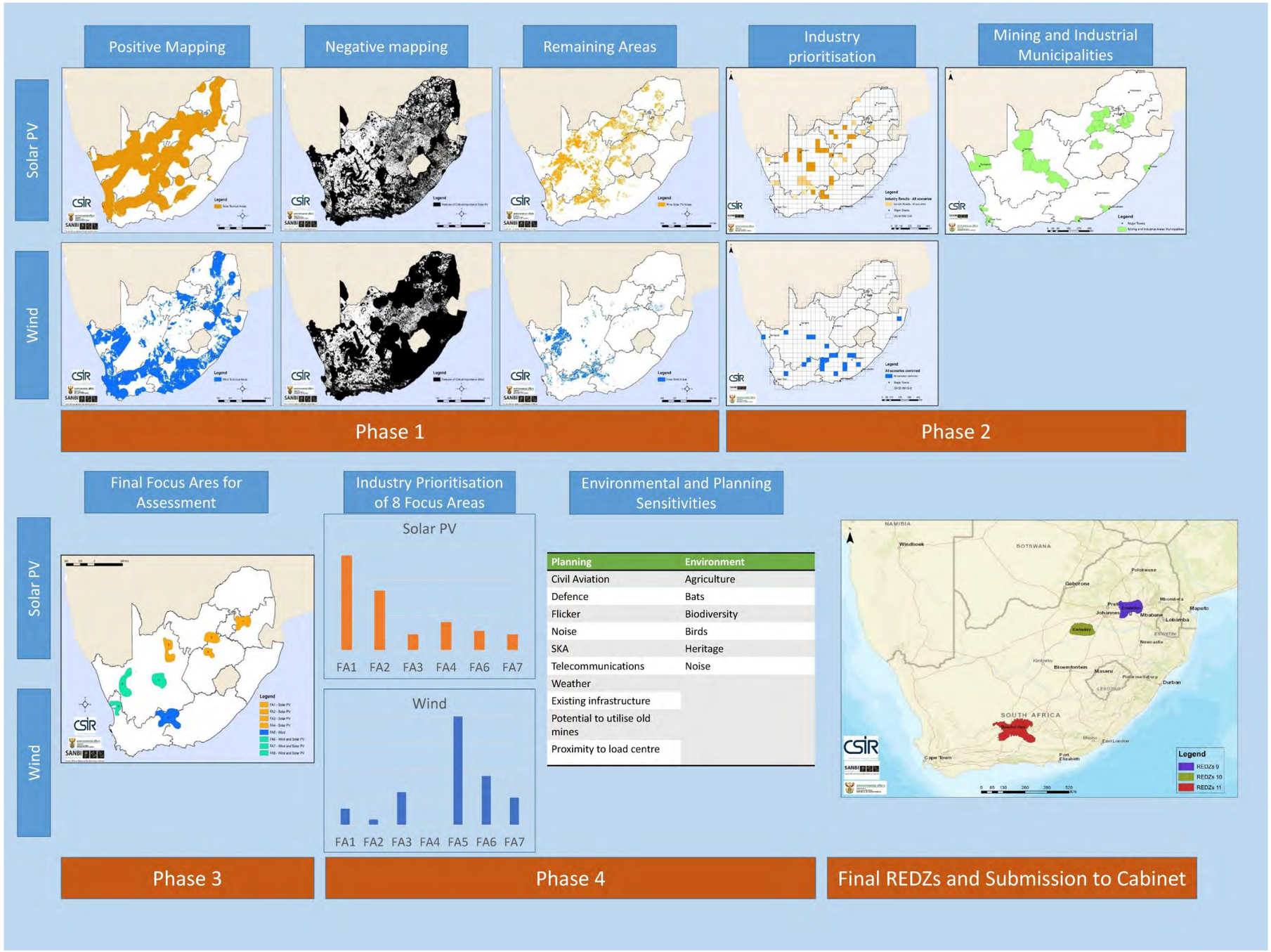


Figure 11: SEA process diagram

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

PART 2

IDENTIFICATION OF THE WIND AND SOLAR PV FOCUS AREAS

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
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FIGURES

INTRODUCTION

This section of the report describes the process undertaken to identify the three REDZs to be taken to cabinet as part of the outcomes of the SEA. The SEA was based on the latest available data at the time and the approach was in line with the study objectives outlined in Part 1 of this report. As noted in Part 1 of the report, the SEA consisted of four Phases. These will be discussed in detail in this chapter.

PART 2. IDENTIFICATION OF FOCUS AREAS

Phase 1 of the SEA consisted of a process to determine the best resource areas for wind and solar PV energy, the most suitable areas from technical and engineering perspectives and identifying the most environmentally sensitive areas in the country.

Phase 1 consisted of two tasks. The first task was to determine the areas in the country best suited for large scale wind and solar PV developments based purely on technical criteria. As wind and solar resource is one of the most important drivers for large scale wind and solar PV developments, resource was considered fundamental criteria for the identification of the REDZs. Other technical criteria for solar PV in this task included the identification of projects within 50km of solar PV projects with approved Environmental Authorisations from DEA, areas within 50 km radius of solar PV projects which have been selected as preferred bidders in REI4P Rounds 1 – 4b, the location of the gazetted Electricity Grid Infrastructure Corridors, and all municipalities where mining and industry (e.g. Industrial Development Zones) are key sectors.

For wind, other technical criteria besides resource included areas within 50km of wind projects with approved Environmental Authorisations from DEA, wind projects all projects within 50 km radius which have been selected as preferred bidders in REI4P Rounds 1 – 4b, the location of the now gazetted Electricity Grid Infrastructure Corridors and areas within 35km of MTS substations identified in the TDP and GCCA2017 datasets.

Thereafter, all environmental features considered being of critical importance and that should be avoided or are incompatible with REDZs, were delineated in consultation with the environmental working group. The list of features considered to be of critical importance will be discussed in more detail in the negative mapping section of this chapter. Other technical criteria such as distance from main roads and slopes were not considered as industry confirmed these were not key determining factors for the placement of RE developments.

Through a combination of positive and negative mapping, it was possible to delineate study areas. The positive and negative mapping exercises were undertaken for the specific purpose of identifying study areas that could be further assessed during the SEA process and the results are not suited for decision making outside the SEA context.

2.1 Positive Mapping

2.1.1 Wind and Solar Resource

Resource potential is considered the most important criterion for the determination of development potential because it is one of the key factors influencing the cost of renewable energy, and hence the macro-economic benefits to the country.

For the wind analysis, the power density in watts per square metre (W/m^2) at 100 m hub height as modelled by the Wind Atlas for South Africa (WASA) project at a 250 m raster resolution was used as the raw resource potential data (Figure 1). All wind areas with values above 250 W/m^2, which is equivalent to a wind speed of above 6m/s for all the 100m height recordings was considered the acceptable wind resource value for competitive wind projects. Power density was used instead of wind speed because it takes into consideration the effect of air density which is not accounted for in the wind speed dataset. The updated WASA High-Resolution Wind Resource Map was released in October 2017 and was modelled using the Wind Atlas Analysis and Application Programme (WAsP) Resource Mapping System with WAsP engine version1. This latest WASA dataset was an improvement from the 2014 dataset as the extent of modelling improved from the coastal provinces to include the entire country. The data covers all nine provinces and an area of about 1,221,000 km^2.

As it is a modelled dataset, it is important to note that the dataset was designed specifically for planning purposes and not for on-site design, development and detailed assessments which would still require on-site wind monitoring. To limit the impacts of potential data inaccuracies the industry was also afforded the opportunity to provide inputs with regard to which areas should be prioritised for development. It is assumed that accurate resource data as measured by the industry would have been taken into consideration when preparing these inputs.

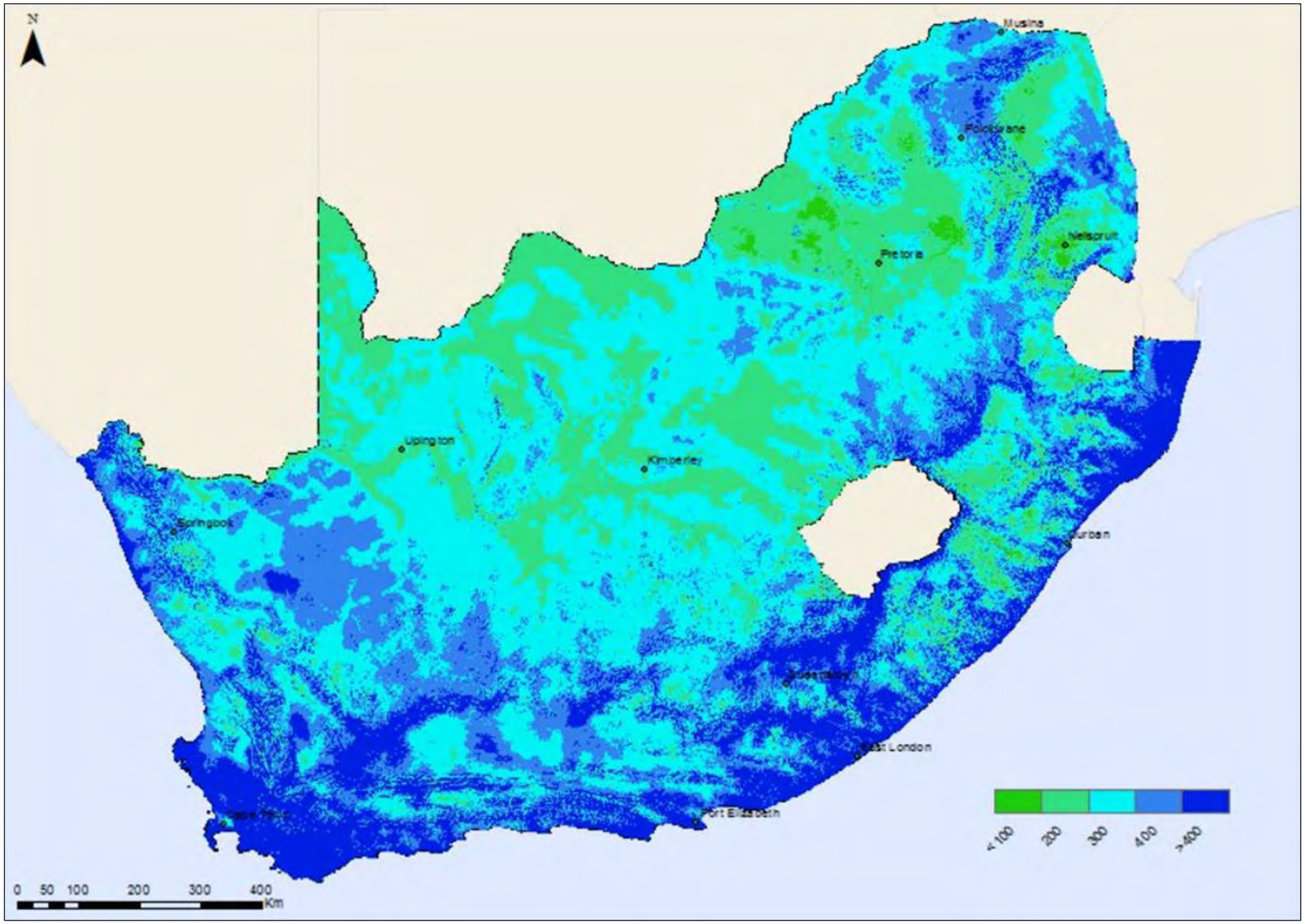


Figure 1: Wind power density in watts per square metre (W/m^2) at 100 m hub height as modelled by the WASA project at a 250 m raster resolution (2017 WAsP).

For the solar PV analysis the Solar Global Horizontal Irradiation (GHI) with PV yield (single axis tracking) in kilowatt hour per kilowatt peak kWh/kWp as modelled by GeoModel Solar at a 250 m raster resolution was used as the raw resource potential data (Figure 3). This dataset measures the power produced by single axis panels and the power the panels achieve under full solar radiation. This was considered the best dataset to use for the SEA to

identify high development potential soar PV areas. All areas with PV yield of above 1850 kWh/kWp were considered acceptable.

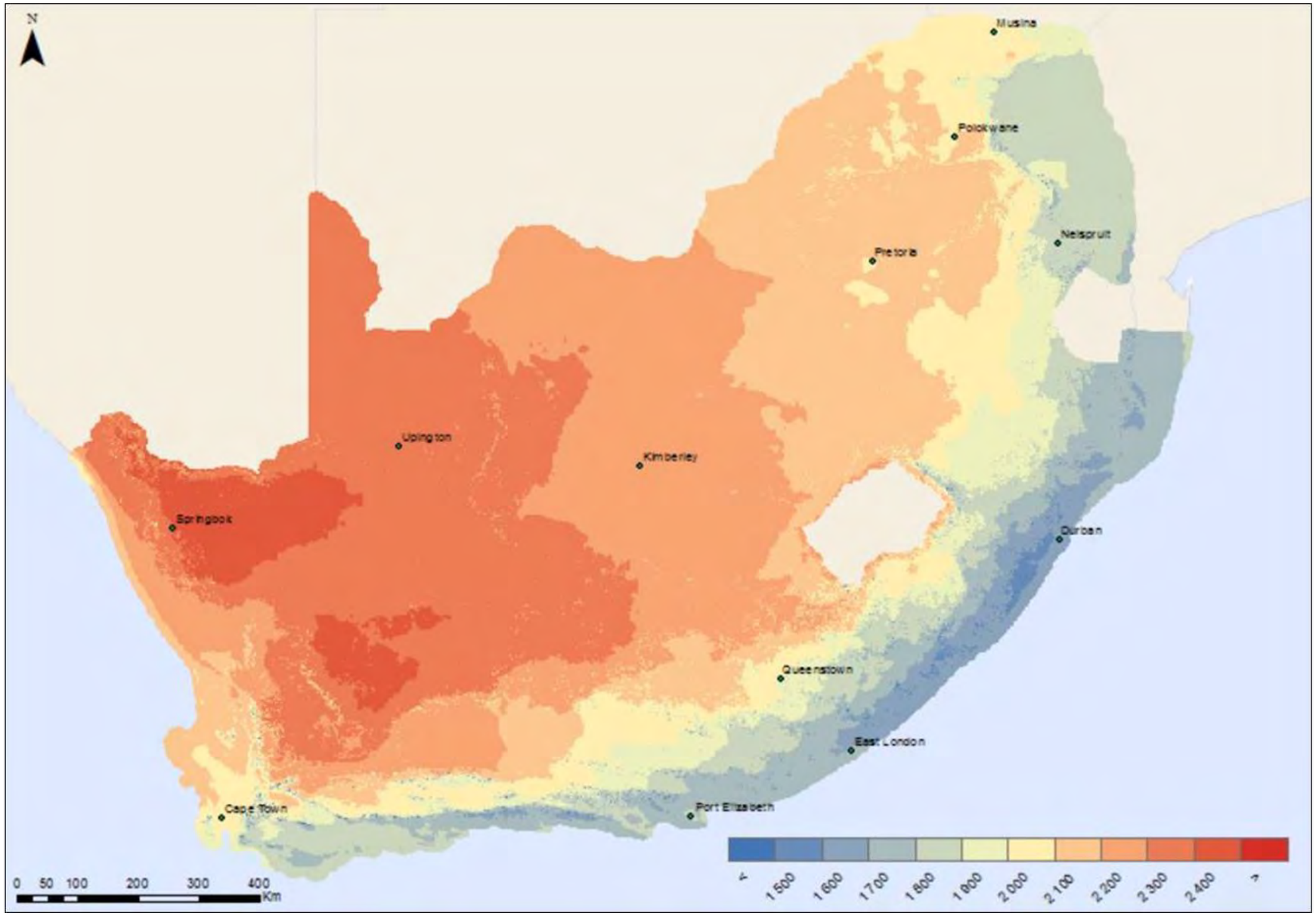


Figure 2: Solar Global Horizontal Irradiation (GHI) in kilowatt hours per square metre per annum (kWh/m²/a) at a 250 m raster resolution

2.1.2 Other criteria used

This section conveys the other criteria used to determine the most suitable areas for wind and solar PV developments in South Africa from a technical and strategic planning perspective.

2.1.2.1 Within 50 km of projects selected in REI4P rounds 1 to 4b

The Department of Energy and National Treasury introduced the current Renewable Energy Independent Power Producer Procurement Programme (REI4P) in August 2011 to encourage private sector investment into renewables in South Africa. It provides a transparent procurement framework that will assist with the diversification of energy as required in the IRP (2010), while contributing to South Africa's infrastructural and socio-economic development. There have been four bidding rounds between 2011 and 2015 and an Expedited Bid Window was held in November 2015. It is important to have REDZs located where projects with preferred bidder status are found as this indicates areas with competitive resource, as well as areas where a number of RE projects are in close proximity in order to support strategic planning and upgrades of electricity infrastructure in these areas. The distance of a 50 km radial buffer was chosen as RE projects that are part of the REI4P have to ensure that their contribution toward socio-economic and enterprise development must be within 50 km of the proposed project. The outcomes of the resulting areas with both suitable resource and proximity to selected REI4P projects can be seen in Figure 3 and Figure 4.

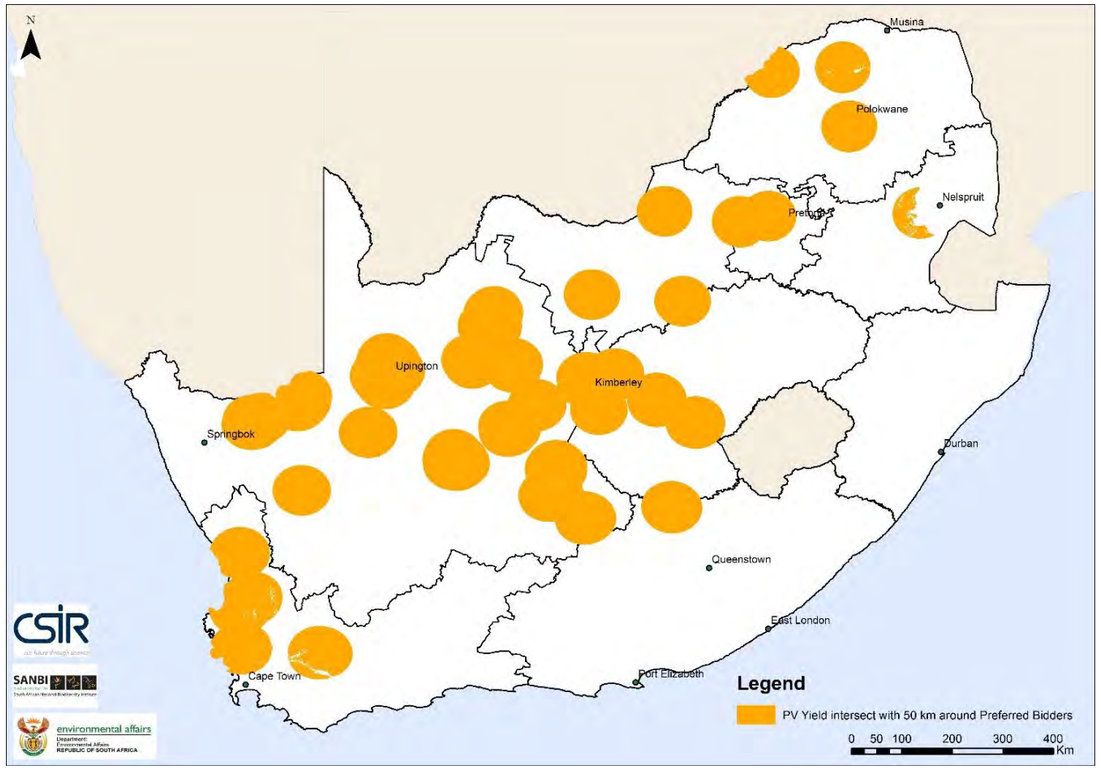
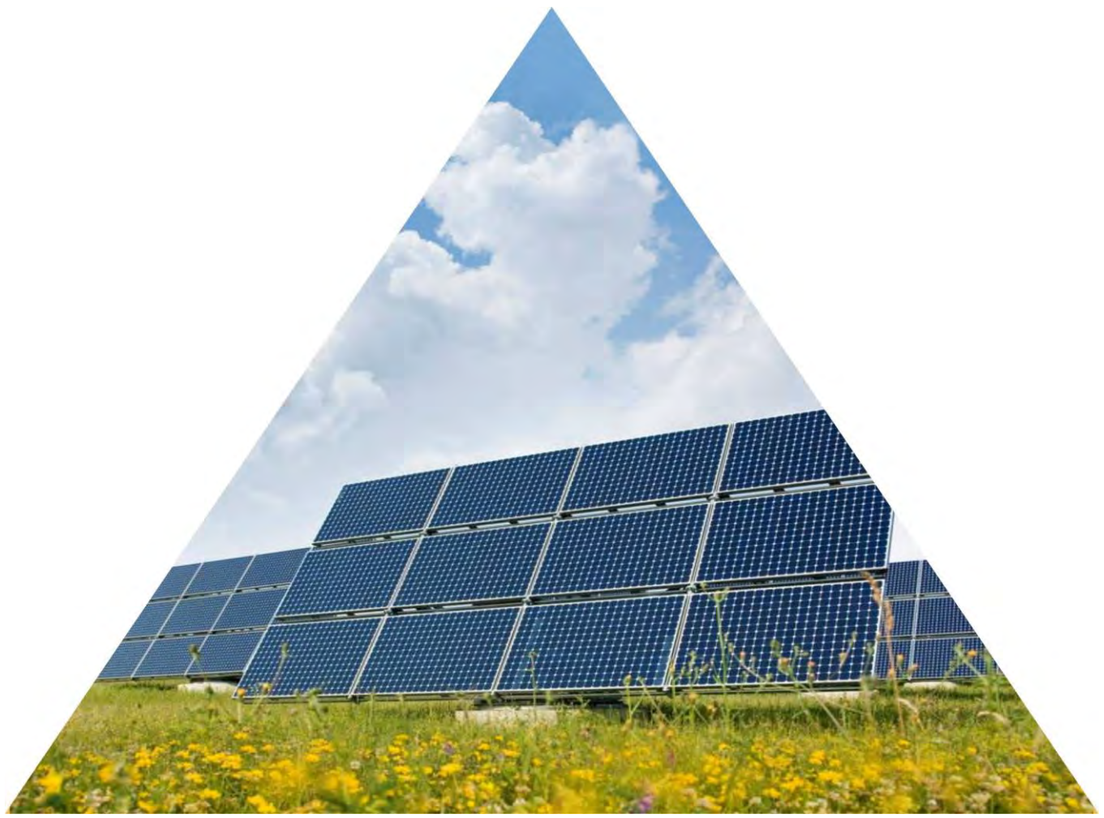


Figure 3: Areas with PV yield (single axis tracking) above 1850 kWh/kWp and within 50km of the solar PV projects selected in Round 1 to Round 4b of the REIPPPP



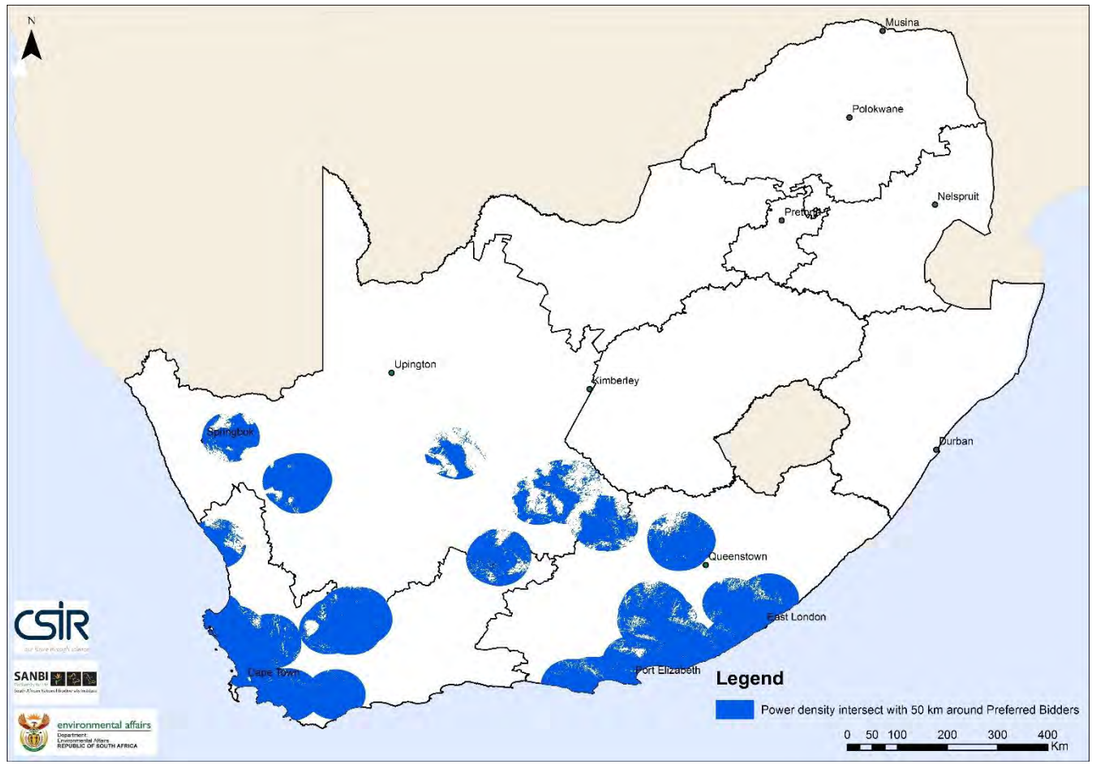


Figure 4: Areas with power density above 250 W/m² and within 50km of the projects selected in Round 1 to Round 4b of the REIPPPP

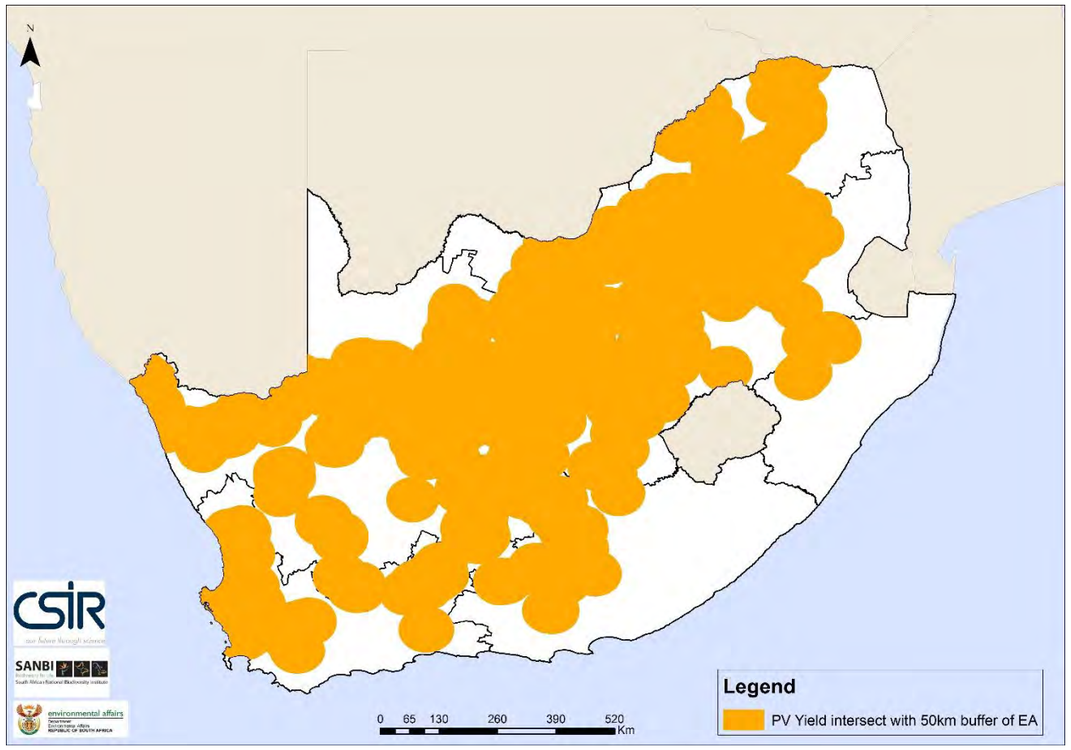


Figure 5: Areas with PV yield (single axis tracking) above 1850 kWh/kWp and within 50km of wind projects with an approved EA from DEFF

2.1.2.2 Within 50 km of the wind and solar PV projects with an approved EA from DEFF

The DEFF RE application map indicates where all applications for Environmental Authorisation for wind and solar PV projects have been submitted to the department (up to July 2018). The project team used this information to identify all the wind and solar PV projects that have received EA. As with the preferred bidder status projects, this mapping is a good indication of areas with good resource and areas where there are minimal environmental fatal flaws, given that thorough environmental assessment processes have been followed (including on-site monitoring and public consultation) and positive authorisations issued. These projects were mapped with a 50 km radial buffer and the outcomes can be seen in applications was produced.

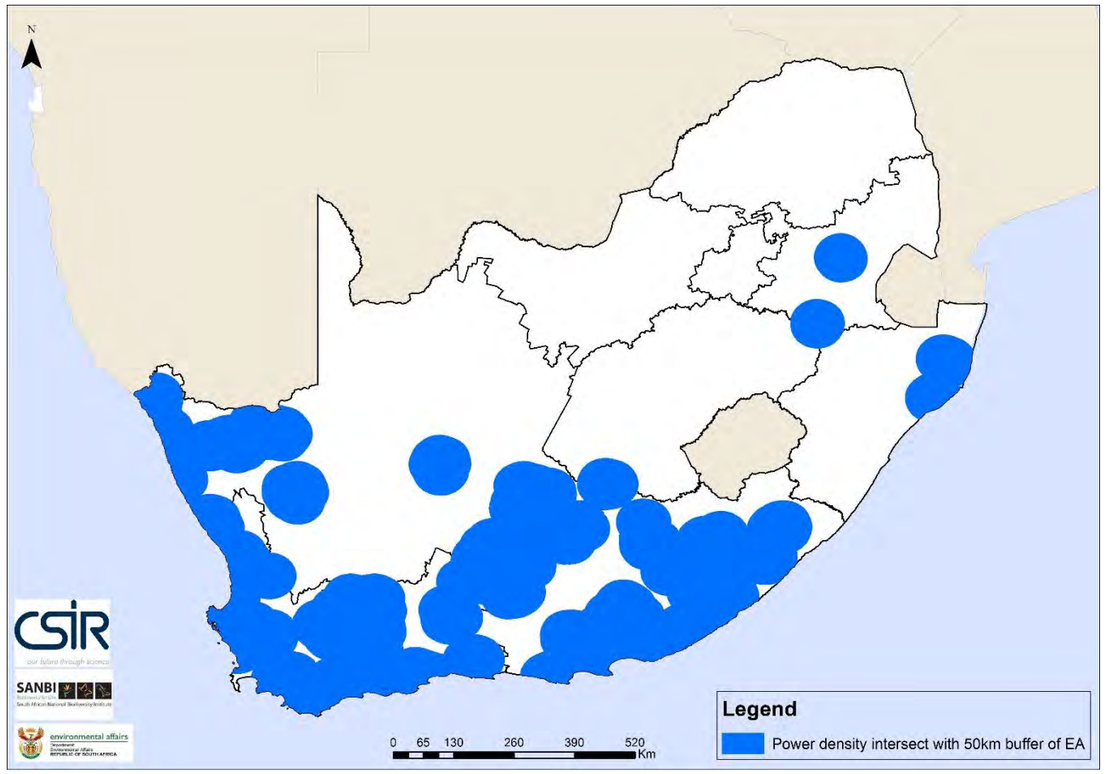


Figure 6: Areas with power density above 250 W/m² and within 50km wind projects with an approved EA from DEFF

2.1.2.3 Areas within the EGI corridors

A reliable electricity transmission network with adequate capacity to meet customer needs is a fundamental condition for the provision of reliable electricity supply in South Africa. To remain reliable, the transmission system requires not only maintenance, but must also be developed and expanded to meet changing electricity demand and energy generation requirements. The Electricity Grid Infrastructure (EGI) SEA identified the optimal location for strategic corridors where transmission infrastructure expansion is needed to enable the regionalised balancing of future demand and supply requirements, whilst minimising negative impacts to the environment. The corridors are referred to as the "Power Corridors" and represent the transmission backbone of South Africa up to 2040.

These corridors were gazetted in February 2018 and are important to inform where large scale renewable energy developments should occur in the country, as electric infrastructure in these areas is strategically important from a grid development perspective. The outcomes of the intersection of resource and EGI corridors can be seen in Figure 7 and Figure 8.

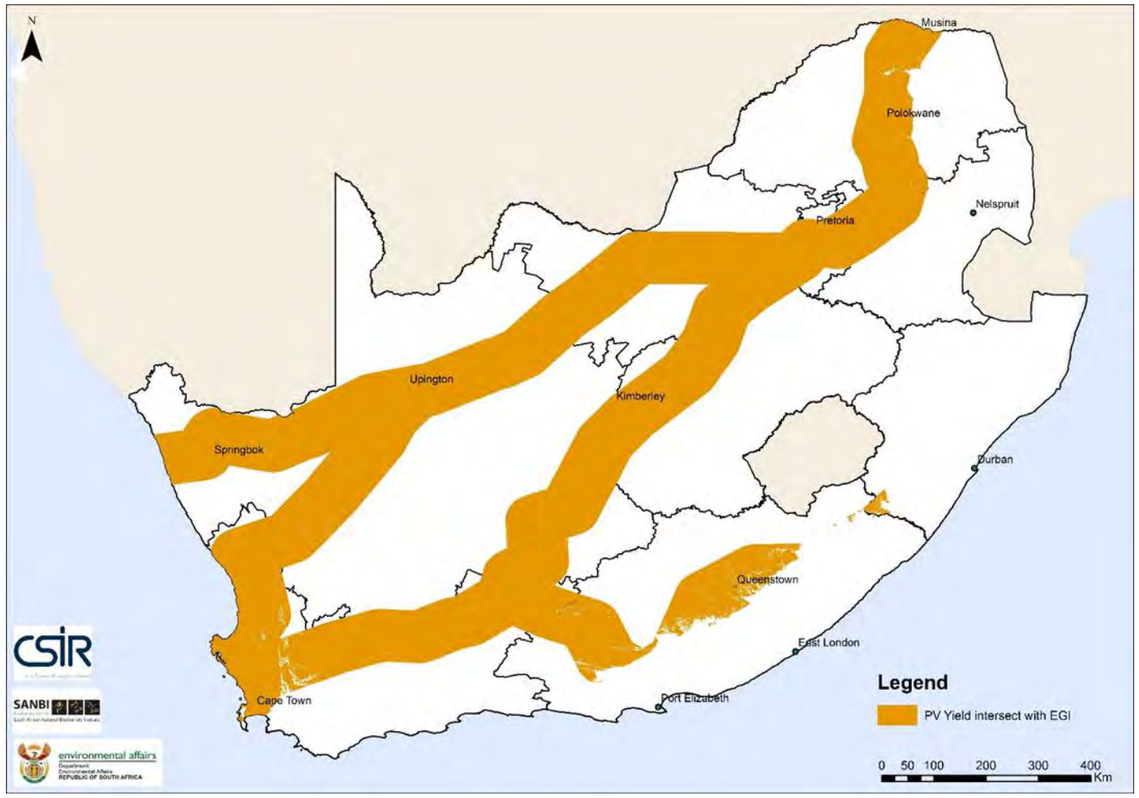


Figure 7: Areas with PV yield (single axis tracking) above 1850 kWh/kWp and within the power corridors identified for the expansion of the strategic grid infrastructure

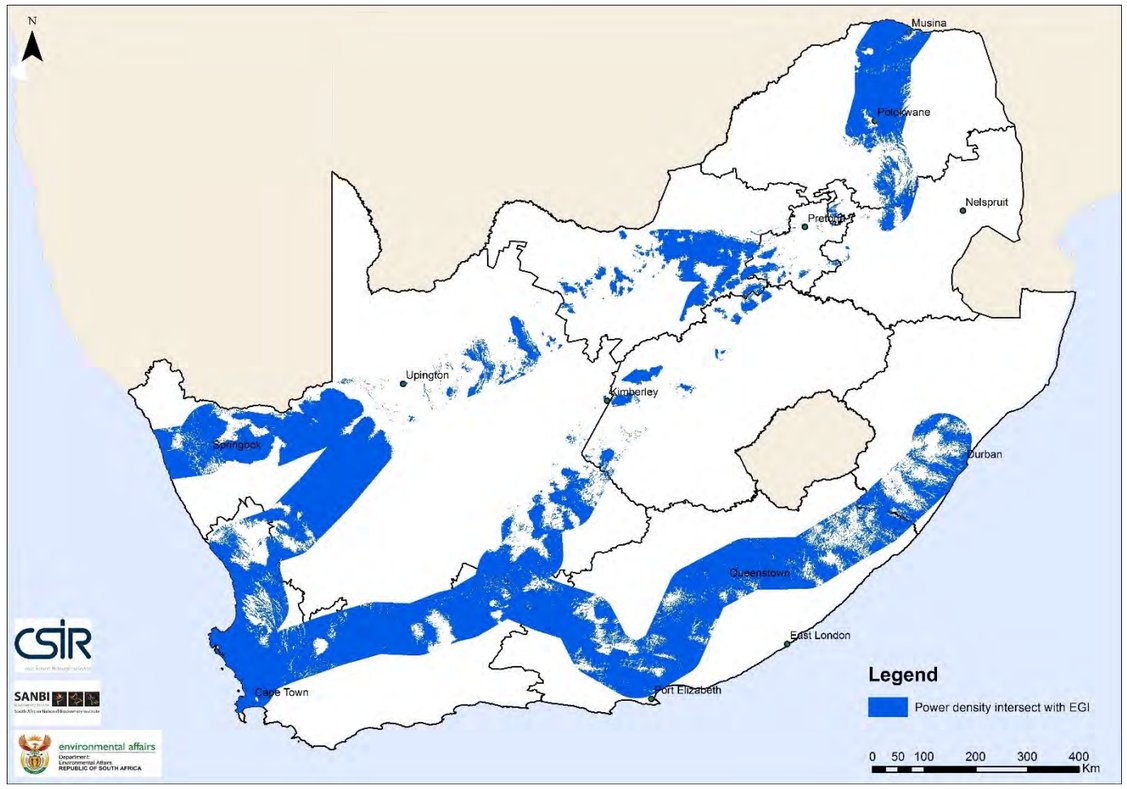


Figure 8: Areas with power density above 250 W/m²and within the power corridors identified for the expansion of the strategic grid infrastructure

2.1.2.4 Areas with PV yield (single axis tracking) above 1850 kWh/kWp and within municipalities with clusters of previously mined land and priority industrial zones

Mining Areas

The identification of areas in the country with previously mined land as possible areas for the development of large scale RE was one of the key objectives of this SEA. Previously mined land is defined in this SEA as any municipality that has mining areas, especially previously mined areas (as represented by abandoned and closed mines), and where mining is one of the key economic drivers for the municipality.

In 2017, Eskom announced the closure of five of its coal mines as a result of these mines coming to the end of their productive life. Mine closures have a number of negative environmental and socio-economic impacts. The closure of mines in South Africa is linked to a number of key drivers, namely:

- IRP (2010) announcement of decommissioning of coal mines which are coming to the end of commercial and operational life;
- IRP (2010) recognition of RE as an increasingly important component of the national energy mix, and reduced role of coal in the energy mix;
- South Africa ratifying a number of climate change policies aimed at the reduction of Greenhouse gasses; and
- Other mines (e.g. diamonds and gold) coming to the end of their operational life.

With the closure of mines, the negative impacts must be anticipated and mitigated. RE can contribute towards the rehabilitation of previously mined areas from an environmental and a socio-economic aspect. The term “Just Transition” is a framework developed by trade unions which identifies key interventions needed to ensure job security for workers in carbon heavy and declining economies. A Just Transition, or “Just Energy Transition”, must identify key sectors and outline a vision that places eradicating poverty at the helm of this vision. The Department of Energy has a presidential task team on climate change who are tasked with overseeing the development of a plan for the Just Transition process for the country.

Research by the CSIR Energy Centre has indicated that a policy decision in the REI4P will be needed to encourage IPPs to build projects in Mpumalanga. This is because the energy from a project built in Mpumalanga may be more expensive as a result of better resource in other places in the country such as the Northern Cape. The additional cost could be mitigated partially by the project being close to infrastructure such as substations, transmission lines and roads that could be under-utilised due to mine closures. Furthermore, other benefits include the re-use and rehabilitation of previously mined land; and contributing toward mitigation of impacts on people such as through new job creation in the RE sector.

Industrial Areas

Certain areas in South Africa have been identified through national and provincial planning initiatives as either being of priority for the development of renewable energy projects or for renewable energy related manufacturing industries. Such areas include the solar and wind corridors identified in the Northern Cape Province, the proposed Special Economic Zones (SEZs) for renewable energy manufacturing in Atlantis and Upington, as well as the existing Industrial Development Zones (IDZs) at ports such as Saldanha, East London, Ngqura (at Coega), Durban and Richards Bay at which components can be imported or manufactured.

In this study, renewable energy development in and around these priority areas is promoted to support the proposed manufacturing industries. Development in the vicinity of these areas would also reduce the requirement for road transportation of large components from these importation or manufacturing hubs to project sites.

This SEA has identified mining and industrial municipalities and included these areas in the pull factors for where solar PV should be located (Figure 9). This analysis was only done for solar PV because solar resource is available at suitable yields over a wider area and the distribution of competitive wind resource is constrained. In addition, for rehabilitation of mining land purposes, solar PV was considered a better fit.

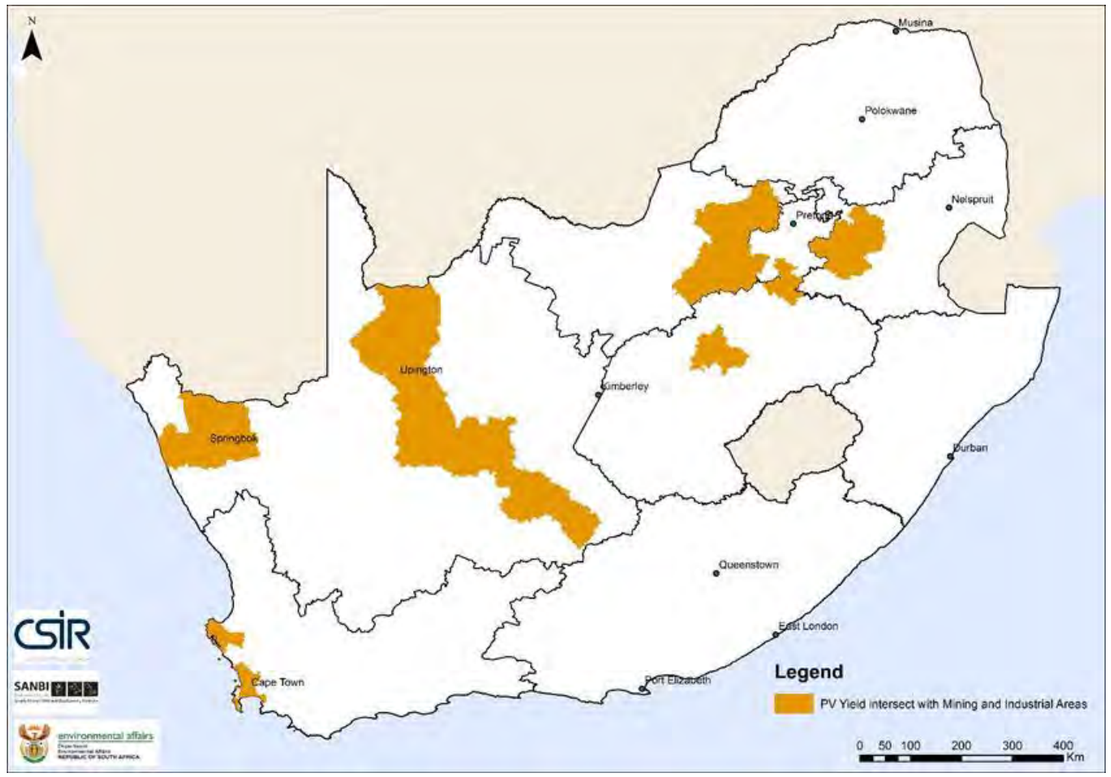


Figure 9: Previously mined areas and industrial development zones initiatives that were used as pull factors for identifying focus areas for solar PV development

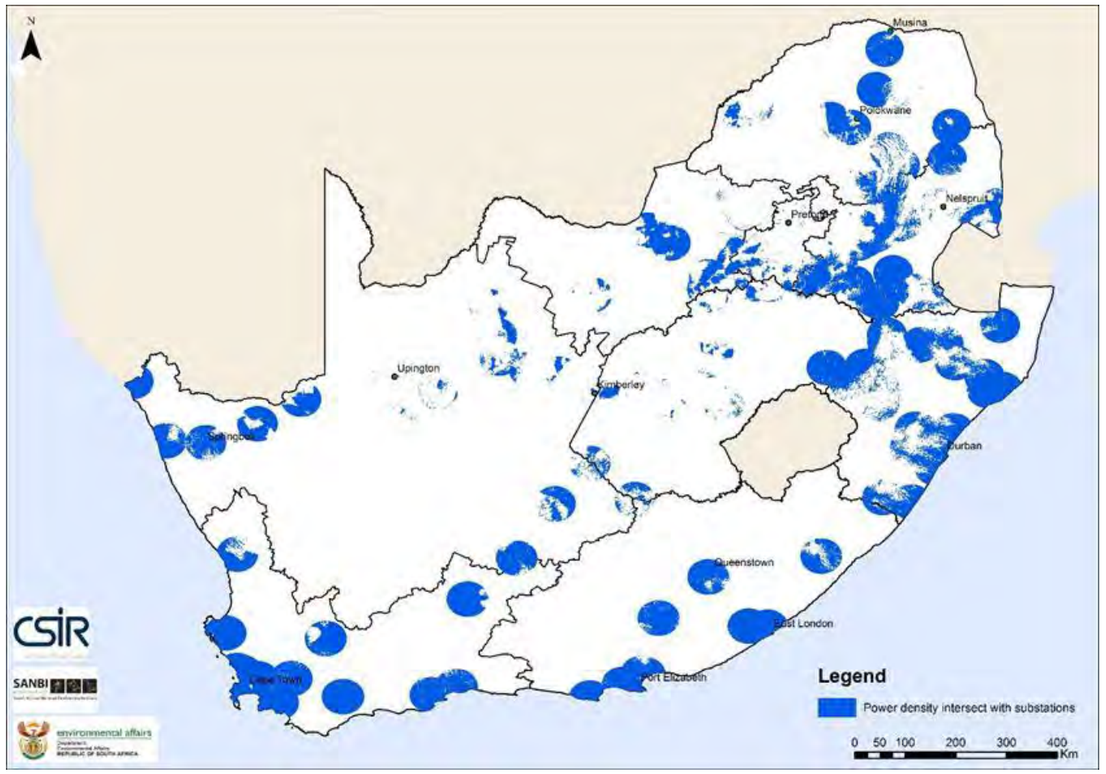
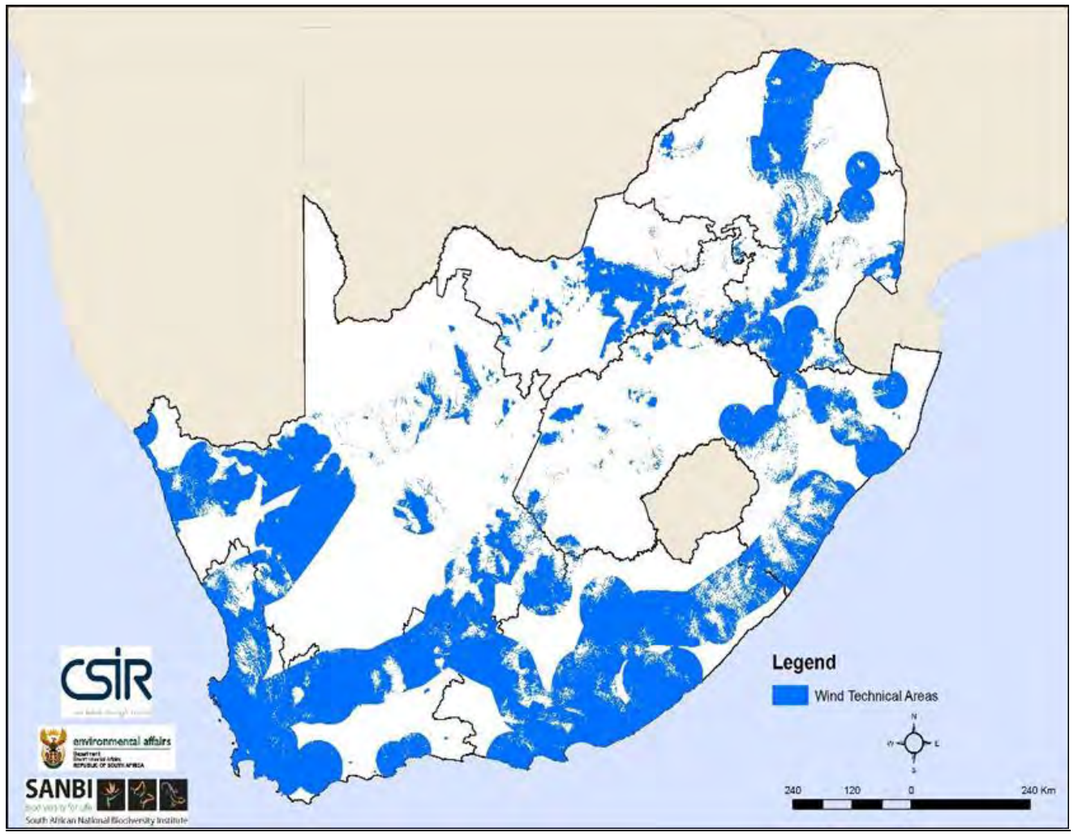


Figure 10: Areas with power density above 250 W/m² and within 35km of Main Transmission Substations (MTS) identified in the TDP and GCCA2017 datasets

2.1.2.5 Areas with power density above 250 W/m² and within 35km of MTS substations identified in the TDP and GCCA2017 datasets

The Transmission Development Plan (TDP), 2017 represents all Eskom transmission network requirements over a 10 year period. All substations with sufficient evacuation capacity, that either already exists or can be unlocked with limited investment, were identified in the TDP and the Generation Connection Capacity Assessment of 2017 (GGCA2017) were buffered by a 35 km radius (Figure 10). This value was determined in consultation with industry as a suitable area for location without incurring additional costs. As agreed with industry members, this analysis was only done for wind and it was not a significant constraint or factor to be considered for solar PV.



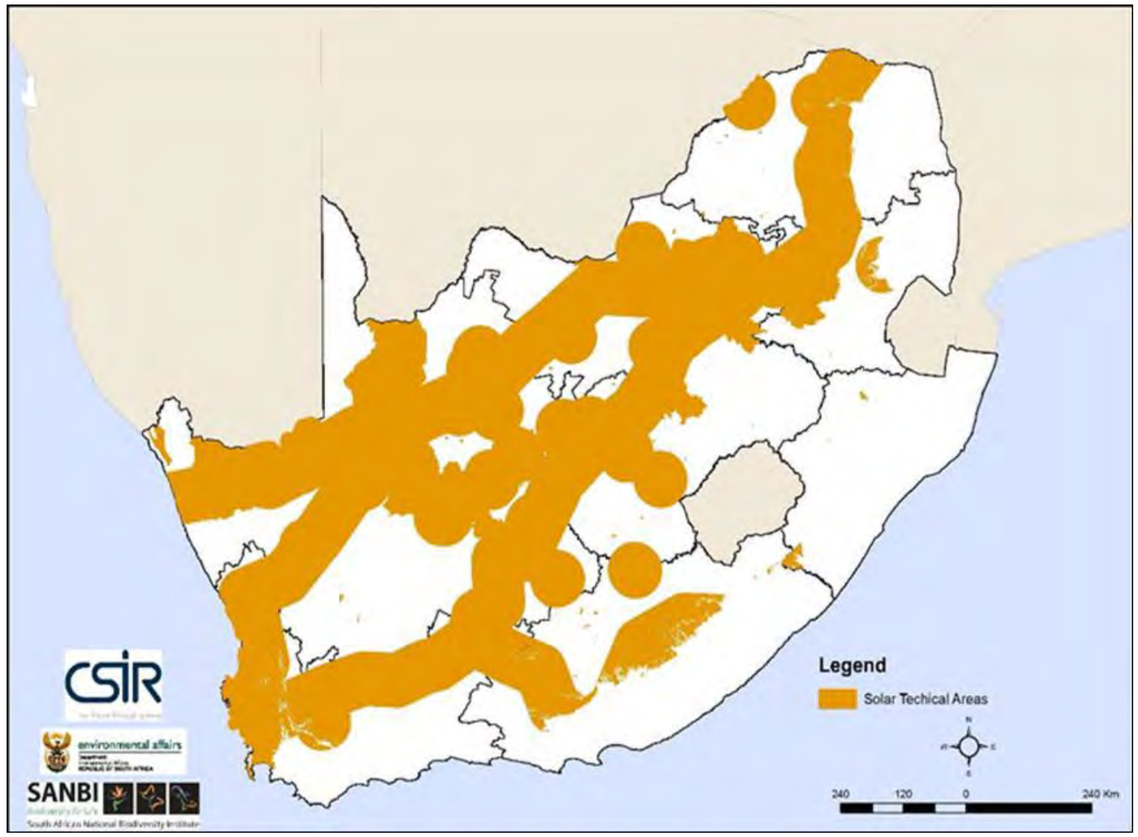


Figure 11: Outcomes of technical pull factors for wind and solar PV

2.2 Negative Mapping

The purpose of the negative mapping phase of the SEA was to identify all environmental features which are constraints in the development of large scale wind and solar PV. These features are referred to as *Features of Critical Importance* and they represent features that should be avoided when delineation areas that should be considered for clusters of large scale wind and solar PV developments because of the proven impact of these projects on these particular features. Datasets and applicable buffers were selected in consultation with the relevant authorities and key stakeholders.
Table 1 lists these features considered to be of critical importance.

Please note that:

- for some features, the entire area of that feature is excluded (e.g. Marine Protected Areas) and then the column with buffers is left blank
- for some features, a buffer is applied around the feature (e.g. 50km radial buffer around a vulture colony).

Table 1: Features of critical importance considered in the SEA

Criteria	Source	Features	Wind Buffers	Solar Buffers
Protected Areas	South African Protected Areas Database (SAPAD) - Q1, 2017, South African National Parks (SANParks) and Provincial.	Marine Protected Areas		
		National Parks		
		Nature Reserves		
		World Heritage Sites (Core)		
		Mountain Catchment Areas (Natural)		
		Protected Environments (Natural)		
		Forest Nature Reserve		
		Forest Wilderness Area		
		Special Nature Reserve		
Critical Biodiversity Areas (CBAs)	Provinces	CBA1 only		
Water features	NFEPA	Wetlands (500m) and Major Rivers (32m)		
	CSIR	Estuaries (Floodplain)		
	CSIR	SWSAs (Natural) –> ONLY KEEP SURFACE SWSAs		
Forest	DAFF	Forest		
Square Kilometre Array (SKA) Area	SKA	SKA study Area		
Heritage	SAHR	All grades and declared sites (add UNESCO sites)		
Field Crop Boundaries	DAFF	Pivot, Shadenet, Horticulture and Viticulture		
Agricultural Land Capability	DAFF	Categories 11-15		
Defence	SANDF	Selected defence features as specified by SANDF		
Birds	VULPRO	VULPRO cape vulture colonies	50km	N/A
		VULPRO cape vulture restaurants	50km	N/A
	NMMU	NMMU cape vulture roost sites	50km	N/A
Bats		Bat Roosts		N/A
		Specified Eco-regions (refer to study)		N/A
		Dolomite and Limestone		N/A
		Dams		N/A
		Vegetation		N/A
Visual: Very high sensitivity areas for elimination from Focus Area specifically for visual sensitivities				
Protected Area	South African Protected Areas Database (SAPAD) - Q1, 2017, South African National Parks (SANParks) and Provincial.	Marine Protected Areas		
		National Parks	0-5 km	0-2.5 km
		Nature Reserves	0-3 km	0-1.5 km
		World Heritage Sites (Core)	0-5 km	0-2.5 km
		Mountain Catchment Areas (Natural)		
		Protected Environments (Natural)	0-3 km	0-1.5 km
		Forest Nature Reserve	0-3 km	0-1.5 km
		Forest Wilderness Area	0-3 km	0-1.5 km
		Special Nature Reserve	0-3 km	0-1.5 km
Critical Biodiversity Areas (CBAs)	Provinces	CBA1 only		
Large Water features	NFEPA	Wetlands (500m) and Major Rivers(32m)	0-1 km	0-500 m
	CSIR	Estuaries, lagoons, lakes, state dams	0-1 km	0-500 m
	CSIR	SWSAs (Natural) –> ONLY KEEP SURFACE SWSAs		
Coastline			0-1 km	0-1 km
SA Large Telescope	SALT	Exclusion area	0-25 km	0-15 km
Square Kilometre Array (SKA) Area	SKA	SKA study Area		
Heritage	SAHRA	All grades and declared sites (add UNESCO sites)	0-1 km	0-1 km
Steep slopes > 25% (1:4)				
Towns, settlements			0-2 km	0-500 m
Major airports			0-8 km	
Small airfields, landing strips			0-3 km	
National roads			0-1 km	0-500 m
Main Passenger Rail Lines			0-1 km	0-500 m
Scenic routes and passes	No data base			

All of these features and relevant buffers were mapped and the results for wind and solar PV can be seen in Figure 12 and Figure 13.

It must be noted that technical considerations such as slope were not considered as industry confirmed these can be engineering and are not a strong determining factor.

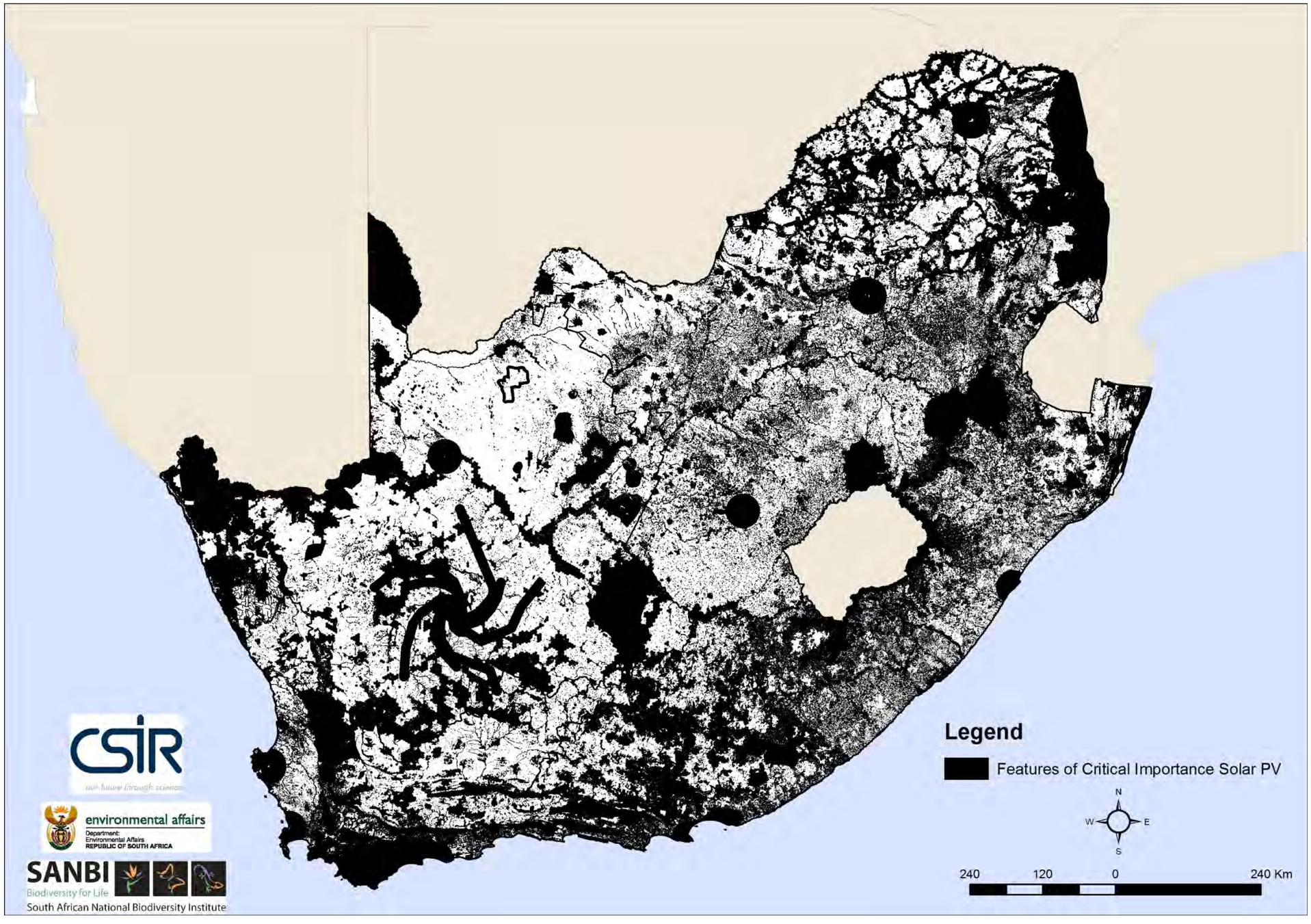


Figure 12: Features of Critical Importance and associated buffers – Solar PV

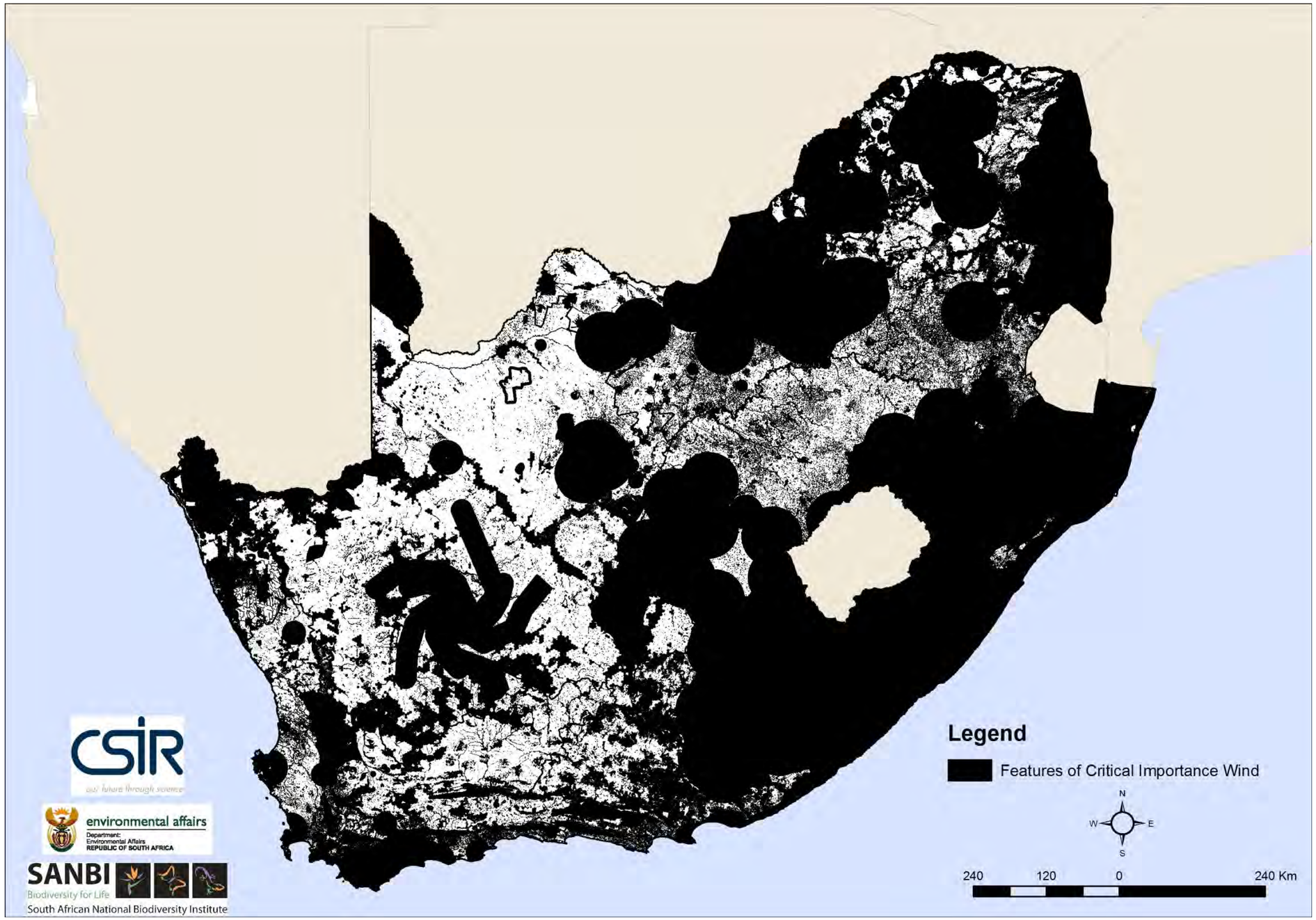


Figure 13: Features of Critical Importance and associated buffers - Wind

2.3 First Draft Focus Areas

Once the technical and environmental criteria were determined, a GIS erase of the features of critical importance from the technical criteria was conducted to generate an outcome that represents the remaining suitable technical areas but without the environmentally sensitive areas. The remaining areas are known as the first draft focus areas (Figure 14).

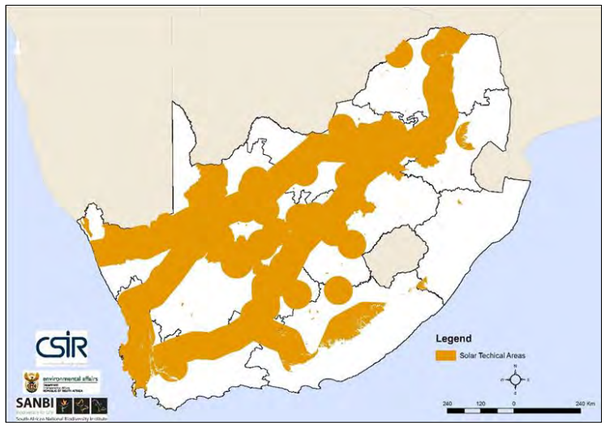
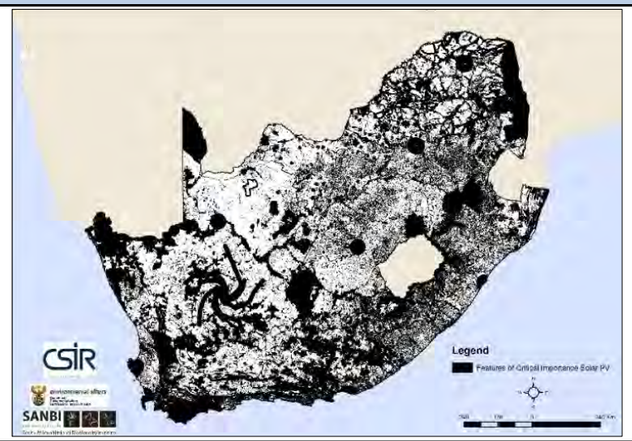
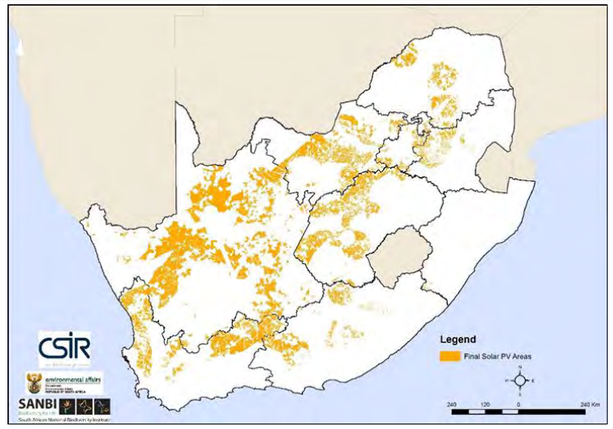
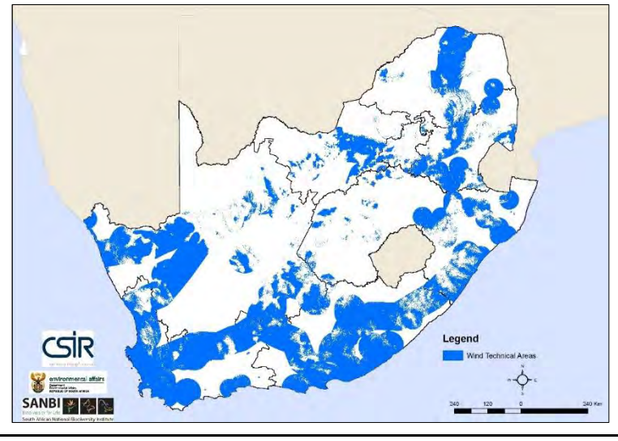
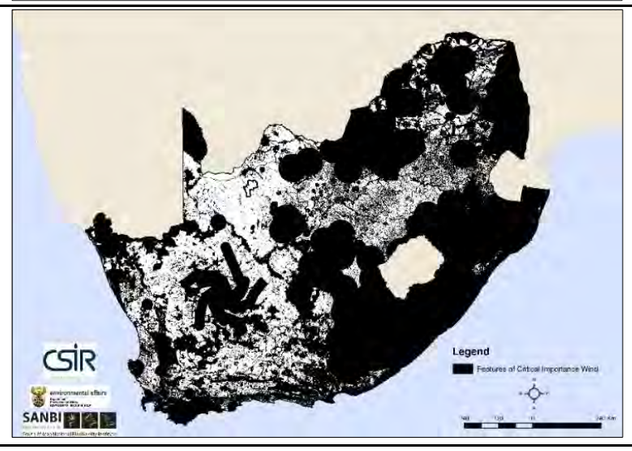
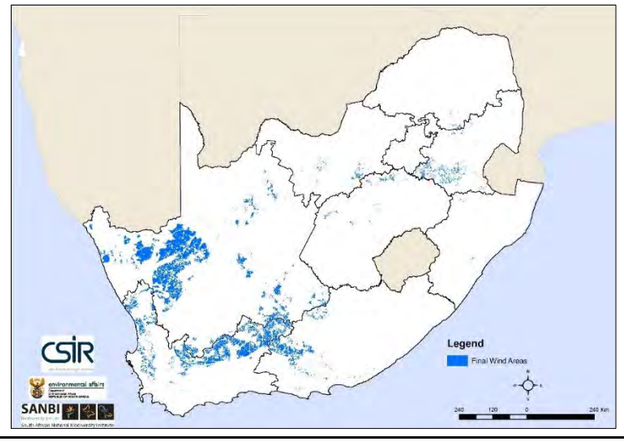
	Top Development Potential Areas Identified	Elimination of Environmental and Technical Constrained Areas	Unconstrained Top Development Potential Areas
Solar PV			
Wind			

Figure 14: Integration of positive and negative mapping results to identify the highest development potential areas that are not constrained

Once the first draft technical areas were delineated, an industry consultation exercise was conducted to determine key areas of interest to RE developers over a 15-year period.

Much data and knowledge exist in the private sector that cannot be made available for public studies such as this SEA due to the competitive nature of the renewable energy industry. Measured resource data which are collected by developers across the country and are more accurate than the modelled resource data used for this study is an example of such confidential data. In order to afford the industry an opportunity to provide inputs based on the confidential data and knowledge at their disposal, without having to actually disclose such information, an appropriate consultation process was designed.

The consultation process consisted of a survey including a map of the area covered by the SEA divided into 50km × 50 km grid cells. This survey was distributed to the members of the South African Wind Energy Association (SAWEA), the South African Photovoltaic Industry Association (SAPVIA), and any other developers registered as stakeholders in the SEA process. A commitment was made that all individual submissions by developers would be treated as confidential while the aggregated results would be used for the study. Developers were requested to select up to 5 different grid cells where wind or solar PV development should be prioritised in 0-5, 5-10, or 10-15 year timeframes (Figure 15).

The results of this survey were overlayed with outcomes of a public participation process and the existing first draft study areas to determine the focus areas to be taken to the next phase of the SEA for specialist assessment.

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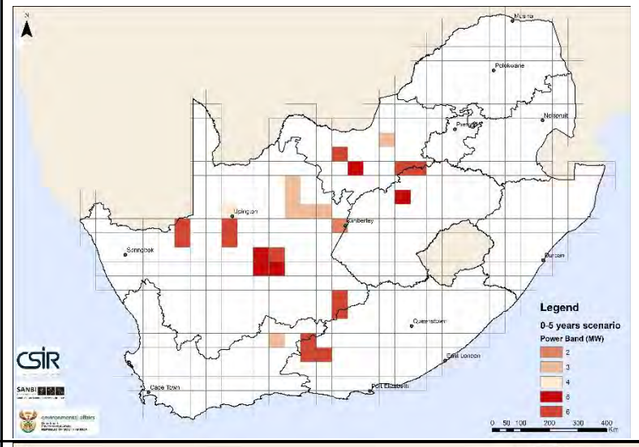
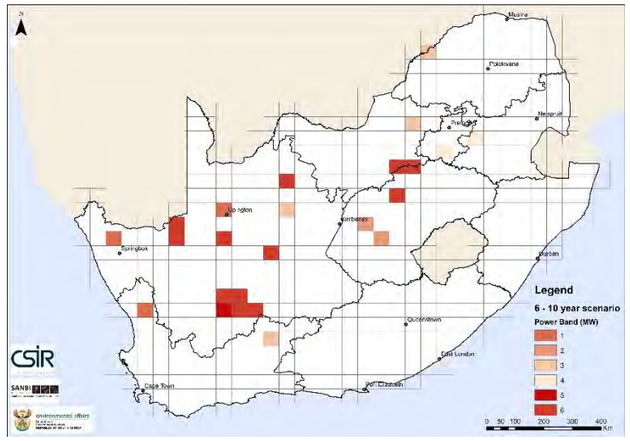
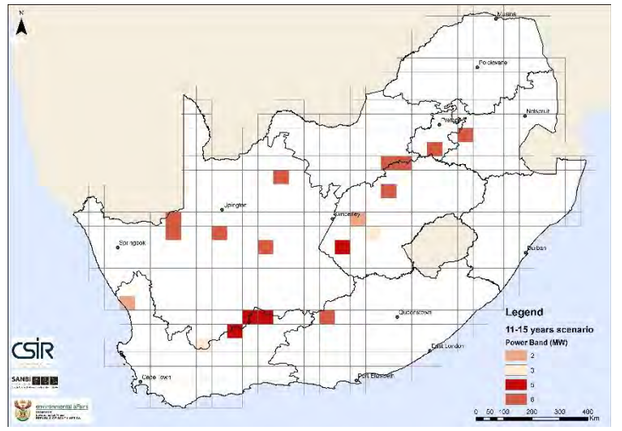
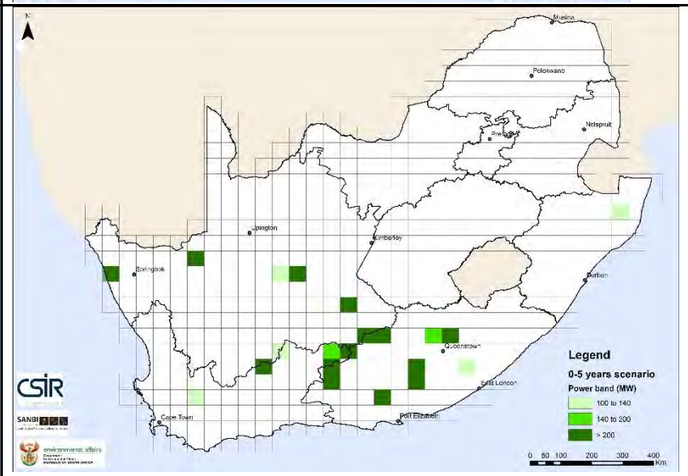
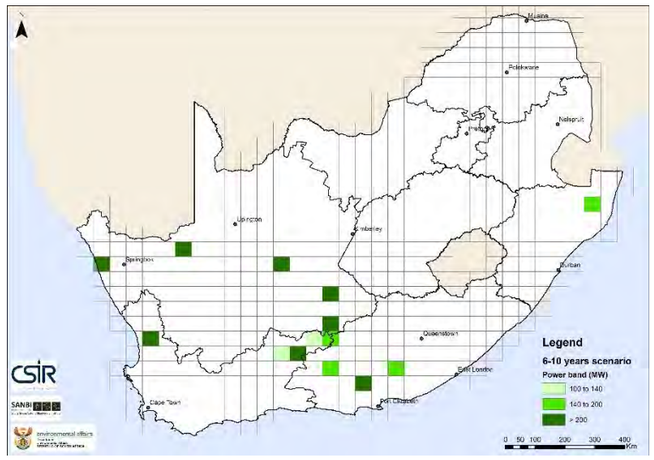
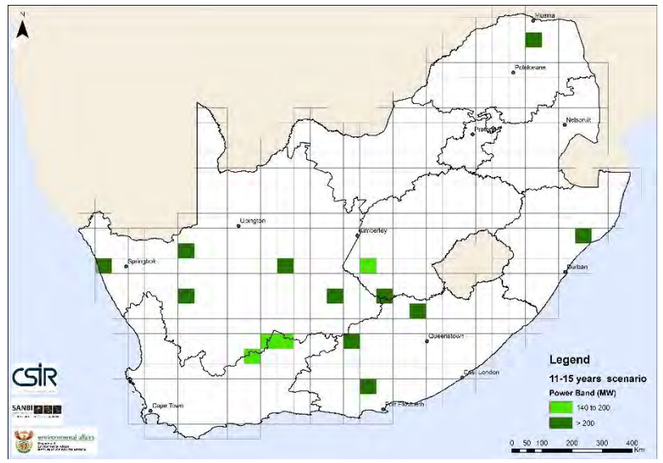
	0-5 Year Industry Priority	5-10 Year Industry Priority	10-15 Year Industry Priority
Solar PV			
Wind			

Figure 15: Results of the industry survey to identify areas and the range in MW where development should be prioritised

2.4 Consultation

The consultation process undertaken in the SEA is detailed in Appendix B of this report. All affected local municipalities and provincial governments were consulted during the SEA roadshow conducted during September 2019. The purpose of this roadshow was to present the SEA process and REDZs to be submitted to cabinet for gazetting, to take note of any concerns from officials regarding the delineation of REDZs, and to discuss the inclusion of REDZs, once adopted, into Spatial Development Frameworks (SDFs) and Integrated Development Plans (IDPs).

In addition to consulting key stakeholder groups through the Expert Reference Group (ERG), extensive wider public consultation was conducted through the exchange of information and data via a dedicated online platform (project website and email). Draft focus areas were released for public comment in April 2019 and all comments have been included in Appendix B of this report.

2.5 Focus Areas for specialist assessment

Taking into consideration all information and data gathered during the consultation process, the boundaries of the eight Focus Areas were determined (see Figure 16).

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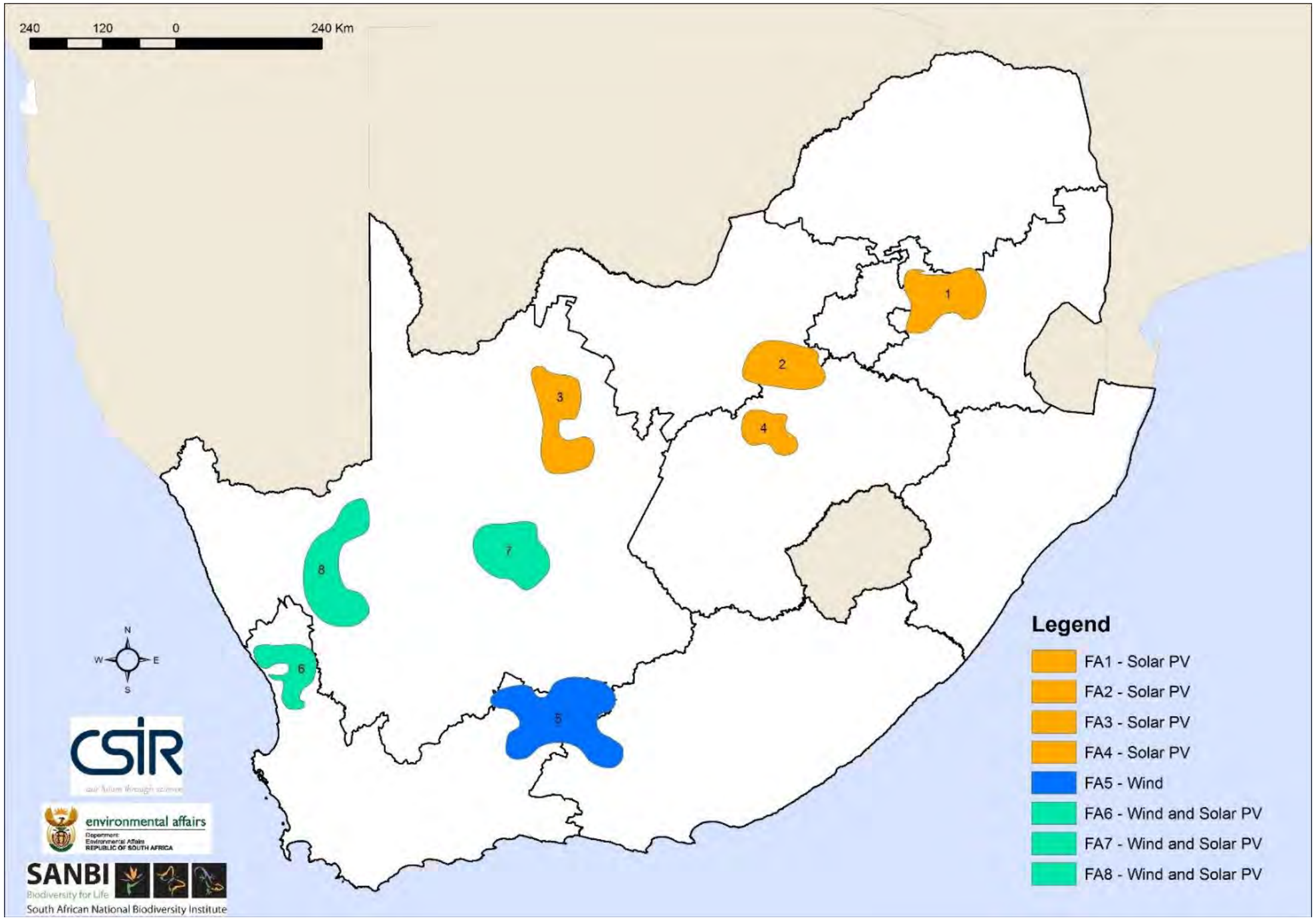

Figure 16: Final wind and solar PV Focus Areas (FAs) identified for further assessment

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

PART 3

SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

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PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
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PART 3.1

AGRICULTURE







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3.1 AGRICULTURE

The following section is informed by the scoping level agricultural pre-assessment of the eight Focus Areas (FAs) based on data available on the National Web Based Screening Tool and reviewed by an agricultural specialist.

3.1.1 Introduction and Scope

The major concern in terms of agriculture with any development is the potential loss of high potential agricultural land. The generation of electricity through the development of renewable energy facilities requires large amounts of land, resulting in concerns pertaining to the potential loss of productive agricultural land. South Africa has a limited supply of high value agricultural land, and similar to any limited and non-renewable resource, it is therefore important to conserve agricultural land.

This section covers potential impacts on agriculture, associated with the development of renewable energy facilities. The approach to the sensitivity analysis and the assessment of impacts is similar to that identified by the national web based environmental screening tool for agricultural resources, which is based on the updated land capability evaluation values as provided by the Department of Agriculture, Forestry and Fisheries (DAFF). The agricultural sensitivity is therefore determined in terms of a desktop exercise, using this updated data of national land capability. The approach to the agriculture assessment follows that undertaken for the Agricultural Assessment in the 2015 SEA (DEA, 2015). It includes the identification of existing agricultural resources and agricultural potential within the eight focus areas, as well as the protocols that should be incorporated for agricultural assessments.

3.1.2 Relevant Legislation

The following are key legislation considered relevant to agriculture in South Africa, in relation to the proposed wind and solar development:

- The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) – The objective of this Act is to provide for the protection of South Africa's natural agricultural resources, including soils. This Act applies to all agricultural land (grazing and cultivated). It manages rehabilitation after disturbances to agricultural land. Any disturbance to soil conservation works such as contour banks requires permission in terms of this Act.
- Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) – The objective of this Act is the preservation of agriculturally viable farm portions. Consent use or change of land use (re-zoning) for developments on agricultural land need to be approved in terms of this Act. This means that any servitude or use of an agriculturally zoned piece of land for non-agricultural purposes requires approval from the DAFF in terms of the SALA. Statutory bodies, such as Eskom, are currently exempt from such approval.[1]
- DAFF Guidelines for the Evaluation and Review of Applications pertaining to Renewable Energy on Agricultural Land, dated September 2011 - These guidelines were compiled with the main objective of the preservation of arable land through prohibition of the development of renewable energy facilities (wind and solar) on cultivated and high potential agricultural land. These guidelines were not produced to be applicable to linear infrastructure such as powerlines, but may have some relevance in terms of DAFF's general concerns about loss of agricultural land.

[1] http://daffarcgis.nda.agric.za/Comp_Atlas_v2/

3.1.3 Data Sources

Table 1: Agricultural data used in the SEA as part of the agricultural sensitivity analysis

Dataset	Source and date of publication	Data Description
Land Capability	DAFF, 2016	Categorises all land nationally into 15 different classes of agricultural land capability. The classification is based on soil, terrain and climate parameters.
Field Crop Boundaries	DAFF, 2016	Delineates the boundaries of all cultivated land, based on satellite and aerial imagery. Five different categories of cultivated land are distinguished. These are irrigated areas (pivot agriculture), horticulture, viticulture, shadenet, and other cultivated areas.
Agricultural Geo-Referenced Information System (AGIS)	DAFF	An on-line information system containing a collection of spatial data on South African agriculture, including all data from the land types survey.

3.1.4 Focus Area Descriptions

The AGIS[1] spatial data website was used to provide a brief description of the agricultural characteristics of each focus area below with regards to:

- Moisture availability;
- Terrain;
- Soils;
- Grazing capacity and
- Land capability.

Moisture availability is described as the ratio of rainfall to evapotranspiration and indicates the viability of rain fed agriculture. It is classified into 6 categories, ranging from "None to slight" through to "Very severe" in terms of limitation rating to agriculture. Land capability is determined by the interaction of soil (a description of generalised soil patterns is included in **Error! Reference source not found.**), climate and terrain; indicating the suitability of these factors to support rainfed agricultural production. Land capability spatial data was updated by DAFF in 2016. This latest data classifies land capability into 15 categories, with 1 being the lowest and 15 being the highest in terms of land capability classes suitable for the production of cultivated crops. An indication of this land capability scale is shown in Figure 1, depicting the land capability classes of South Africa.

3.1.4.1 Focus Area 1

Moisture availability in this focus area depicts a predominantly slight limitation to agriculture, with small sections consisting of moderate limitation. The terrain predominantly consists of plains with open low hills or ridges. Soils in this focus area are largely PT1. Focus area 1 is predominantly categorised with a moderate to high land capability values of 8 and 10, and varies to as high as 11 and as low as 2 to 4 in some areas, with a few isolated areas of land capability class 6 to 9. Majority of the area supports a grazing capacity of between 4 to 7 hectares per large stock unit, even higher in some areas at less than 4, with some small parts at 8 to 10 in the north-west

boundary of the focus area. The most important agricultural enterprises are cattle and summer grains (maize). Mean annual rainfall varies between approximately 500 and 800 mm.

3.1.4.2 Focus Area 2

Moisture availability is a moderate to severe limitation over the majority of this focus area, with some moderate limitation in the south western area. The terrain is mostly level plains with some relief, with some plains with open low hills or ridges, rolling or irregular plains with high hills or ridges, as well as open hills or ridges. The soils are dominated by PT2, with smaller areas of PT1, LP1, LP2 and R. Majority of the focus area contains land capability values of 7, 8 and 9, with some isolated patches of land capability value 6. This focus area also contains small amounts of land capability values as low as 3 and 4. The area supports a grazing capacity of between 4 to 7 hectares per large stock unit, with a small section on the western boundary at a capacity of 8 to 10. The most important agricultural enterprise is summer grains (maize). Mean annual rainfall varies between approximately 480 and 680 mm.

3.1.4.3 Focus Area 3

Moisture availability is a severe limitation to agriculture over the majority of the focus area, with some very severe limitation on the western corners of this focus area. The terrain predominantly consists of level plains with some relief. Soils in this focus area consist of AR2, R, LP2, AR1 and CM. Focus area 3 is predominantly characterised with a low land capability value of 5. This varies from 1 to 4 in some isolated patches, and at 7 in some places, indicating a low to moderate land capability. Grazing capacity varies between 8 and 17 hectares per large stock unit. The most agricultural enterprises are cattle and game farming. Mean annual rainfall varies between approximately 220 and 460 mm.

3.1.4.4 Focus Area 4

Moisture availability is a severe limitation in this focus area. The terrain predominantly consists of level plains with some relief. Dominant soil types are PT2, PL2 and CM. There are smaller areas of VR in the south-east and AR2 in the western boundary of this focus area. Land capability is mostly class 9, with some areas containing 6 to 8; characterised as moderate to high agricultural capability. Scattered across this focus area are small parts as low as class 4 to 5. Grazing capacity in this focus area is at 4 to 7 hectares per large stock unit. The most important agricultural enterprise is summer grains (maize). Mean annual rainfall varies between approximately 450 and 530 mm.

3.1.4.5 Focus Area 5

In this focus area moisture availability is a very severe limitation to agriculture. The terrain is very diverse in this focus area, including level plains with some relief, plains with open low hills or ridges, rolling or irregular plains with low hills or ridges, as well as open low hills or ridges and low mountains located in the northern parts of the focus area. Soils are predominantly LP2 with some R, PL1, CM, FL and PL2. This focus area is categorised with land capability values as low as 1 to 5, 6 to 7 in some areas, and as high as class 8 in some parts; indicating a very low to moderate land capability. Grazing capacity is at 18 to 21 and 22 to 25 in the east, low in the west at 26 to 30 and even lower in the south western corner of the focus area at 36 hectares per large stock unit. The most important agricultural enterprises are sheep and game farming. Mean annual rainfall varies between approximately 130 and 350 mm, although it is higher in one area of mountainous land in the east.

3.1.4.6 Focus Area 6

Moisture availability is a very severe limitation over the majority of this focus area, with some moderate to severe limitation along the south to western boundary of the focus area, and some small sections of none to slight limitation to agriculture. The diverse terrain in this focus area includes level plains with some relief, plains with open low and high hills or ridges, rolling or irregular plains with low and high hills or ridges, open hills and high hills or ridges, as well as low hills and hills or ridges and low mountains along the south eastern boundary of the focus area. The soils are dominated by LP2, with smaller areas of AR2, AR3, PL2, CM, R, LP1 and FL. Land capability in this focus area is mostly class 5, with some areas at 1 to 4 and isolated patches at class 6 to 7; characterising a very low to moderate land capability. Grazing capacity is predominantly low at 41 to 80 hectares per large stock unit, and at 30 in the south western area. The most important agricultural enterprises are sheep and game farming in the northern parts, with grapes along the Oliphants River and some Rooibos tea and winter grains (wheat) in the south. Mean annual rainfall varies between approximately 130 and 300 mm, although it is higher in one area of mountainous land in the east.

3.1.4.7 Focus Area 7

Moisture availability is a very severe limitation over the entire focus area. The terrain predominantly consists of level plains with some relief. The dominant soil type is LP2, with some areas of SC, CM and R. Focus area 7 is predominantly characterised with a low land capability value of 5, and varies as low as 1 to 4 in some places and as high as 6 to 7 in other parts of the focus area. Grazing capacity is predominantly low at 32 hectares per large stock unit, and at 24 in the north east and south east corners of this focus area. The most important agricultural enterprises are sheep and game farming. Mean annual rainfall varies between approximately 150 and 230 mm.

3.1.4.8 Focus Area 8

Moisture availability is a severe limitation to agriculture over majority of this focus area, with a very severe limitation in the north west and south west corners of the focus area. The terrain varies from level plains to level plains with some relief over majority of the focus area, with some plains with open low hills or ridges, open high hills or ridges and high hills or ridges in some parts. Soils in this focus area are AR2, LP2, AR1, CM and R. Land capability in this focus area is mostly class 5, with some areas at class 1 to 4 and class 6 to 7, indicating a very low to moderate land capability. Grazing capacity ranges between 28 and 48 hectares per large stock unit. The most important agricultural enterprises are sheep and game farming. Mean annual rainfall varies between approximately 90 and 190 mm.

Table 2: Description of generalised soil patterns in South Africa

Label	Description
AC	Red and yellow soils with low to medium base status.
FR	Red and yellow soils with a humic horizon.
CM	Red, massive or weakly structured soils with high base status.
PT1	Red, yellow and greyish soils with low to medium base status.
PT2	Red, yellow and /or greyish soils with high base status.
AR1	Red, excessively drained sandy soils with high base status, mainly dunes.
AR2	Red and yellow, well drained sandy soils with high base status.
AR3	Greyish, sandy excessively drained soils.
CM	Red soils with high base status.
FL	Soils with negligible to weak profile development, usually occurring on deep alluvial deposits.
LP1	Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime rare or absent in the landscape.
LP2	Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape.
PL1	Soils with a marked clay accumulation, strongly structured and a reddish colour. Prismacutanic and/or pedocutanic diagnostic horizons dominant.
PL2	Soils with a marked clay accumulation, strongly structured and a non-reddish colour. They may occur associated with one or more of vertic, melanic and plinthic soils.

SC	Strongly saline soils generally occurring in relatively deep deposits in low lying arid areas.
R	Rock with limited soils.

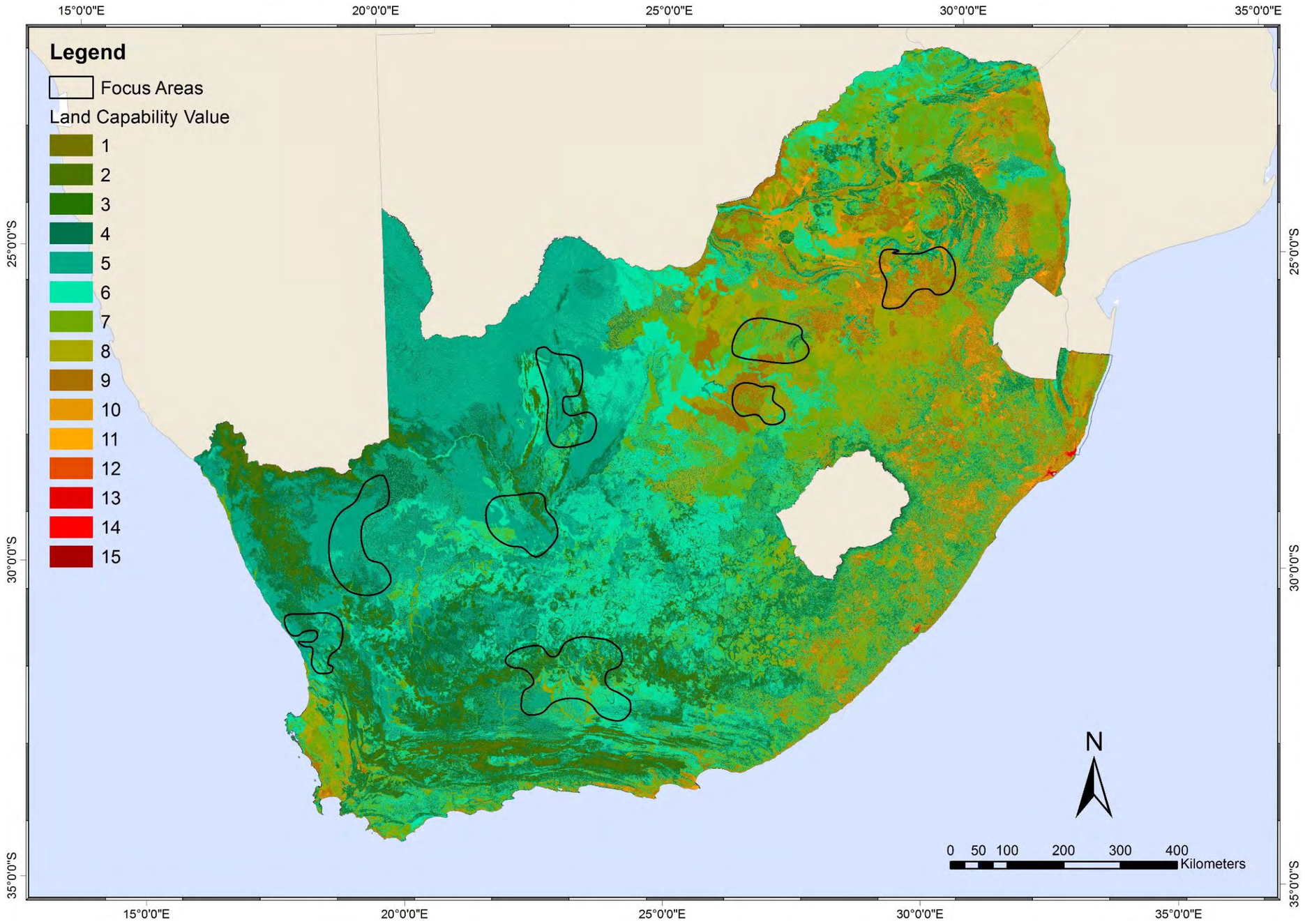

Figure 1: Land Capability Classes of South Africa from 1 (very low) to 15 (very high)

3.1.5 Sensitivity Analysis

A major concern in terms of agricultural impact is the loss of high potential agricultural land, and agricultural sensitivity is therefore directly related to the agricultural potential of an area. This is in view of the fact that a negative impact on land of higher agricultural capability is more adverse than an impact on land of low agricultural capability. Arable, high potential agricultural land is regarded as a scarce resource in South Africa, and is therefore considered high sensitivity, and land that is only suitable for grazing is considered low sensitivity.

As part of the agricultural assessment of the eight focus areas, sensitivity mapping based on the updated DAFF dataset was undertaken. The data consist of a combination of the Land Capability dataset which categorises all land nationally into 15 different classes of agricultural land capability, and the Field Crop Boundaries dataset which delineates the boundaries of all cultivated land, based on satellite and aerial imagery. These two datasets are combined to classify agricultural sensitivity into four tiers; **Very High**, **High**, **Medium** and **Low** sensitivity classes. The sensitivity mapping results for the country are illustrated in Figure 1, as well as the individual maps for each of the 8 focus areas. Since the footprint of wind and solar PV development have the same agricultural impact of land loss, the sensitivity criteria are considered the same, and therefore the sensitivity maps are applicable to both technologies.

The agricultural features, and respective sensitivities, that would be impacted by wind and solar development are indicated in Table 3 to classify agricultural sensitivity into four tiers.

Table 3: Criteria for defining agricultural sensitivities

Sensitivity Feature	Sensitivity	Colour
Land capability classes 11 - 15	Very High	
Field crop boundaries for pivot irrigation, horticulture/viticulture and shadenet	Very High	
Land Capability Class 8 - 10	High	
All other field crop boundaries not considered very high sensitivity	High	
Land Capability Class 6 - 7	Medium	
Land Capability Class 1 - 5	Low	

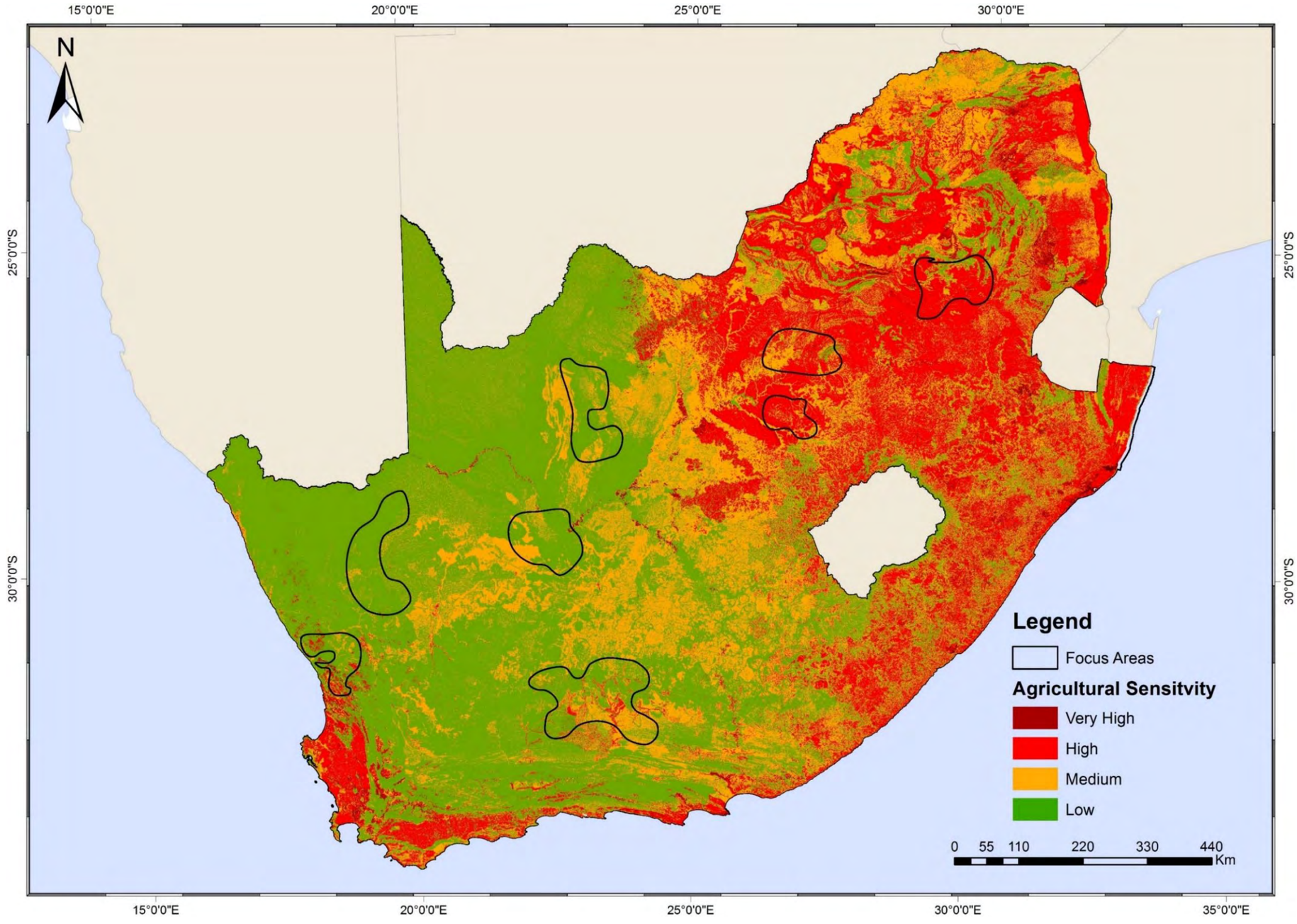

Figure 2: Agricultural sensitivity for wind and solar PV development

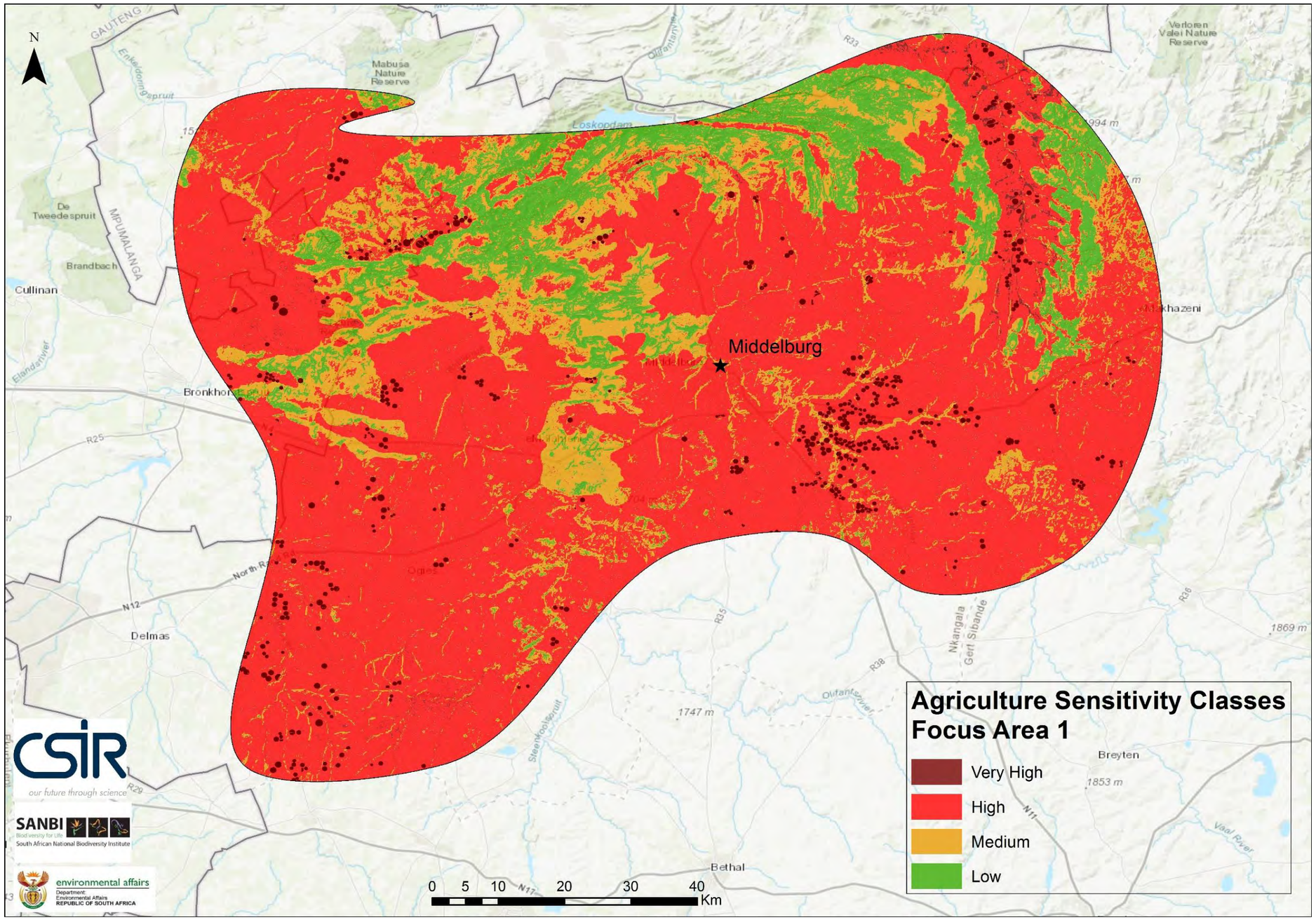

Figure 3: Agricultural sensitivity for wind and solar PV development in Focus Area 1

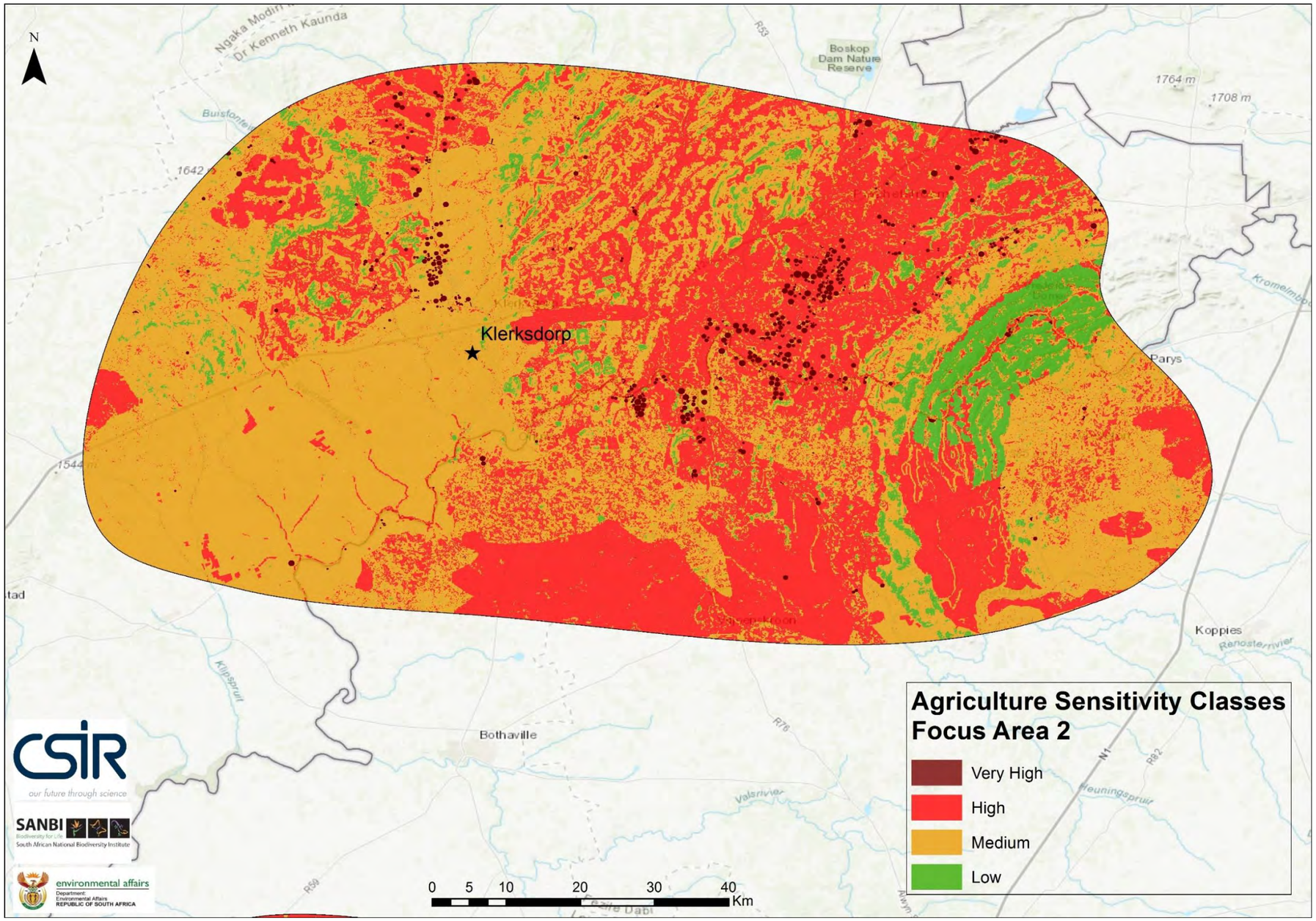

Figure 4: Agricultural sensitivity for wind and solar PV development in Focus Area 2

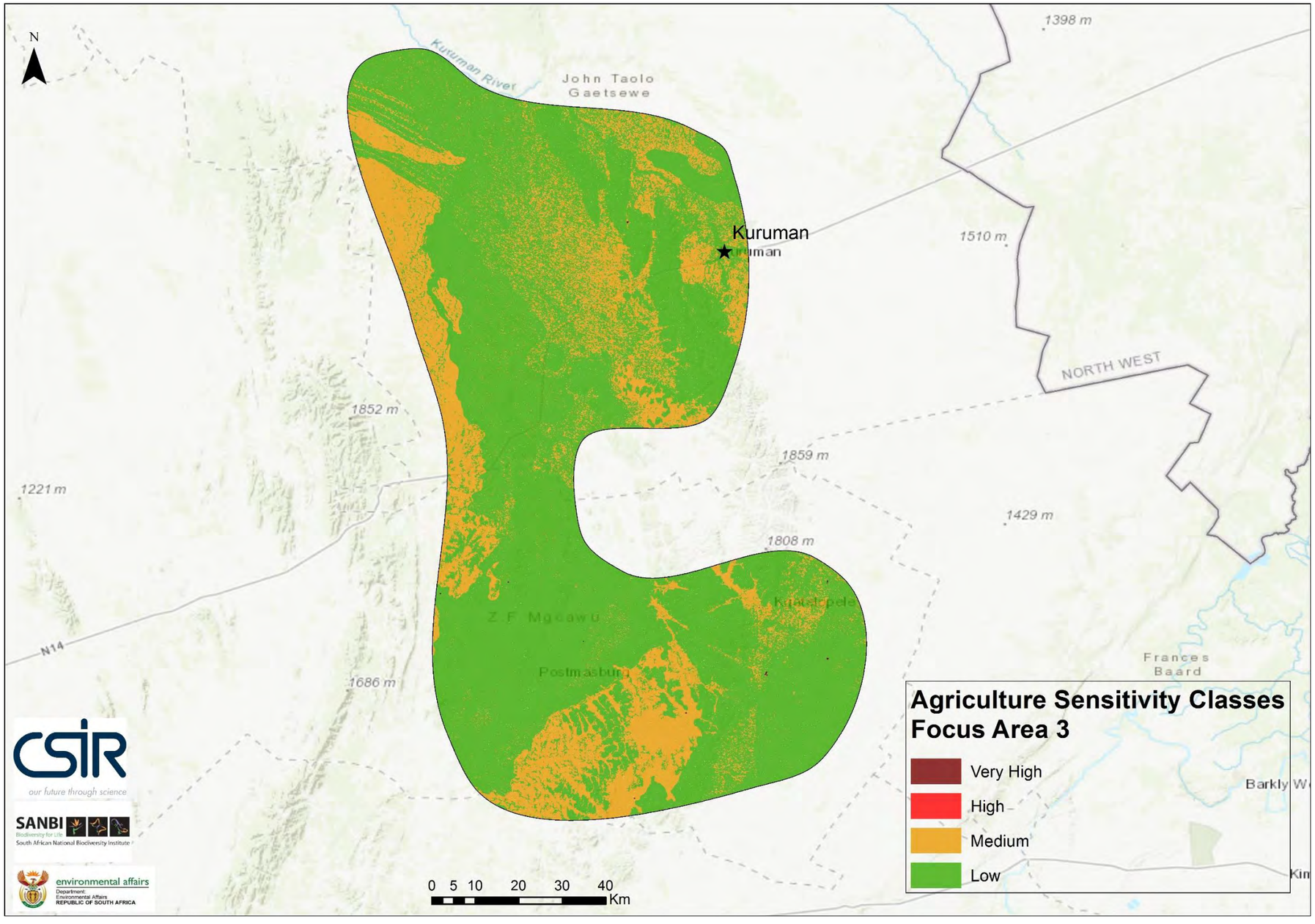

Figure 5: Agricultural sensitivity for wind and solar PV development in Focus Area 3

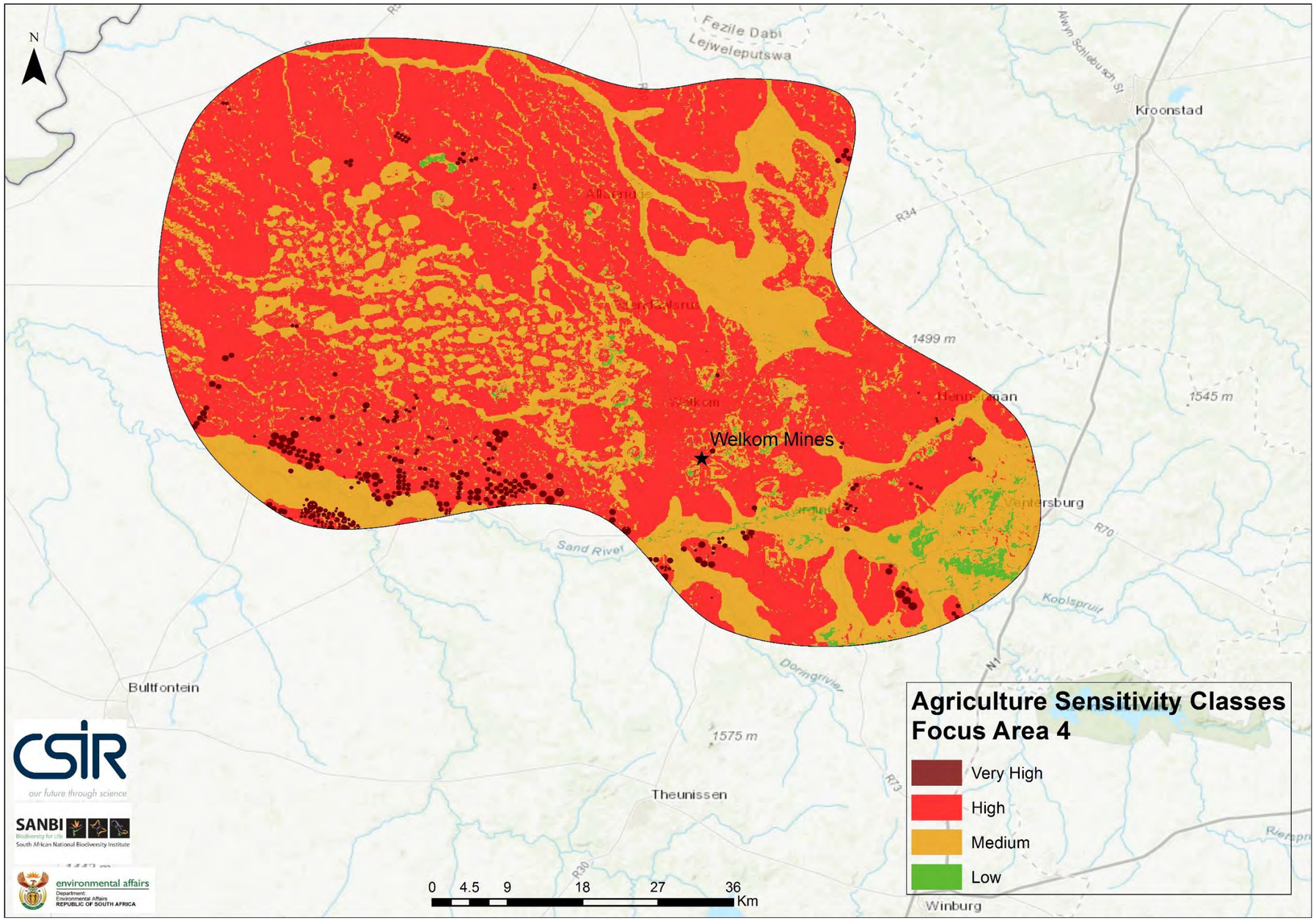

Figure 6: Agricultural sensitivity for wind and solar PV development in Focus Area 4

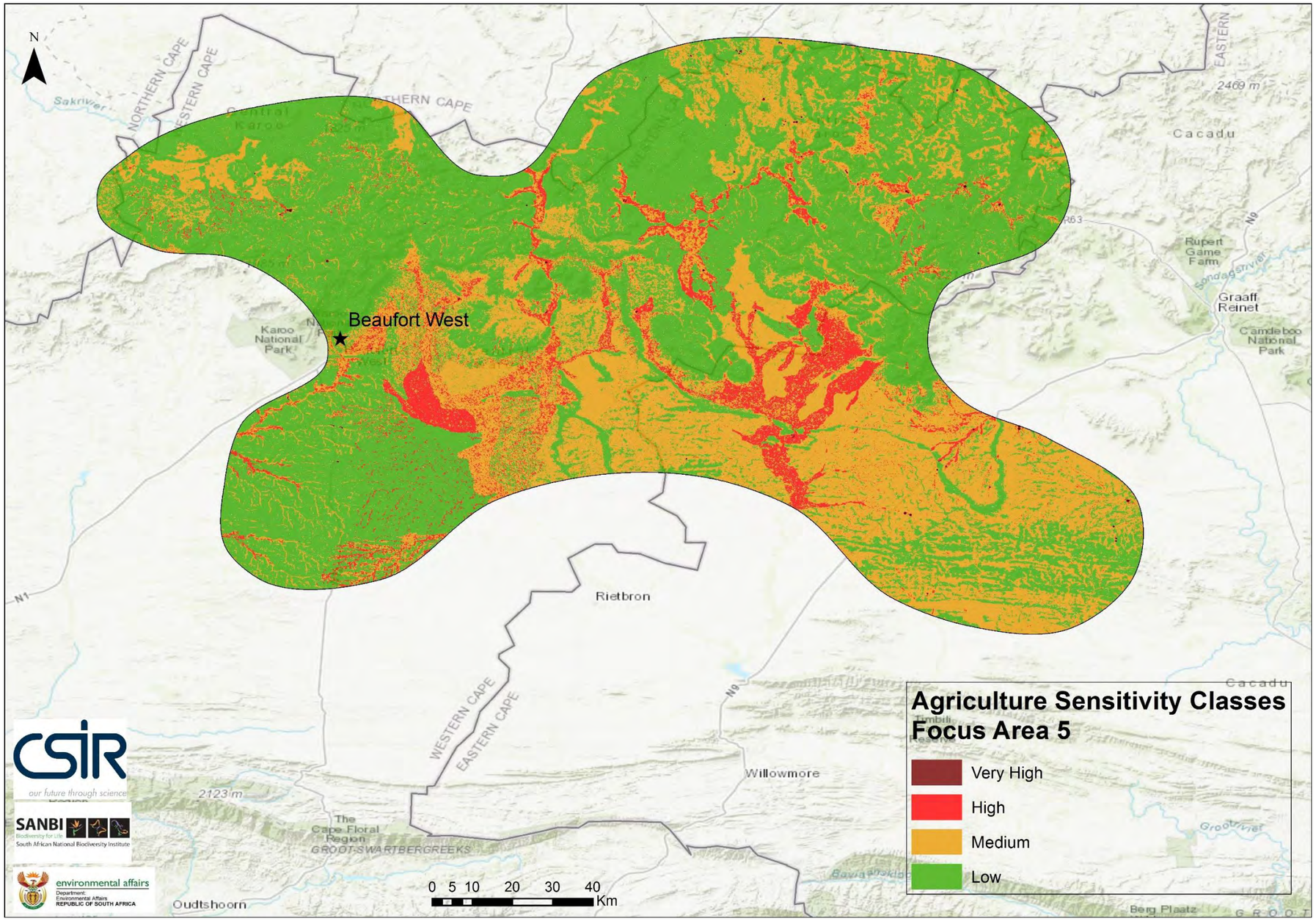

Figure 7: Agricultural sensitivity for wind and solar PV development in Focus Area 3

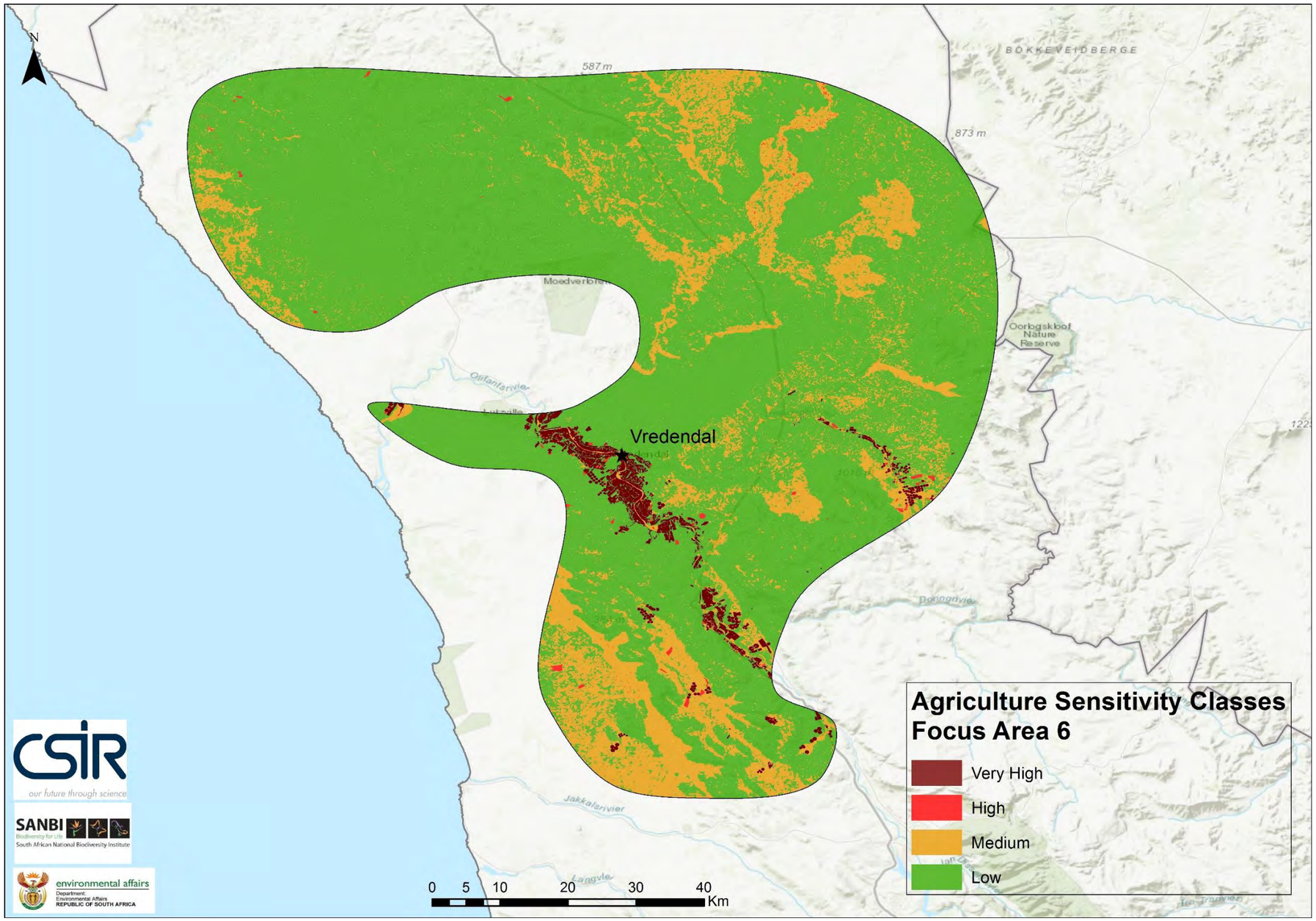

Figure 8: Agricultural sensitivity for wind and solar PV development in Focus Area 6

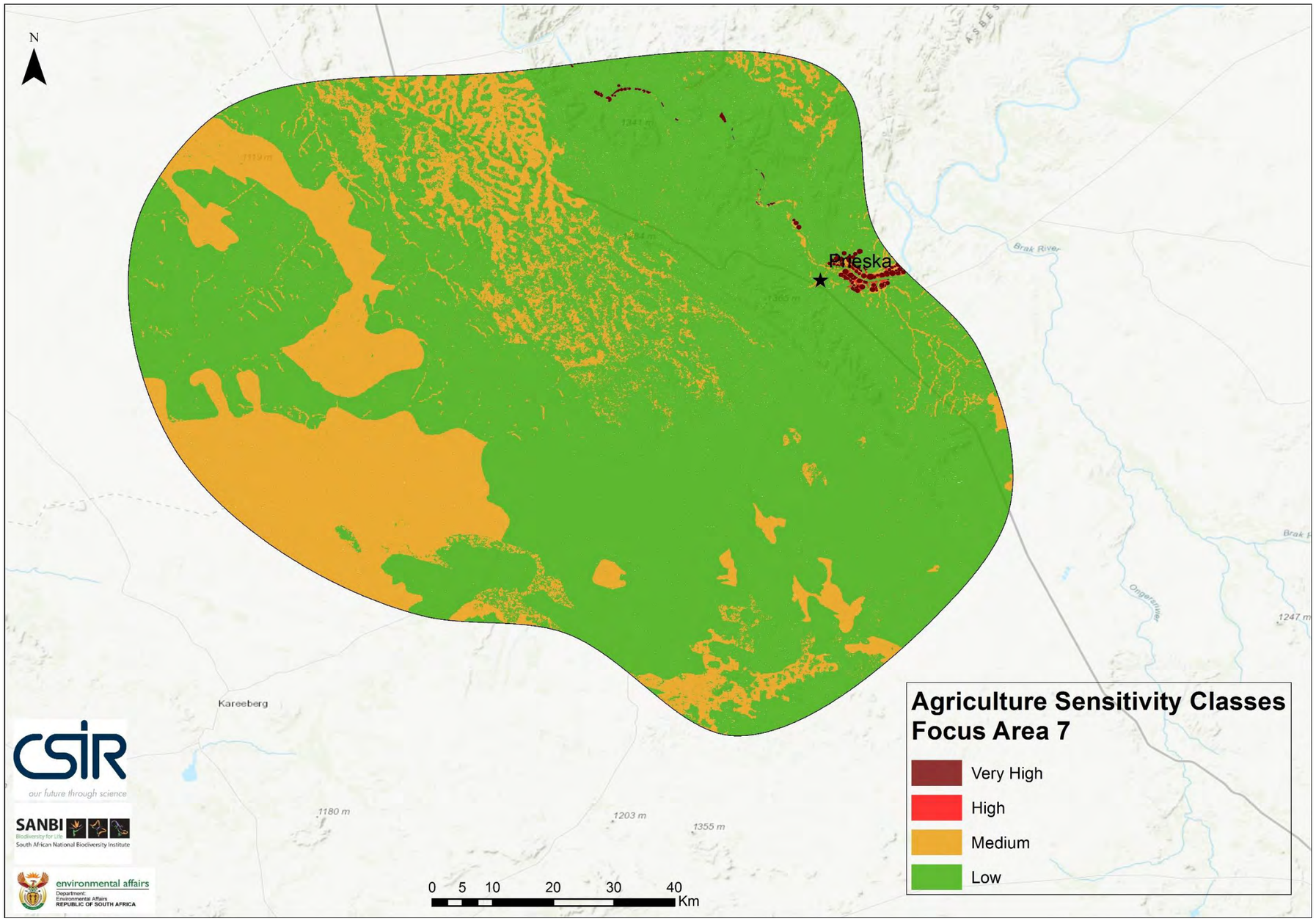

Figure 9: Agricultural sensitivity for wind and solar PV development in Focus Area 7

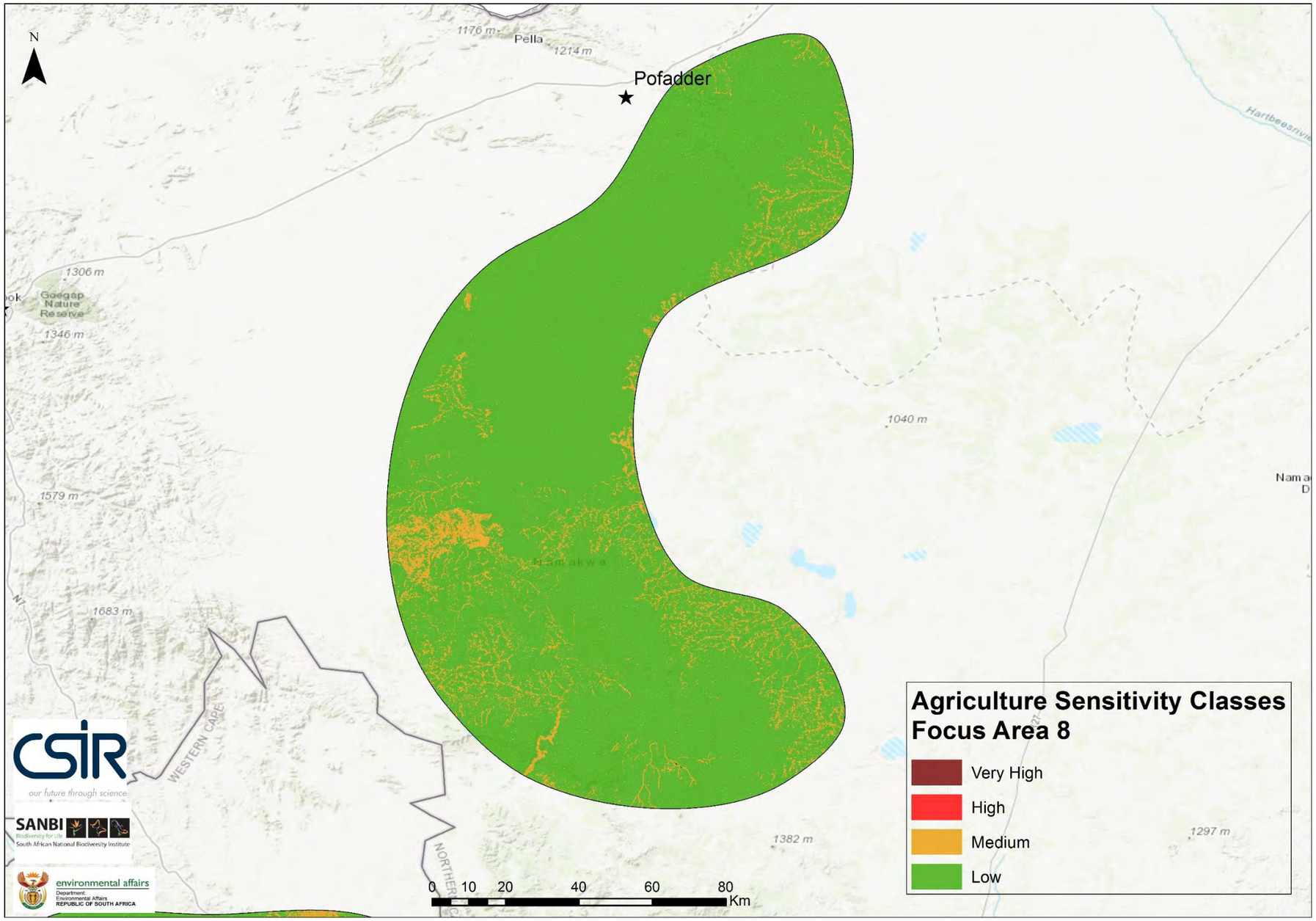

Figure 10: Agricultural sensitivity for wind and solar PV development in Focus Area 8

3.1.6 Potential Impacts on Agriculture and Mitigation

Key potential impacts of solar PV and wind development on agriculture are assessed and mitigation measures to reduce these impacts are outlined below:

- Potential disturbance to agricultural practices and management due to construction activities.
    - Mitigation measure: Clearing activities must be kept to a minimum as far as possible.
- Soil erosion due to alteration of the land surface run-off characteristics and susceptibility to wind erosion. Alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, the establishment of hard standing areas and roads, and the preparation of flat surfaces for solar panels. Erosion causes loss and deterioration of soil resources.
    - Mitigation measure: Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Soil surface stabilising measures must be used if necessary on all areas that are highly susceptible to erosion. Where soils are highly susceptible to wind erosion, the extent of areas cleared of vegetation must be minimized. Cleared areas should be subdivided if possible by leaving strips of undisturbed vegetation across them. The effectiveness of the run-off control system and the occurrence of any erosion on site or downstream must be monitored. Corrective action must be implemented to the run-off control system in the event of any erosion occurring
- Loss of agricultural land as a result of direct occupation by the footprint of the energy facility infrastructure, including roads. This takes affected portions of land out of agricultural production.
    - Mitigation measure: Minimise the footprint of disturbance and make use of existing roads for development as far as possible.
- Loss of agricultural land use due to fragmentation of agricultural land. Energy facility infrastructure can lead to the division of fields and isolation of portions into non-viable small areas for cultivation. Such fragmentation leads to an effective additional loss of agricultural land over and above that lost to the direct footprint
    - Mitigation measure: The layout design must be done to avoid the division of fields and the isolation of portions of land into non-viable small areas for cultivation. Placement of all infrastructure, in particular roads, turbines and hard standing areas should be positioned along existing field crop boundaries and the length of roads and number of turbine placements that intrude into existing fields, must be minimised wherever possible.
- Erosion may also be caused by disturbance to existing contour banks and drainage systems that were established to control run-off and erosion.
    - Mitigation measure: The layout of the energy facility should be done so as to avoid disturbance to any existing contour banks. If any disturbance to contour banks occurs, they must be restored to the same specifications (height, slope, and spacings between banks) as prior to disturbance, and to the satisfaction of a soil conservation specialist. The integrity of the contour bank run-off control system as a whole must be maintained, monitored and repaired in the event of any erosion occurring due to breaks in its integrity.
- Degradation of vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling.

    Mitigation measure: Restrict all vehicle traffic within the footprint of disturbance and control dust during construction.
- Loss of topsoil due to poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability to support plant growth.

    Mitigation measure: If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on newly topsoiled areas, which are likely to be susceptible to erosion.
- Disturbance of cultivation practices due to the division of existing fields by turbines and access roads.

    Mitigation measure: The layout design must be done to avoid the division of fields and the isolation of portions of land into non-viably small areas for cultivation. Placement of all infrastructure but particularly roads, turbines and hard standing areas should be positioned along existing field crop boundaries and the length of roads and number of turbine placements that intrude into existing fields, must be minimised wherever possible.
- Prevention of crop spraying by aircraft over land occupied by turbines.

    Mitigation measure: If crop spraying by aircraft is ever required, it can be agreed that if necessary the wind farm will shut down all necessary turbines (with 1 day's notice) with the blades parked in parallel to facilitate easy access for aeroplanes between them. Crop spraying by aeroplane is usually done when there is little or no wind.

3.1.7 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts of agriculture by wind and solar PV developments. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

AGRICULTURE
1(a) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON AGRICULTURAL RESOURCES

1. SCOPE

This Protocol provides the criteria for the assessment and reporting of impacts on agricultural resources for activities requiring environmental authorisation. The assessment requirements of this Protocol are associated with a level of environmental sensitivity identified by the national web based environmental screening tool for agricultural resources, which is based on the land capability evaluation values as provided by the Department responsible for Agriculture[2]. If any part of the proposed development falls within an area of "very high" sensitivity, the requirements prescribed for such sensitivity apply.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. DEVELOPMENT LIMITS

a. Renewable energy generation facilities

For facilities generating renewable energy on land zoned for agriculture, development limits apply and are provided in the Table 1 below.

Table 1: Development limits for renewable energy generation developments

Criteria (land capability evaluation value and category of crop boundary)	Allowable development footprint in hectares per MW of installed generation capacity (with sensitivity ratings from the national web based environmental screening tool shown in brackets)	
	Within field crop boundaries	Outside field crop boundaries
Land capability evaluation value 11 – 15; Irrigation, horticulture/viticulture, shadenet; high value agricultural areas with a priority rating A and/or B	0 (Very High Sensitivity)	0 (Very High Sensitivity)
Land capability evaluation value 8 – 10; all cultivated areas including sugarcane; high value agricultural areas with a priority rating C and/or D	0.20 (High Sensitivity)	0.35 (Medium Sensitivity)
Land capability evaluation value 6 - 7;	0.25 (High Sensitivity)	2.50 (Low Sensitivity)
Land capability evaluation value 1 - 5;	0.30 (High Sensitivity)	2.50 (Low Sensitivity)

[2] Refer to the land capability metadata sheet available on the national web based environmental screening tool.

The development limits are based on the pre-assessment work undertaken through the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa, 2015, for the effective and efficient roll-out of large scale wind and solar development in South Africa. The pre-assessment was undertaken in specific areas referred to as the Renewable Energy Development Zones (REDZs) as published under Government Notice No. 114, Gazette No. 41445 on 16 February 2018 and extrapolated to cover the entire country. The sensitivities were refined through further public consultation and stakeholder interaction and have been captured in the national web based environmental screening tool.

Allowable development limits refer to the area of a particular land capability that can be directly impacted (i.e. taken up by the physical footprint) by a renewable energy development. Footprint in this context is the area that is directly occupied by all infrastructure, including roads, hard standing areas, buildings, substations, etc. that is associated with the renewable energy generation facility during its operational phase, and that result in the exclusion of that land from potential cultivation or grazing. It excludes all areas that were already occupied by roads and other infrastructure prior to the establishment of the renewable energy facility, but includes the surface area required for expanding existing infrastructure (e.g. widening existing roads). It excludes the corridor underneath overhead power lines, but includes the pylon footprints. It therefore represents the total land that is actually excluded from agricultural use as a result of the renewable energy facility.

The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa, 2015 can be accessed at:

https://redzs.csir.co.za/?page_id=611 and https://egis.environment.gov.za/redz.

3. REQUIREMENTS FOR THE INITIAL SITE SENSITIVITY VERIFICATION

Requirements for the assessment and reporting of impacts on agricultural resources for all activities requiring environmental authorisation are set out in Table 2 below, and correlate to the sensitivity ratings contained in the national web based environmental screening tool. Prior to beginning the assessment, the current use of the land and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

1.1 The Initial Site Sensitivity Verification must be undertaken by an environmental assessment practitioner or a registered specialist with expertise in the relevant environmental theme being considered.

1.2 The Initial Site Sensitivity Verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery and/or other available and relevant information; and
(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

1.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and

(c) is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

4. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 2: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AGRICULTURAL RESOURCES FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

VERY HIGH SENSITIVITY RATING - Land capability evaluation values 11 – 15; all irrigated land; horticulture and viticulture; demarcated high value agricultural areas with a priority rating of A and/or B. These areas are potentially unsuitable for development owing to: • high agricultural value and preservation importance • high production capability • high capital investment made • unique agricultural land attributes.	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified by the national web based environmental screening tool as being of "very high" or "high" sensitivity for agricultural resources must submit an **Agricultural Agro-Ecosystems Assessment,** unless the: 1.1.1 application is for a linear activity for which impacts to the agricultural resource are temporary and the land in the opinion of the soil scientist/agricultural specialist based on the mitigation and remedial measures, can be returned to the current land capability within two years of the completion of construction phase; or 1.1.2 impact on agricultural resources is from an electricity pylon which is self-supporting; or 1.1.3 information gathered from the Initial Site Sensitivity Verification contemplated in section 3 of this Protocol or the specialist assessment differs from the designation of "very high" or "high" agricultural sensitivity from the national web based environmental screening tool and it is found to be of a "medium" or "low" sensitivity. 1.2 Should either paragraphs 1.1.1, 1.1.2 or 1.1.3 apply, an **Agricultural Compliance Statement** is to be provided. In the case of paragraph 1.1.3, an environmental assessment practitioner or a registered soil scientist/agricultural specialist registered with the South African Council for Natural Scientific Professionals (SACNASP), as appropriate, must append to the **Agricultural Compliance Statement** a motivation and evidence (e.g. photographs) of the different agricultural resource sensitivity. **2 The Agricultural Agro-Ecosystems Assessment** 2.1 The assessment must be undertaken by a SACNASP registered soil scientist/agricultural specialist, on the site being submitted as the preferred development site. 2.2 The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify: 2.2.1 the extent of the impact of the proposed development on the agricultural resources; 2.2.2 whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources. 2.3 Description of the status quo, including the following aspects which must be considered as a minimum in the baseline description of the agro-ecosystem: 2.3.1 The soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope; 2.3.2 Where applicable, the vegetation composition, available water sources as well as agro-climatic information;
HIGH SENSITIVITY RATING - Land capability evaluation values 8 - 10 including all cultivated areas[3] including sugar cane areas and demarcated high value agricultural areas with a priority rating of C and/or D. High sensitivity areas are still preservation worthy since they include land with an agricultural production potential and suitability for specific crops.	2.3.3 The current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units; 2.3.4 The current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure; 2.3.5 Existing impacts on the site, located on a map (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc.). 2.4 Assessment of impacts, including the following aspects which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem: 2.4.1 Change in productivity for all agricultural activities based on the figures of the past 3 years, expressed as an annual figure and broken down into production units; 2.4.2 Change in employment figures (both permanent and casual) expressed as an annual figure; 2.4.3 Any alternative development footprints within the preferred development site which would be of "medium" or "low" sensitivity for agricultural resources as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification. 3 The findings of the **Agricultural Agro-Ecosystem Assessment** must be written up in an **Agricultural Agro-Ecosystem Report.** 3.1 This report must contain the findings of the Agro-Ecosystem Assessment and the following information: 3.1.1 Details and relevant experience as well as the SACNASP registration number of the soil scientist/agricultural specialist/s preparing the assessment including a curriculum vitae; 3.1.2 A signed statement of independence by the specialist; 3.1.3 The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment; 3.1.4 A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant; 3.1.5 A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national web based environmental screening tool; 3.1.6 An indication of the potential losses in production and employment from the change of the agricultural land use as a result of the proposed development; 3.1.7 An indication of possible long term benefits that will be generated by the project in relation to the benefits of the agricultural activities on the affected land; 3.1.8 Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc.; 3.1.9 Information on the current agricultural activities being undertaken on adjacent land parcels; 3.1.10 A motivation must be provided if there were development footprints identified as per paragraph 2.4.3 above that were identified as having a "low" biodiversity sensitivity and that were not considered appropriate; 3.1.11 Confirmation from the soil scientist/agricultural specialist that all reasonable measures have been considered in the micro-siting of the development to minimise fragmentation and disturbance of agricultural activities;

[3] The Field Crop boundary and Land Capability dataset has been provided by DAFF. For details of the datasets, click on the options button to the right of the Field Crop Boundary layer and Land Capability layer respectively, in the Agricultural Theme to view the metadata.

TABLE 2: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AGRICULTURAL RESOURCES FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3.1.12 A substantiated statement from the soil scientist/agricultural specialist with regards to agricultural resources on the acceptability or not of the development and a recommendation on the approval or not of the development; 3.1.13 Any conditions to which the statement is subjected; 3.1.14 Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and 3.1.15 A description of the assumptions made and any uncertainties or gaps in knowledge or data. 3.2 In addition, where the activity is related to the generation of renewable energy of 20 MW or more, the report must contain: 3.2.1 Calculations of the total development footprint area for each land parcel as well as the total footprint area of the development (including supporting infrastructure); 3.2.2 Confirmation whether the development footprint is in line with the development limits set in the Table 1 above, including where applicable any deviation from the set development limits and motivation to support the deviation, including; a. Where relevant, reasons why the proposed development footprint is required to exceed the limit; b. Where relevant, reasons why this exceedance will be in the national interest; c. Where relevant, reasons why there are no alternative options available including evidence in terms of alternatives assessed. 3.3 A map showing the renewable energy applications within a 50 km radius of the proposed development with valid Environmental Authorisations. 4 The findings of the **Agricultural Agro-Ecosystems Assessment** must be incorporated into the Basic Assessment Report, or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which are to be contained in the EMPr. A signed copy of the full Agricultural Agro-Ecosystems Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
MEDIUM SENSITIVITY RATING - Land capability evaluation values 6 – 7. Medium sensitivity areas are likely to be very marginal arable land.	**1. General Information** 1.1. An applicant intending to undertake an activity identified in the Scope of this Protocol proposed on a site identified by the national web based environmental screening tool as being of "medium" or "low" sensitivity for agricultural resources or where the activity is related to the generation of renewable energy of 20 MW or more and the development footprint complies with the development limits identified in the Table 1 above, must submit an **Agricultural Compliance Statement,** unless: 1.1.1. The information gathered from the Initial Site Sensitivity Verification contemplated in section 3 of this Protocol differs from that identified as having a "medium" or "low" agricultural sensitivity by the national web based environmental screening tool and it is found to be of a "very high" or "high" sensitivity; or 1.1.2. Where the activity is related to the generation of renewable energy of 20 MW or more, the development footprint deviates from any of the allowable development limits contained in Table 1 above. 1.2. Should paragraphs 1.1.1 or 1.1.2 apply, an **Agricultural Agro-Ecosystems Assessment** is to be undertaken and a report prepared in accordance with the requirements of an Agro-Ecosystems Assessment. **2. Agricultural Compliance Statement**

TABLE 2: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AGRICULTURAL RESOURCES FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	The **Agricultural Compliance Statement** must be prepared by a soil scientist/agricultural specialist registered with the SACNASP, on the site being submitted as the preferred development site and must indicate whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site. 3. The **Agricultural Compliance Statement** must contain, as a minimum, the following information: 3.1. Details and relevant expertise as well as the SACNASP registration number of the soil scientist/agricultural specialist preparing the statement including a curriculum vitae; 3.2. A signed statement of independence by the specialist; 3.3. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national web based environmental screening tool; 3.4. Calculations of the total development footprint area for each land parcel as well as the total footprint area of the development (including supporting infrastructure); 3.5. Confirmation that the development footprint is in line with the development limits set in Table 1 above. 3.6. Confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimise fragmentation and disturbance of agricultural activities; 3.7. A substantiated statement from the soil scientist/agricultural specialist on the acceptability of the development and a recommendation on the approval or not of the development; 3.8. Any conditions to which the statement is subjected; 3.9. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and 3.10. A description of the assumptions made and any uncertainties or gaps in knowledge or data. 4. The signed Agricultural Compliance Statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

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

PART 3.2

BATS

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.2 BATS

The following section is informed by the scoping level specialist bat pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A1.

3.2.1 Renewable Energy and Bats

3.2.1.1 Wind Energy

The key impacts of wind energy facilities on bats are barotrauma and direct collision. 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[1].

There are four main groups of bats that are at risk of collision or barotrauma2 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. This group is made up of the families Molossidae and Emballonuridae. All species within these families are at high risk of fatality.
- 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*[3] .
- 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 South Africa migrating bats are generally cavity roosting species. Migrating bats are considered to be at Medium to High risk of fatality.
- Fruit bats. 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.

Bat fatalities raise serious concerns because of the population-level impacts that mass fatalities may cause. Unpublished post construction monitoring reports (referred to by the authors of the bat specialist study) have found several of the above-mentioned bats beneath turbines.

Further suspected direct and indirect impacts which need to be investigated at national and international levels in further detail include:

- Disturbance to or loss of roost sites;
- Loss or alteration of foraging habitat; and
- Barrier or fragmentation effect of wind farms on dispersing or migrating bats.

3.2.1.2 Solar PV Energy

To date, Solar PV developments have not been found to present a significant direct impact on bat populations. Consequently, in South Africa, such projects have generally received environmental authorisation without requiring bat baseline monitoring or specialist studies.

However, there are secondary and speculative impacts that are mentioned in international scientific publications which deserve consideration and should be further investigated. A potential impact is the disturbance of bat communities through land clearance. In the event that a Solar PV facility is constructed near bat roosting habitats, such as trees, buildings or caves, there may be a disturbance and displacement impact, especially due to the land on which the development is sited remaining relatively sterile for the life of the facility.

3.2.2 Sensitivity Mapping

3.2.2.1 Key Environmental Considerations

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 the presence bats.

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 (Table 1).

3.2.2.1.1 Terrestrial Ecoregions

Ecoregions are large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions. The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. The nine Biomes of South Africa are broader scale than the more detailed 15 Ecoregions. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level. From numerous monitoring assessments[4], 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). The Ecoregions relevant to this SEA are listed in Table 1.

3.2.2.1.2 Geology

Geology is a significant environmental parameter for bats, as many South African bats are crevice or hollow-roosting species. Crevice roosting bats utilizing rock cracks, bridge expansion joints, 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 carbonate rocks such as limestone and dolomite. Although there is not much known about the migration routes of bats in South Africa, it is known that three cave dwelling species undertake seasonal migrations. Four main lithologies were selected as relevant to bats in terms of roosting potential: Limestone, Dolomite, Arenite and Sedimentary and Extrusive rock.

3.2.2.1.3 Bat Roosts

Mapped bat roosts from a number of sources including SABAA were mapped as part of this SEA. All roosts were considered to be of a Very

[1] Arnett, E.B. (2017). Mitigating Bat Collisions. In: Wildlife and Wind Farms, Conflicts and Solutions. Volume 2 Onshore: Mitigating and Monitoring (Perrow, M.R. eds). Pelagic Publishing, Exeter, UK.

[2] 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)

[3] Doty & Martin, 2012; MacEwan, 2016; IWS several assessments unpublished

[4] MacEwan, K., Lötter, C., Morgan, T. Weiss, J. Pierce, M. and Baumgartner, M. (2016). A comparison of bat activity in different South African Terrestrial Ecoregions. In press.

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.

3.2.2.1.4 Wetlands, Rivers & Dams

Wetlands and damns were used as sensitivity layers in the SEA because wetlands and dams provide drinking and foraging opportunities for bats.

3.2.2.1.5 Extent of Occurrence of Bat Species of Conservation Importance

Extent of Occurrence (EoO) 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).

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.

Only species, where their EoO overlaps with the FAs and they are relevant to wind and solar PV development, are mentioned here.

3.2.2.1.6 Land use

Bat sensitivities are affected by land use in the form of buildings that represent roosting habitat for specific crevice and hollow-roosting species and field crop areas, representing altered foraging land for bats. Human induced land-use changes can be beneficial for certain species of bats, with irrigated and fertile crop lands potentially being hotspots for insectivorous bat foraging.

Images from Inkululeko Wildlife Services

Table 1: Spatial data used in the bat sensitivity mapping

Sensitivity Feature		Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Ecoregions	Albany thickets	- Terrestrial Ecoregions (Olson et al., 2001). The Nature Conservancy, Arlington, VA. Available at http://maps.tnc.org/files/shp/terr-ecoregions-TNC.zip	- Medium	- N/A
	Lowland Fynbos and Renosterveld		- High	- Low
	Nama Karoo		- Medium	- Low
	Drakensberg Montane Grasslands, Woodlands and Forest		- Medium	- Medium
	Montane Fynbos and Renosterveld		- Low	- Low
	Succulent Karoo		- Low	- Low
	Southern African Bushveld		- N/A	- Medium
	Highveld Grassland		- N/A	- Low
	Kalahari Xeric Savannah		- N/A	- Low
	Zambesian and Mopane Woodlands		- N/A	- Medium
	KwaZulu-Cape Coastal Forest Mosaic		- N/A	- Very High
Dams, Rivers and Wetlands - There is strong support for the importance of rivers and riparian areas for bats.		- Wetlands = National Freshwater Ecosystem Priority Areas (NFEPA). CSIR. July 2011. - Dams = dams500g_wgs84 shapefile. Dept. Water and Sanitation.	- Very High Sensitivity within sensitivity distances within 200 m	- Very High Sensitivity within sensitivity distances within 200 m
Geology Geological features in the form of rock crevices and caves are essential roosting habitats for many bats species.	Dolomite	- Council for Geosciences SA. - Geology wr90 shapefile and Geology Geoscience shapefile. Limited metadata are available but date of creation is 1997.	- Very High within sensitivity distances within 200 m	- Very High within sensitivity distances within 200 m
	Arenite		- High within sensitivity distances within 200 m	- Mediun within sensitivity distances within 200 m
	Sedimentary and Extrusive Rock		- Medium within sensitivity distances within 200 m	- Medium within sensitivity distances within 200 m
Forests - Forests provide a favourable habitat for bats.		- Mucina, L. & Rutherford, M.C. (2006). The vegetation map of South Africa, Lesotho and Swaziland.	- High Sensitivity forest habitats	- High Sensitivity forest habitats
Coastline - The unique costal habitat provides several foraging and rousting opportunities.		- Surveyor General (2006) 1:50 000 topographical maps	- Very High Sensitivity within 5 km of coastline - High Sensitivity between 5 and 10 km from coastline - Medium Sensitivity between 10 and 20 km from coastline	- High Sensitivity Within 2km from coastline
Bat Roosts		- Various sources and field verifications	- Very High Sensitivity Buffers depend on sixe of the roost and type of bats	- Very High Sensitivity within 500 m of roost

Sensitivity Feature		Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Land Cover: Vegetation		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	- Medium Sensitivity between 200 m	- Medium Sensitivity between 200 m
Land Cover: Urban Built-up Areas	Urban 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	- Medium	- Medium
	Disturbed Land (Eroded)		- Low	- Low
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.	- Medium	- Medium - No buffer
Extent of Occurrence of Bat Species of Conservation Importance	*Cistugo seabrae*	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.	- Medium	- Medium
	Epomophorus wahlbergi		- High	- N/A
	Cloeotis percivali		- N/A	- Medium
	Laephotis namibensis		- Medium	- Medium
	Otomops martiensseni		- N/A	- Medium
	Rhinolophus blasii		- N/A	- Medium
	Rhinolophus cohenae		- N/A	- Medium
	Rhinolophus denti		- Medium	- Medium
	Rhinolophus swinnyi		- N/A	- Medium

3.2.3 Sensitivity Maps

The criteria details in the Table above were used to classify bat sensitivities into four tiers of Very High, High, Medium and Low, as shown in Figure 1 to Figure 10. The sensitivity classes are as follows:

- 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.
- High sensitivity areas were considered to have high roosting and/ or foraging potential and/ or due to high bat activity levels.
- 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.
- 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.

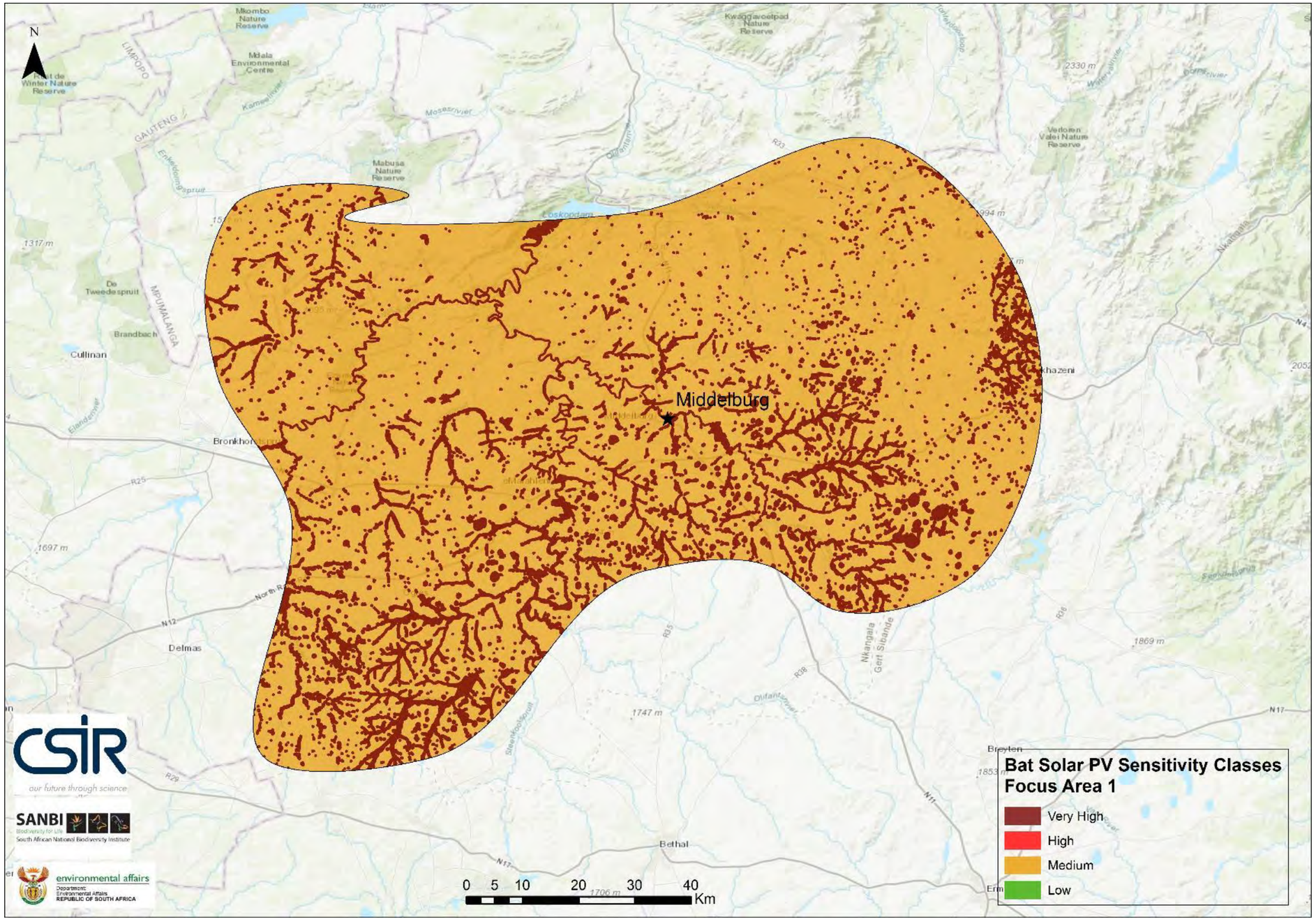

Figure 1: Bat sensitivity map for solar PV development in FA 1

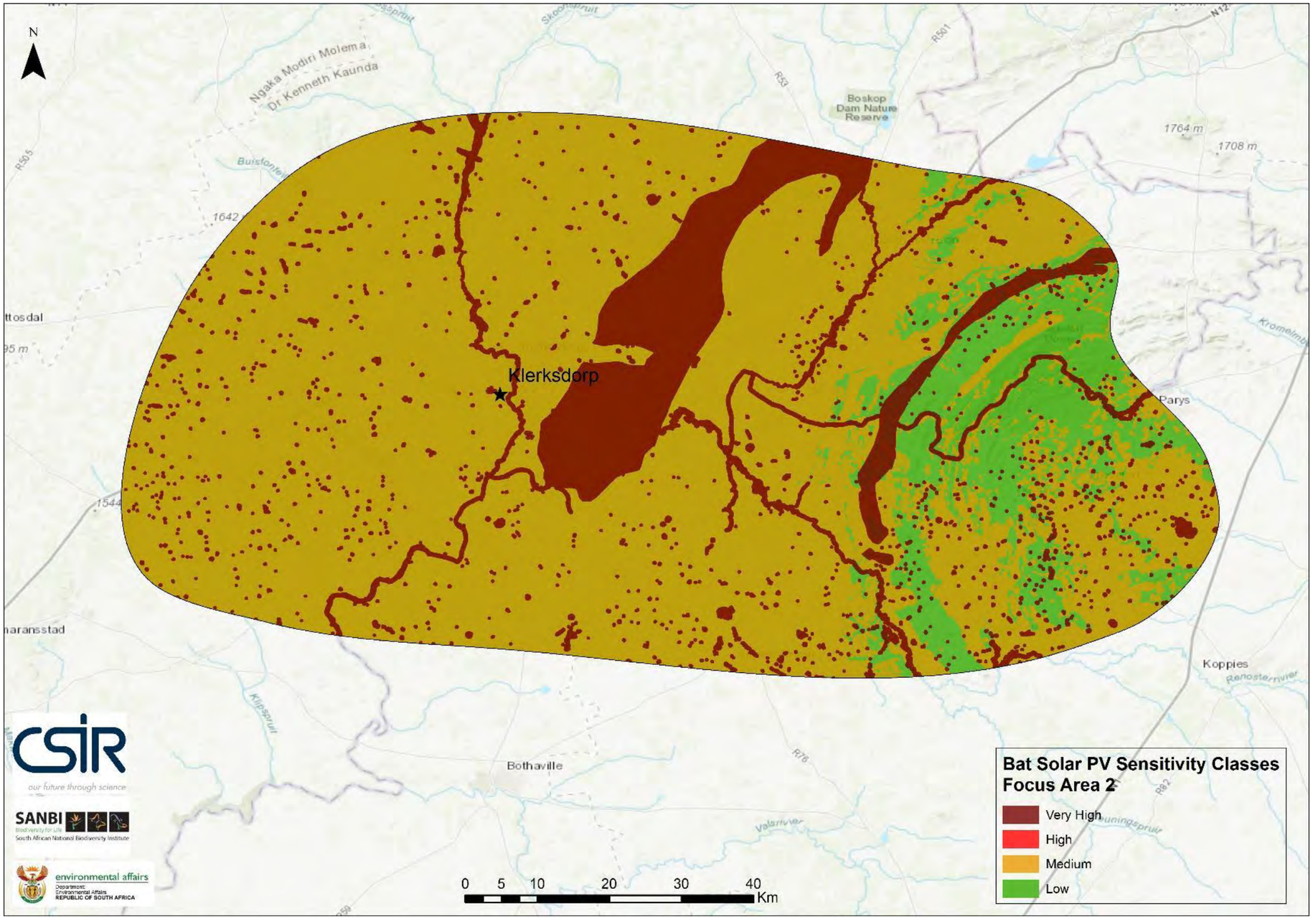

Figure 2: Bat sensitivity map for Solar PV development in FA 2

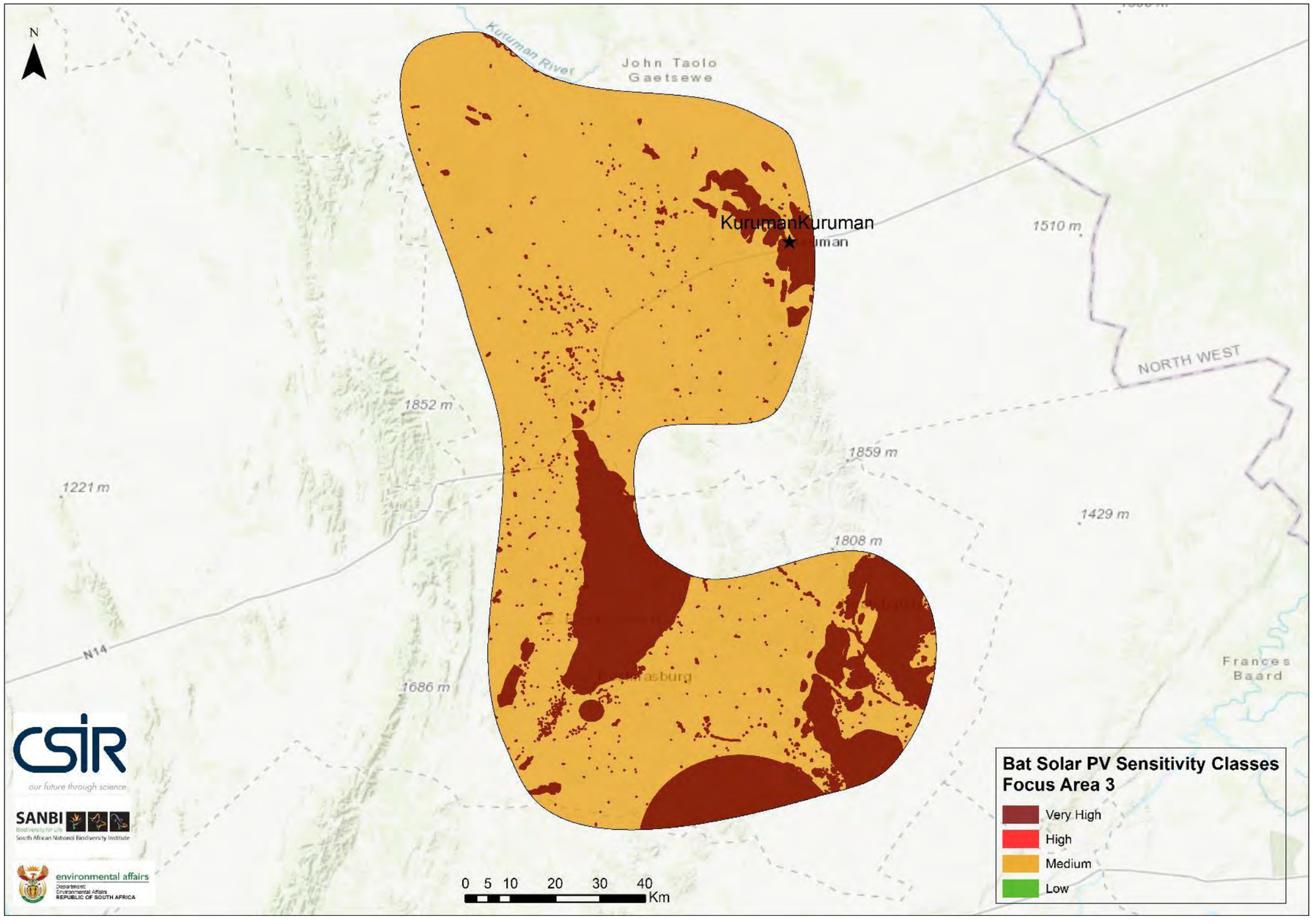

Figure 3: Bat sensitivity map for solar PV development in FA 3

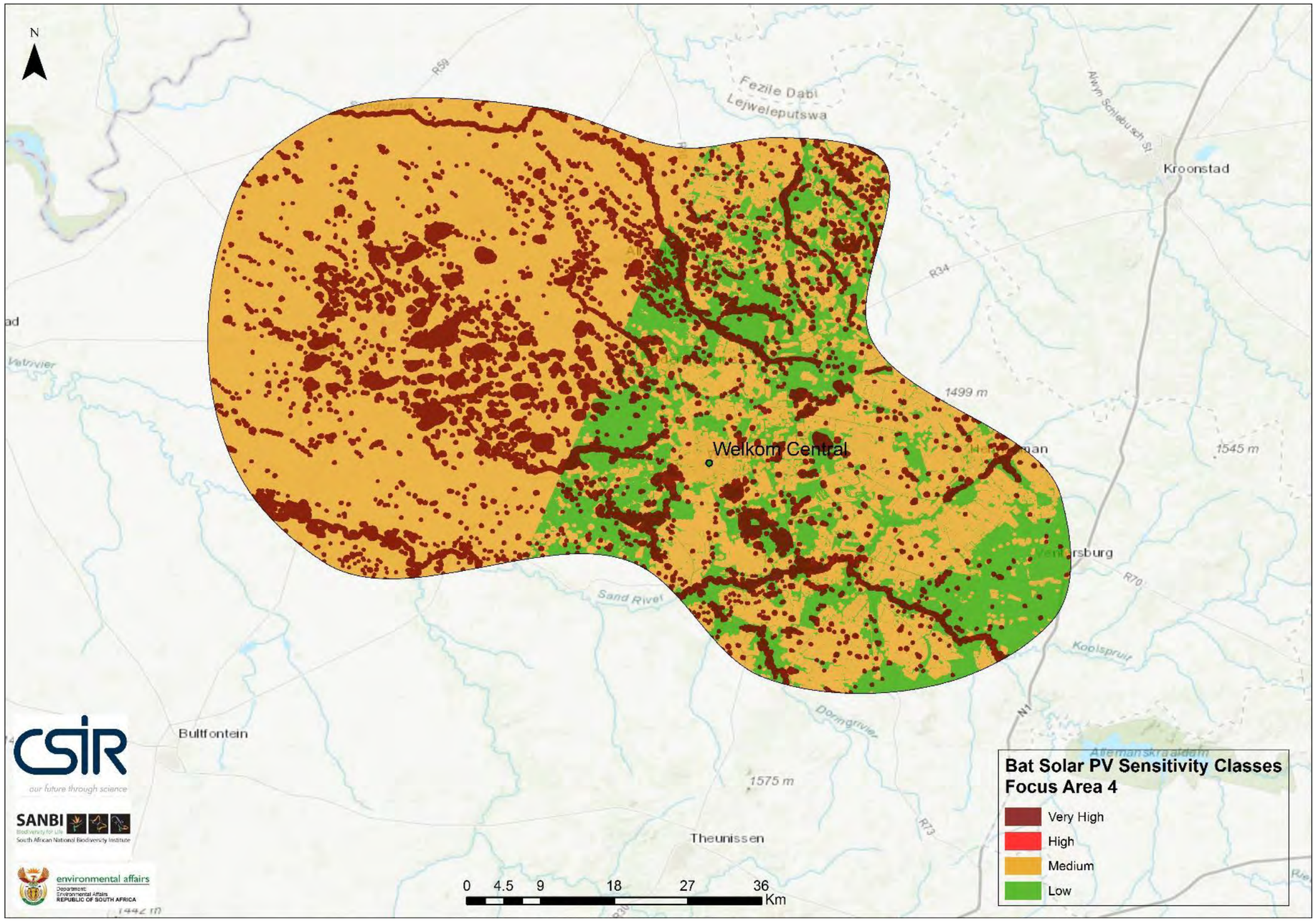

Figure 4: Bat sensitivity map for Solar PV development in FA4

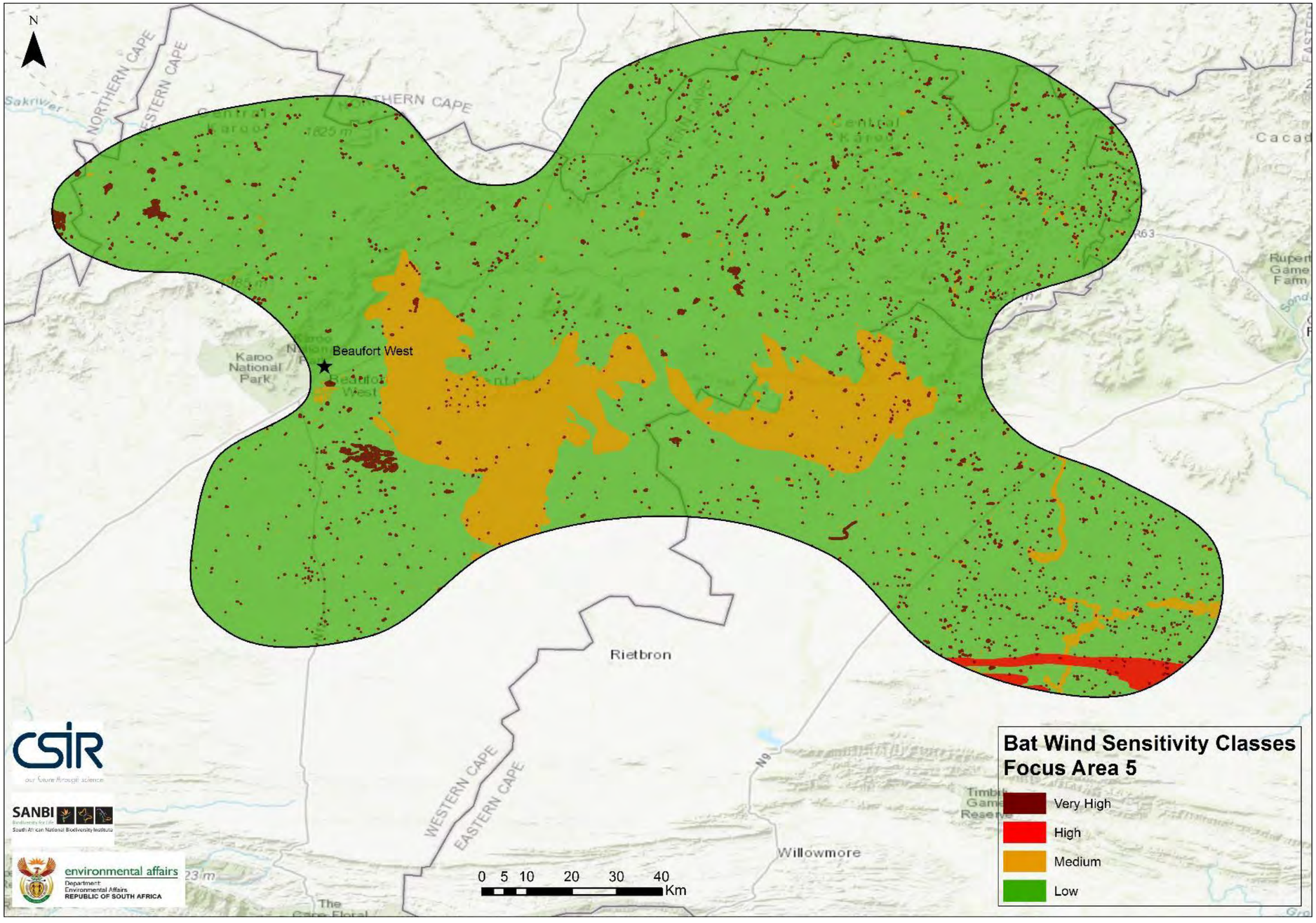

Figure 5: Bat sensitivity map for Wind development in FA 5

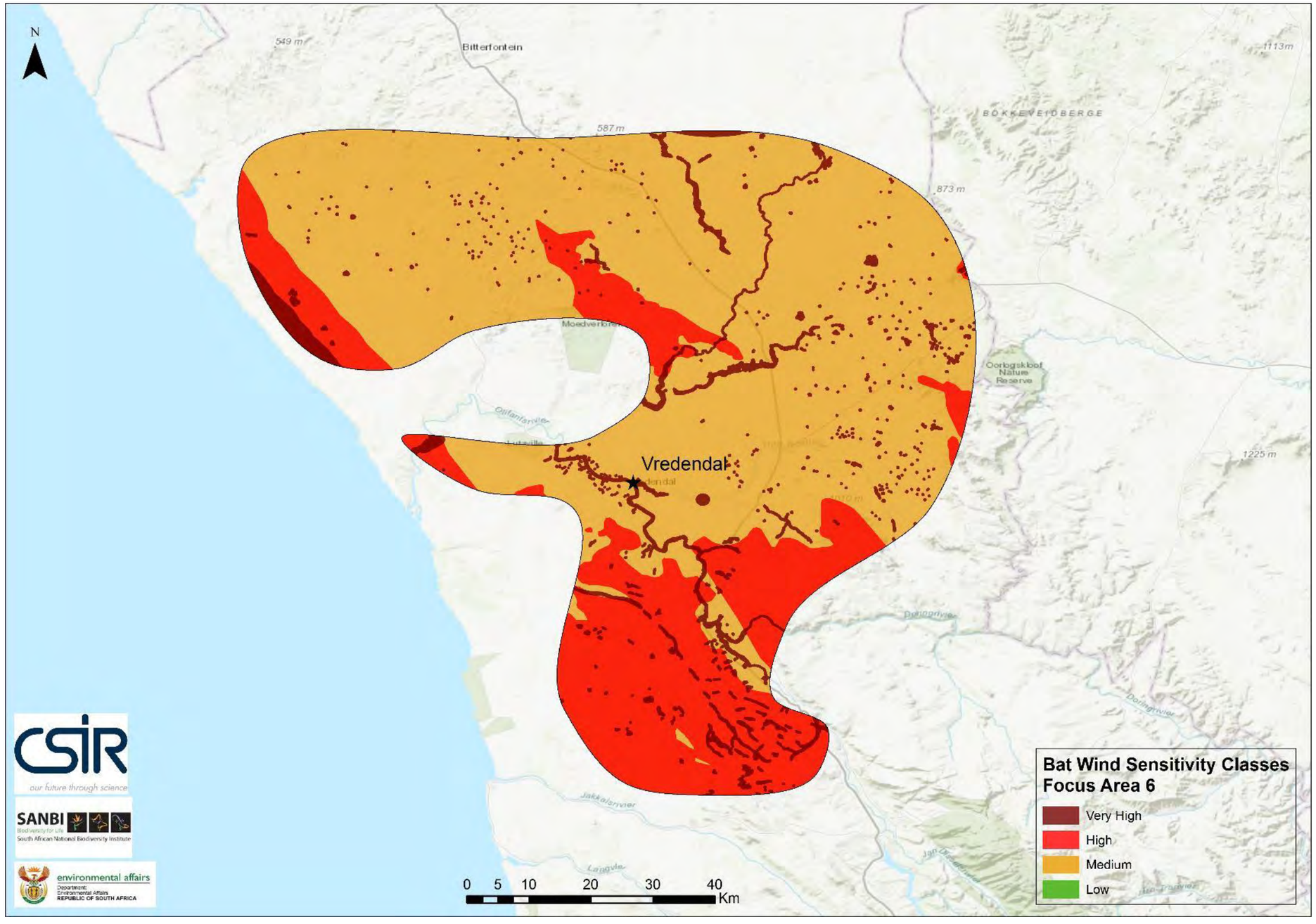

Figure 6: Bat sensitivity map for Wind development in FA 6

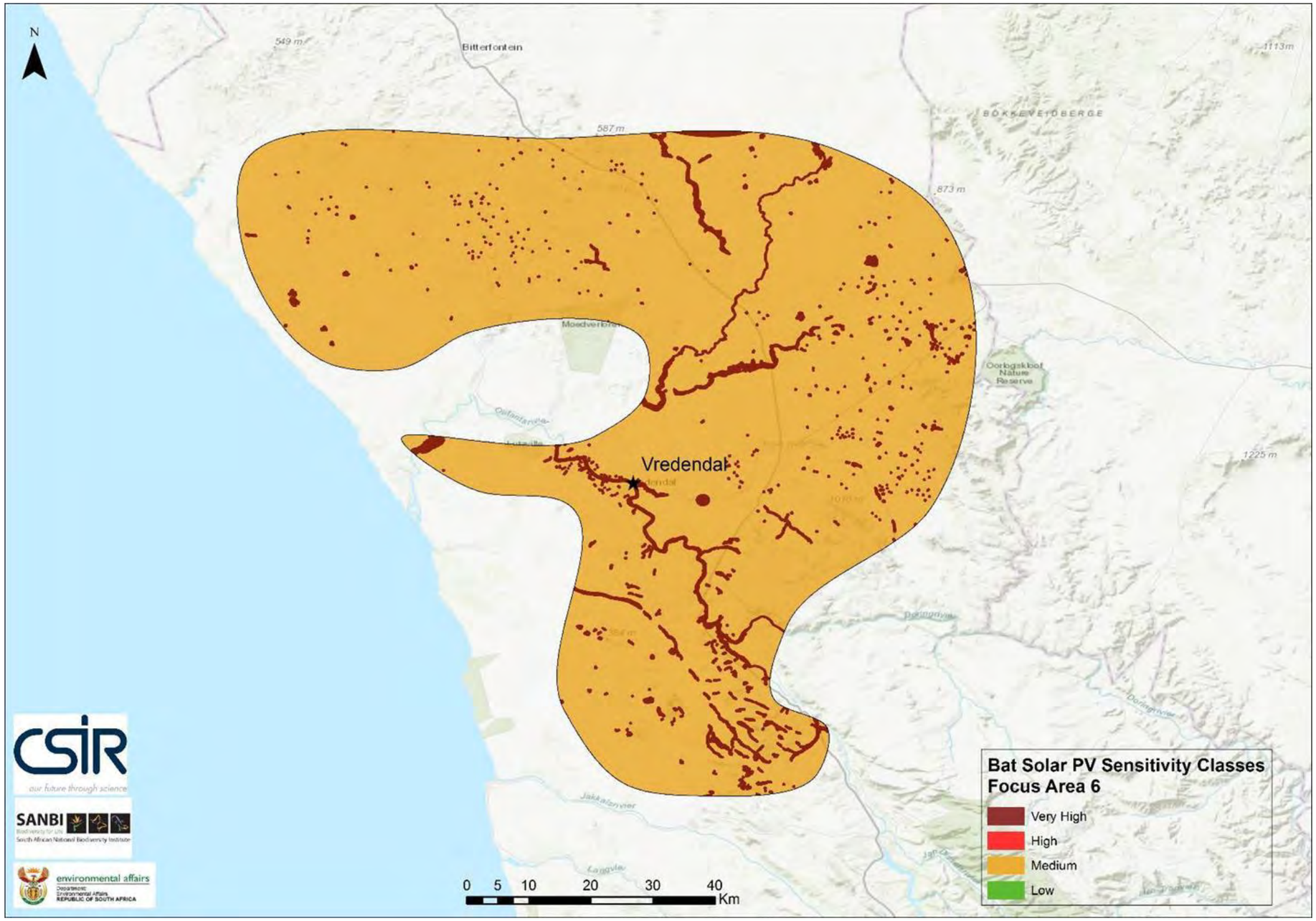

Figure 7: Bat sensitivity map for Solar PV development in FA 6

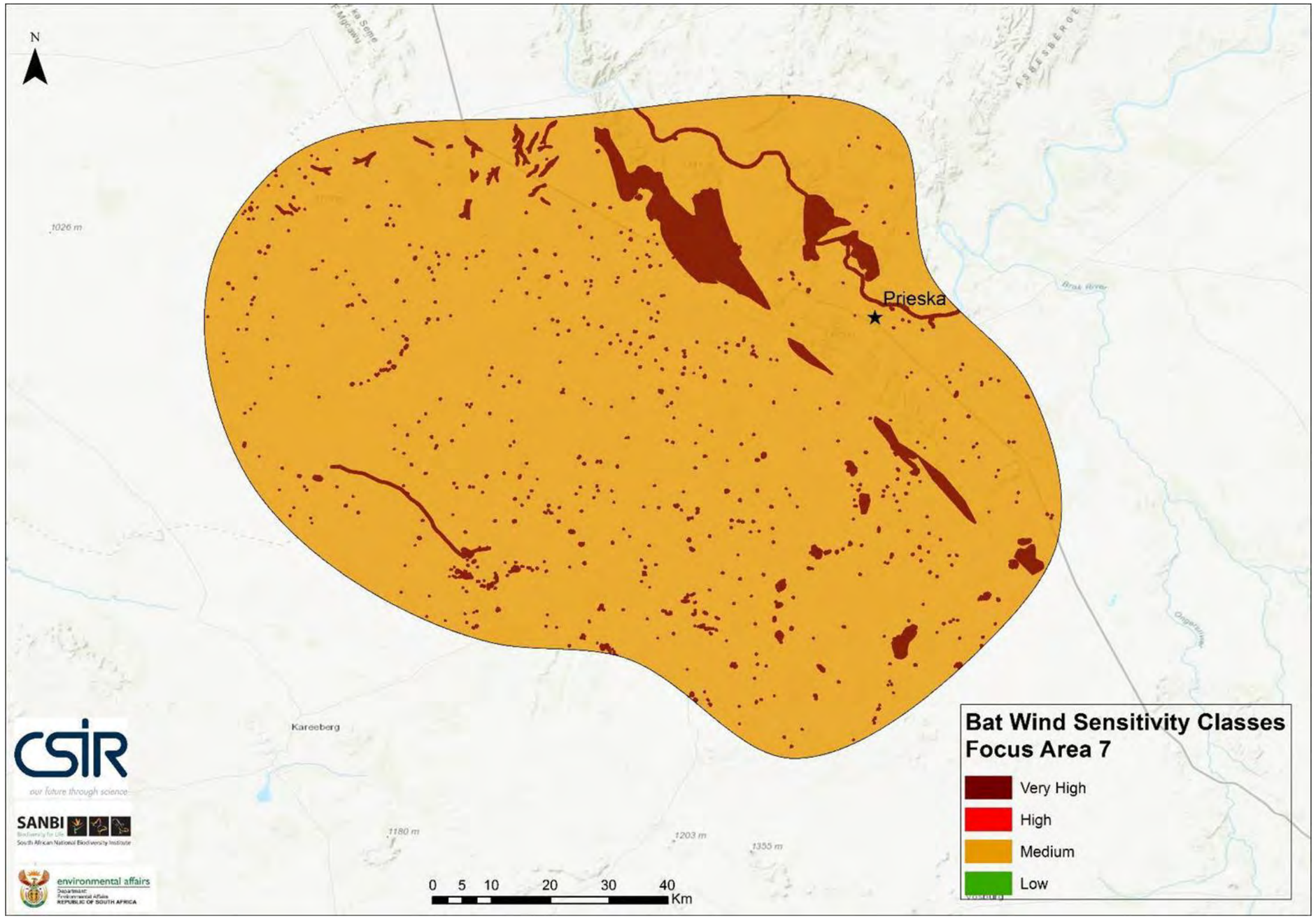

Figure 8: Bat sensitivity map for Wind development in FA 7

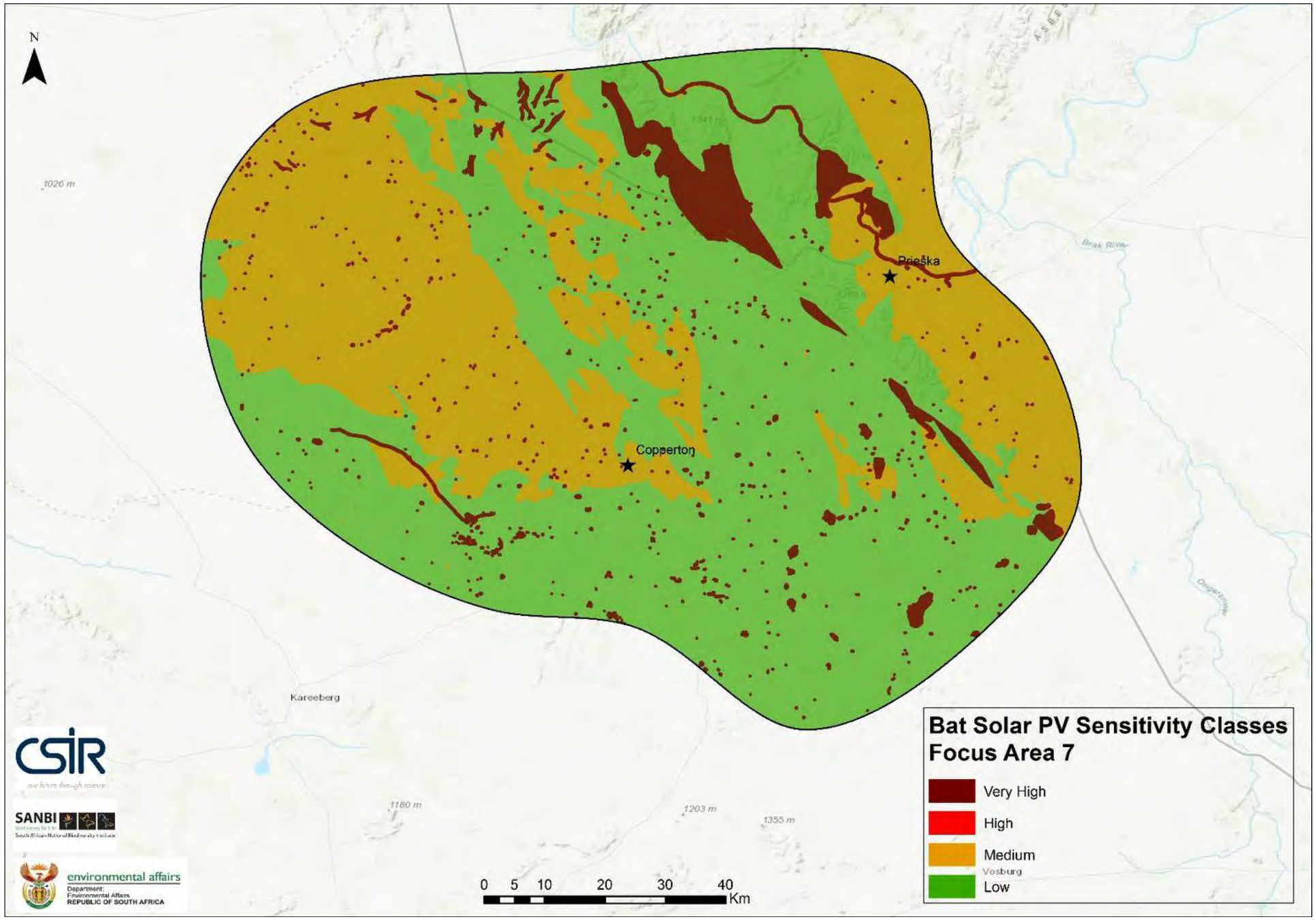

Figure 9: Bat sensitivity map for Solar PV development in FA7

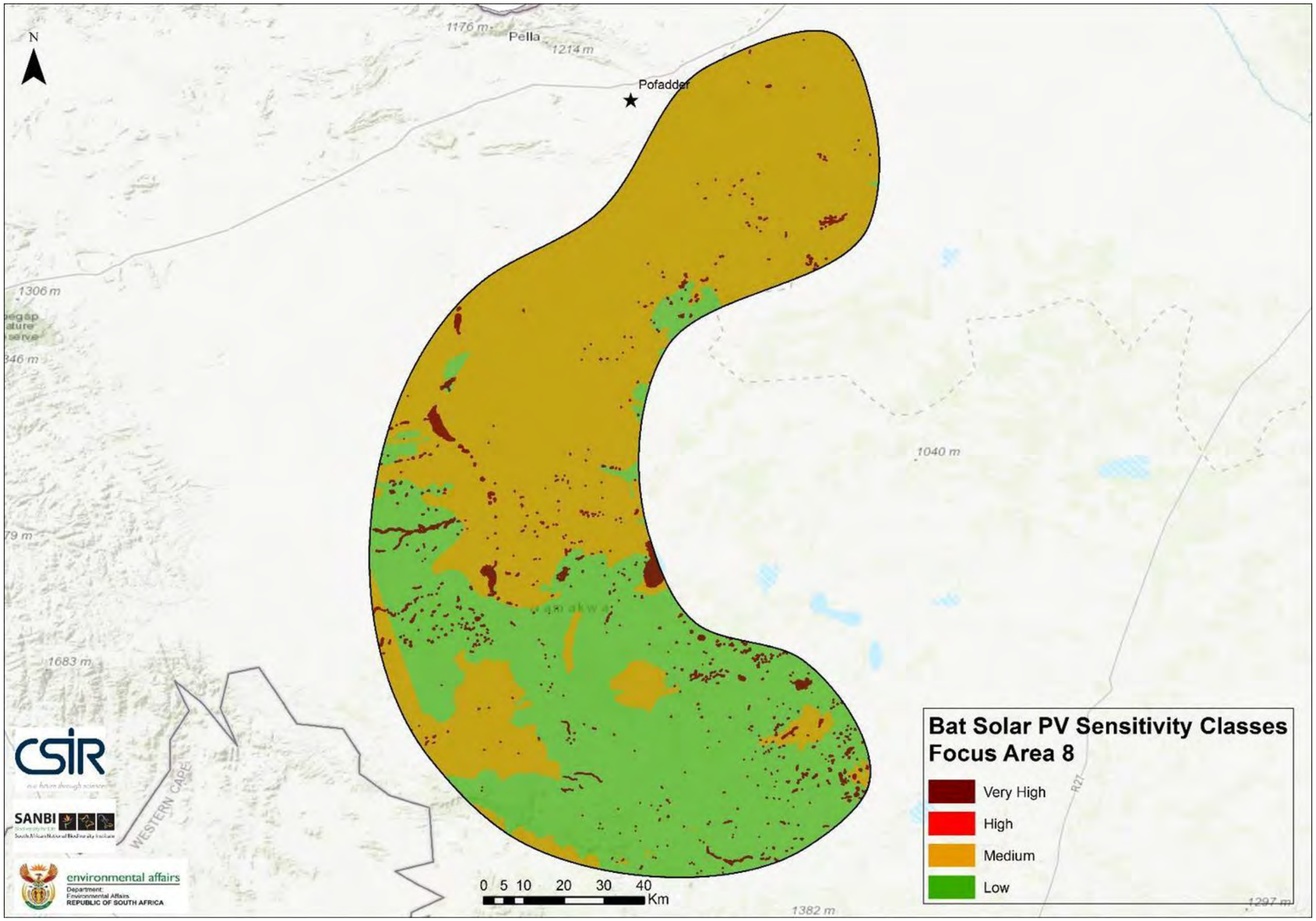

Figure 10: Bat sensitivity map for Solar PV development in FA8

3.2.4 Development Protocols

The protocols for bat impact assessment for wind energy are currently in development and will be finalised and linked to the sensitivity data on the National Web Based Screening Tool. As a result of the bat data used in the SEA and uploaded in the screening tool being of a desk top nature, field assessments will always need to be conducted at EIA level. In Table 2 below, the current requirements for bat assessment are described.

Table 2: Interpretation of bat sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current assessment requirements	
		Wind	Solar PV
Any area is considered as potentially being of very high sensitivity.	In the absence of any pre-assessment it is assumed that any area is potentially highly sensitivity to development from a bat perspective, either due to the presence of roosting or foraging habitat.	Proponents intending to develop a wind facility triggering an environmental assessment process must prove to the relevant competent authority 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 12 months of pre-construction bat monitoring undertaken in accordance with best practice guidelines[5]. If such a body exists, quarterly progress and final reports and recommendations must be peer reviewed by a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.	Proponents intending to develop a solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a competent general ecologist must consider significant bat impacts (if any) **as part of the terrestrial and ecological biodiversity assessment**. In the case that any significant bat sensitivities are identified, a competent bat specialist should be involved to assess the impacts in accordance with the NEMA regulations pertaining to specialist reports and impact assessment. If such a body exists, final reports and recommendations prepared for significant bat sensitivities must be peer reviewed by a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

[5] latest Edition of the South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction

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

PART 3.3

TERRESTRIAL AND AQUATIC BIODIVERSITY

environmental affairs
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3.3 TERRESTRIAL AND AQUATIC BIODIVERSITY

3.3.1 Introduction

Renewable energy provides the much needed diversification of South Africa's electricity generation, it is however recognised that renewable energy facilities can have negative impacts on biodiversity. In parallel with the potential to mitigate climate change, wind and solar PV facilities utilise significant amounts of land, causing habitat loss/change and ultimately impacting on biodiversity. The most significant impacts in solar power development occur during the construction phase, associated with vegetation clearing and top soil removal, resulting in habitat fragmentation, barriers to the movement of species etc. Significant impacts of wind power installation on biodiversity include bird and bat collisions with wind turbines. Sensitive biodiversity areas need to be considered when developing renewable energy facilities, in an effort to minimise the energy installation's negative impacts on biodiversity and maximise energy generation. The aim of this SEA, in the context of this section, is to investigate the biodiversity sensitivity and impacts of wind and solar on a national scale, in order to optimise the planning and siting for wind and solar PV developments.

3.3.2 Scope

This section covers the sensitivity analysis and potential impacts on biodiversity associated with the development of renewable energy facilities. Information is assessed at desktop level, based on existing spatial data that was developed by the South African National Biodiversity Institute (SANBI) and is made available on the DEFF National web-based environmental screening tool[1]. This assessment is, therefore, primarily focussed on the interpretation of national aquatic and terrestrial sensitivities, as well as the protocols that should be incorporated for biodiversity assessments.

3.3.2.1 Relevant Legislation

The following legislation is relevant to biodiversity assessments in South Africa:

- National Environmental Management Act (107 of 1998) (NEMA) – a primary environmental framework in South Africa that provides for co-operative governance and decision making in matters affecting the environment. The Act provides for listed activities that trigger the requirement for environmental authorisation, prior to development, which is it aims to restrict and control development and potential harmful activities through the Environmental Impact Assessment (EIA) regulations and the undertaking of relevant assessments prior to commencement of listed activities (Section 24 (5) and 44). Imposes a general "duty of care" for the environment (Section 28) which means that all persons undertaking any activity that may potentially harm the environment must undertake measures to prevent pollution and environmental degradation.

- National Environmental Management Act, Environmental Impact Assessment 2014 Regulations, as amended in 2017 – the purpose of these regulations is to avoid negative impacts on the environment or where they cannot be avoided, ensure mitigation and management of the impacts to acceptable levels, while optimising positive environmental impacts.

- National Environmental Management: Biodiversity Act (10 of 2004) (NEM:BA) – enacted to provide for the management and conservation of the country's biodiversity within the framework of NEMA. Aimed at regulating activities that may impact South Africa's biodiversity, including habitat destruction, over-exploitation, alien plant and animal invasion.

- National Environmental Management: Protected Areas Act (57 of 2003) (NEM:PAA) – enacted to provide for the protection and conservation of ecologically viable areas that represent the country's biodiversity and natural landscapes, through the declaration and management of these protected areas.

- National Environmental Management: Waste Act (59 of 2008) (NEM:WA) – regulates waste management in an aim to protect the environment through the prevention of pollution and ecological degradation. Provides for specific waste management activities to secure ecologically sustainable development.

- National Water Act (36 of 1998) (NWA) – legal framework enforced to promote the protection, sustainable use, conservation, management and control of South Africa's water resources.

- National Environmental Management: Integrated Coastal Management Act (24 of 2008) (NEM:ICM) – makes provision for integrated coastal and estuarine management. It aims to preserve and promote the country's coastal environment and landscape, and ensure sustainable use of natural resources in these environments.

- National Forest Act (84 of 1998) (NFA) – provides for the protection of natural forests and indigenous tree species through supporting sustainable forest management and the restructuring of the forestry sector.

- Draft National Biodiversity Offset Policy – the purpose of the policy is to ensure that significant residual impacts of developments are remedied as required by the NEMA, thereby ensuring sustainable development. Should it be determined in the EIA process that there will be residual impacts that cannot be avoided and/or mitigated, then an offset will need to be established to account for the loss of biodiversity. The core principles for offsetting, as set out in the policy, should be used to guide the process of evaluating, designing and implementing an offset.

3.3.3 Focus Area Descriptions

A brief description of the main vegetation and aquatic attributes of the eight focus areas is provided below. The SANBI data was used to undertake desktop evaluations of the areas to define the vegetation types and water resources present. The Strategic Water Source Areas (SWSAs) layer was used as the basis for the description of the freshwater ecosystems within each focus area. SWSAs are defined as "areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b)".

[1] Modelled species data on National Web Based Screening Tool to be considered when undertaking all assessments

Table 1: Focus Area Description in terms of key vegetation and aquatic attributes.

Focus Area and Location	Brief Description
Focus Area 1 **(solar PV)** is located is located in Mpumalanga, near Middelburg and Witbank, in the vicinity of the Emalaheni Local Municipality.	**Vegetation:** It is characterised by the Rand Highveld Grassland, Eastern Highveld Grassland, Central Sandy Bushveld, Steenkampsberg Montane Grassland, Loskop Mountain Bushveld and the Sekhukhune Montane Grassland vegetation types. It is represented mostly by the Grassland and Savanna biomes, with small amounts of the Eastern Temperate Freshwater Wetlands represented by the Azonal biome. Among the vegetation types identified in this focus area; 3 are listed as Vulnerable, 3 as Endangered and 1 as Critically Endangered in terms of the National List of Threatened Ecosystems in need of protection. **Aquatic:** Focus Area 1 consists of a network of streams and rivers that span across the area. Majority of the rivers within Focus Area 1 are perennial in nature. The Present Ecological State (PES) of rivers is assessed to be generally "Moderately Modified", with 38% of the rivers assessed to be "Largely Modified", and a small proportion (2.5%) are in a "Largely Natural With Few modifications" condition. The dominant wetland vegetation group is the Mesic Highveld Grassland Groups, with 8% of this area characterised by the Central Bushveld Groups. This Focus Area includes wetlands of all types - Channelled valley-bottom, Depressions, Flats, Floodplain wetlands, Seeps, Unchannelled valley-bottom wetlands and Valley-head seeps. Focus Area 1 includes the Northern Highveld Groundwater SWSA.
Focus Area 2 **(solar PV)** spans between the North West and Free State provinces, located near Klerksdorp and Potchefstroom.	**Vegetation:** The area is dominated by the Vaal-Vet Sandy Grassland vegetation type. Other vegetation types include Rand Highveld Grassland, Vredefort Dome Granite Grassland, Gold Reef Mountain Bushveld, Vaal Reefs Dolomite Sinkhole Woodland, Klerksdorp Thornveld, Andesite Mountain Bushveld, Carletonville Dolomite Grassland, Central Free State Grassland, Highveld Salt Pans and Highveld Alluvial Vegetation. Two vegetation types occurring in this Focus Area, the Rand Highveld Grassland and Vredefort Dome Granite Grassland, are listed as Vulnerable, while the dominant Vaal-Vet Sandy Grassland is Critically Endangered. **Aquatic:** Majority of the rivers in the Focus Area are perennial, that is maintain a continuous flow throughout the year. From a river condition perspective, 64% of the rivers are classified as "Moderately Modified". The dominant wetland types within this Focus Area are the Channelled valley-bottom, Seeps and Unchannelled valley-bottom wetlands, typical of the Dry Highveld Grassland Group vegetation type. This focus area includes the Far West Karst Region Groundwater SWSA.
Focus Area 3 **(Solar PV)** is located in the Northern Cape and includes the mining towns of Hotazel, Sishen and Postmansburg.	**Vegetation:** There are 10 vegetation types in the focus area; the Kathu Bushveld, Kuruman Thornveld, Postmasburg Thornveld, Ghaap Plateau Vaalbosveld, Olifantshoek Plains Thornveld, Kuruman Mountain Bushveld, Northern Upper Karoo, Gordonia Duneveld, Southern Kalahari Salt Pans and Southern Kalahari Mekgacha vegetation type, representing the Savanna and Azonal vegetation biomes. None of the vegetation types occurring in Focus Area 3 are listed as threatened. **Aquatic:** The aquatic environment of Focus Area 3 is dominated by the ephemeral Ga-Mogara and the perennial Kuruman rivers, flowing from the north to south west and south east respectively. The PES of these rivers is classified as "Largely Natural". All the other streams in this Focus Area are ephemeral, ranging from a "Largely Natural" PES in the south-west of the Focus Area to "Moderately Modified" PES in the south-east. The wetlands in this Focus Area are largely typical of the Eastern Kalahari Bushveld Groups vegetation types. Majority of the wetlands are Depressions, in natural or good condition (class AB), scattered across the focus area. Groundwater SWSAs present in Focus area 3 include the Northern Ghaap Plateau, Sishen/Kathu and the Southern Ghaap Plateau.
Focus Area 4 **(Solar PV)** in the Free State, encompasses Welkom, Odendaalsrus, Allanridge, Hennenman and Virginia.	**Vegetation:** Seven vegetation types are identified in this area, representing the Grassland, Savanna and Azonal Vegetation biomes. One of the vegetation types, the Vaal-Vet Sandy Grassland, found within this focus area is listed as Endangered. Other vegetation types include the Western Free State Clay Grassland, Highveld Salt Pans, Highveld Alluvial Vegetation, Central Free State Grassland, Kimberley Thornveld and Winburg Grassy Shrubland. **Aquatic:**

Focus Area and Location	Brief Description
	Focus Area 4 is characterised by ephemeral watercourses located in the north-east of the area, as well as the perennial rivers and tributaries located south-east of the area. The rivers range from a "Moderately Modified" PES (class C), largely in the north of the Focus Area, to "Largely Modified" PES (class D) in the south-east of the area. One of the tributaries in this Focus Area is classified as "Seriously Modified" in terms of the PES (class E). Numerous depression wetlands occur within this focus area, largely typical of the Dry Highveld Grassland Groups and the Eastern Kalahari Bushveld Groups vegetation types. Majority of the wetlands located in Focus Area 4 are in heavily to critically modified condition. No Groundwater SWSAs are located with Focus area 4.
Focus Area 5 **(wind)** straddles between the Western Cape, Eastern Cape and a small portion over the Northern Cape, with Beaufort West on the western edge of the Focus Area.	**Vegetation:** There are 9 vegetation types in the focus area, representing the Grassland, Nama-Karoo and Azonal Vegetation biomes. These consists of the Gamka Karoo, Eastern Upper Karoo, Western Upper Karoo, Upper Karoo Hardeveld, Eastern Lower Karoo, Lower Karoo Gwarrieveld, Camdebo Escarpment Thicket, Karoo Escarpement Grassland and Southern Karoo Riviere vegetation types. None of the vegetation types in this focus area are listed as threatened. **Aquatic:** A network of streams and rivers spread across this area, and a majority of these are ephemeral systems. The river systems flowing along the north-west boundary of the Focus Area are classified as "Largely Natural" (PES Class B), while majority of the systems flowing through this Focus Area are classified as "Moderately Modified" (PES Class C). Numerous Channelled valley-bottom wetlands, seeps and unchannelled valley-bottom wetlands characterise the majority of Focus Area 5. These natural and artificial wetlands are scattered throughout this area, and are typical of the Lower and Upper Karoo Vegetation types. Focus Area 5 includes the Eastern Upper Karoo, Nelspoort, Beaufort West and Groundwater SWSAs. It is also characteristic of the Nuweveld Surface water SWSA.
Focus Area 6 **(wind and solar PV)** is located in the Western Cape, and includes the town of Vredendal.	**Vegetation:** There are 21 distinct vegetation types in Focus Area 6, representing the Succulent Karoo, Fynbos and Azonal Vegetation biomes. These vegetation types include the Namaqualand Strandveld, Namaqualand Sand Fynbos, Namaqualand Salt Pans, Namaqualand Klipkoppe Shrubland, Central Knersvlakte Vygieveld, Knersvlakte Quartz Vygieveld, Knersvlakte Shale Vygieveld, Vanrhynsdorp Gannabosveld, Namaqualand Spinescent Grassland, Kobee Succulent Shrubland, Bokkeveld Sandstone Fynbos, Namaqualand Riviere, Vanrhynsdorp Shale Renosteveld, Vanrhynsdorp Gannabosveld, Namaqualand Strandveld, Lammbert's Bay Strandveld, Klawer Sandy Shrubland, Doringrivier Quartzite Karoo, Leipoldtville Sand Fynbos, Nardouw Sandstone Fynbos and Graafwater Sandstone Fynbos. One of these vegetation types, Leipoldtville Sand Fynbos, is listed as Vulnerable. **Aquatic:** A number of streams and rivers fall within this Focus Area, including the major perennial Olifants river flowing south-west, which passes through the Vredendal town and drains into the Atlantic Ocean. Although this system is classified as "Largely Modified" (PES Class D), its' main tributary, the Doring river, is classified as river FEPA, and a section of this tributary traverses this focus area. The perennial Sout river, which passes through this focus area, is also a tributary of the Olifants river. The Sout river is classified as "Moderately Modified" (PES Class C). From a wetland perspective, Channelled valley-bottoms, Flats and seeps are the dominant wetland types within this Focus Area, which are largely characteristic of the Knersvlakte, Namaqualand wetland vegetation types. The only Floodplain wetland found in this focus area is associated with the Olifants river. Focus Area 6 includes the Kamieskroon, Vanrhynsdorp, Strandfontein and Sandveld Groundwater SWSAs.
Focus Area 7 **(wind and solar PV)** lies in the Northern Cape, near the town of Prieska	**Vegetation:** There are 8 distinct vegetation types in the focus area representing the Nama-Karoo and Azonal Vegetation biomes. These include the Bushman Arid Grassland, Lower Gariep Broken Veld, Northern Upper Karoo, Gordonia Duneveld, Upper Gariep Alluvial Vegetation, Bushman Vloere, Upper Karoo Hardeveld, and Bushmanland Basin Shrubland vegetation types. None of the vegetation types in this focus area are listed as threatened. **Aquatic:** The aquatic system in this focus area is dominated by the perennial Orange river, flowing east to west across the northerly boundary of the area. The river ranges from "Moderately Modified" towards the town of Prieska, to "Largely Natural" (PES Class B). Numerous depression wetlands are the dominant wetland type scattered across this Focus Area. These are largely characteristic of the Nama Karoo Bushmanland wetland vegetation type. These depression wetlands are predominantly in natural or good condition (NFEPA condition AB). No Groundwater SWSAs are located with Focus area 7.
Focus Area 8 **(wind and solar PV)** is located in the Northern Cape, between the towns of Loeriesfontein in the south and Pofadder in the north.	**Vegetation:** There are 13 vegetation types in this Focus Area, representing the Nama-Karoo, Azonal Vegetation and Succulent Karoo biomes. The area is largely dominated by the Bushmanland Arid Grassland vegetation types. Other vegetation types include the Eastern Gariep Plains Desert, Bushmanland Sandy Grassland, Eastern Gariep Rocky Desert, Bushmanland Inselberg Shrubland, Bushmanland Basin Shrubland, Bushmanland Vloere, Western Bushmanland Klipveld, Namaqualand Blomveld, Namaqualand

Focus Area and Location	Brief Description
	Klipkoppe Shrubland, Northern Knersvlakte Vygieveld, Namaqualand Riviere, and Hantam Karoo vegetation types. None of the vegetation types in this focus area are listed as threatened. **Aquatic:** The aquatic system in this Focus Area is made up of ephemeral streams largely located in the northern and southern parts of the area. Majority of these streams are classified as "Largely Natural" (PES Class B), and the four streams flowing along the western part classified as "Not an Acceptable Class" (PES Class E). Numerous depression wetlands are the dominant wetland type scattered in the central and south-eastern part of this Focus Area. These are largely characteristic of the Nama Karoo Bushmanland wetland vegetation type. These depression wetlands are predominantly in natural or good condition (NFEPA condition AB), with a few of them in moderately modified (NFEPA condition C) and heavily to critically modified (NFEPA condition Z1) condition. No Groundwater SWSAs are located with Focus area 8.

3.3.4 Sensitivity Analysis

Based on the SANBI data, key biodiversity features in terms of terrestrial and aquatic were used to create the sensitivity maps. The biodiversity features that would be impacted by development are listed in Table 2. The spatial representation of these biodiversity important features in South Africa is depicted in Figure 1 and Figure 2. This assessment follows the DEA environmental screening tool criteria of sensitivity classification for biodiversity features. All mapped sensitive biodiversity features (such as protected areas, critical biodiversity areas, wetlands with their relevant buffers) are considered to be **Very High** sensitivity areas and most likely to be unsuited for development. Areas without features of biodiversity importance are considered to be Low sensitivity. Sensitivity maps with respect to the 8 Focus Areas are depicted in **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 2: Biodiversity Features used as part of the Environmental Sensitivity

Biodiversity Features	Summary
Conservation Areas	Areas recognised as being of special natural and/or historic interest, whose features and existence is important in preserving or enhancing that area.
Protected Areas	Areas designated for the protection and conservation of ecologically viable areas representative of the country's biological diversity and its natural landscapes and seascapes.
Freshwater Ecosystem Priority Areas	River Freshwater Ecosystem Priority Areas (FEPAs) and associated sub-quaternary catchments, Fish Support Areas and associated sub-quaternary catchments and Upstream Management Areas. River FEPAs achieve biodiversity targets for river ecosystems and threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
Terrestrial Critical Biodiversity Areas	Land-based areas identified, through systematic biodiversity planning, as critical for conserving biodiversity and maintaining ecosystem functioning.
Strategic Water Source Areas	Defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b).
Indigenous Forest Patches	Identified priority forests for conservation, at both the level of forest patch and forest clusters.
Aquatic Critical Biodiversity Areas	Water areas which must be safeguarded at both their natural or near-natural state, as a result of their identification as being critical for conserving biodiversity and maintaining ecosystem functioning.
Rivers	Areas considered to be naturally flowing watercourses
Estuaries	Areas where freshwater meets the ocean. This encompasses the sand, mudflats and salt marshes of this area.
Wetlands	The land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil[2].

[2] National Water Act (Act 36 of 1998)

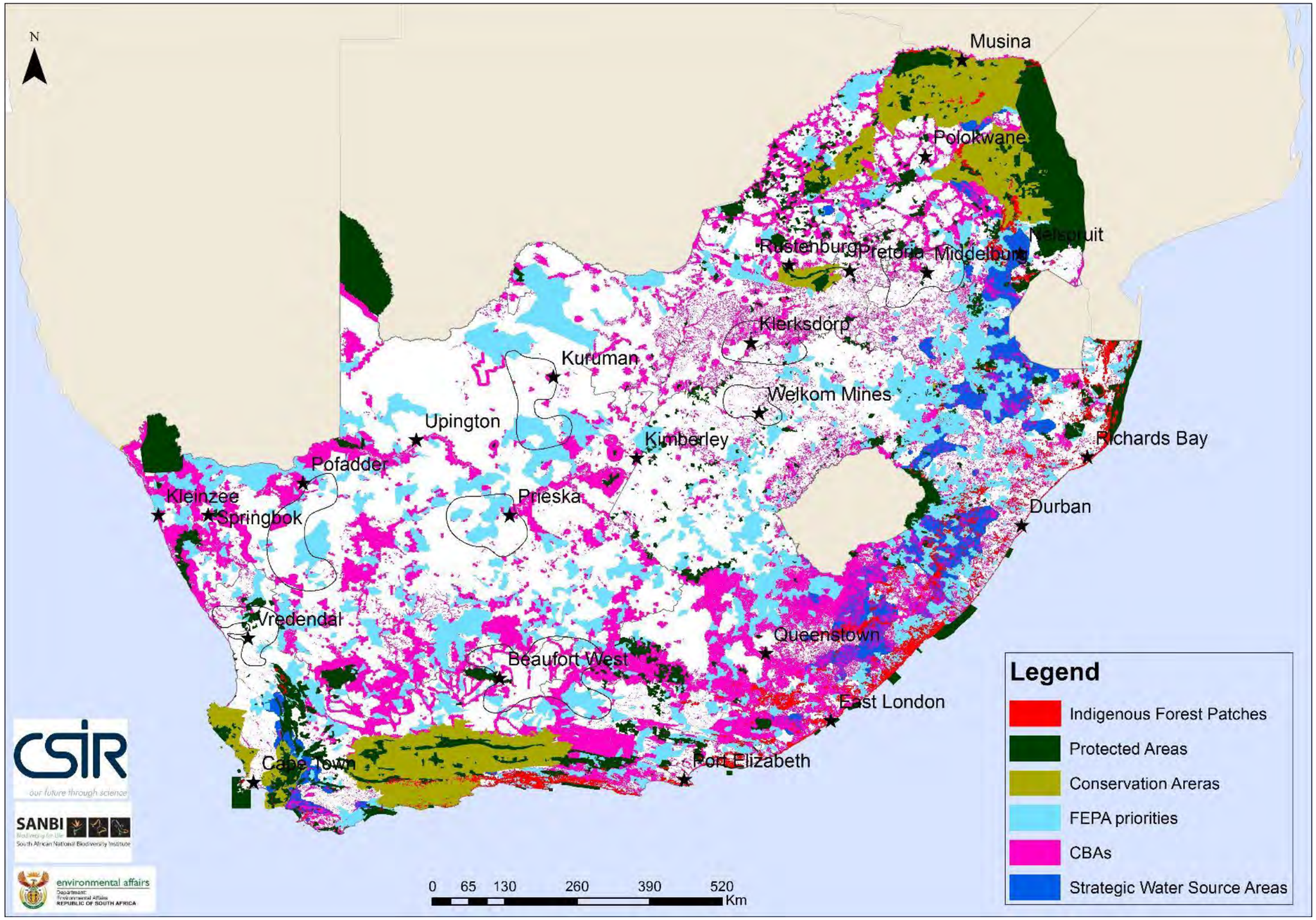

Figure 1: Focus Areas overlaid onto national terrestrial biodiversity features

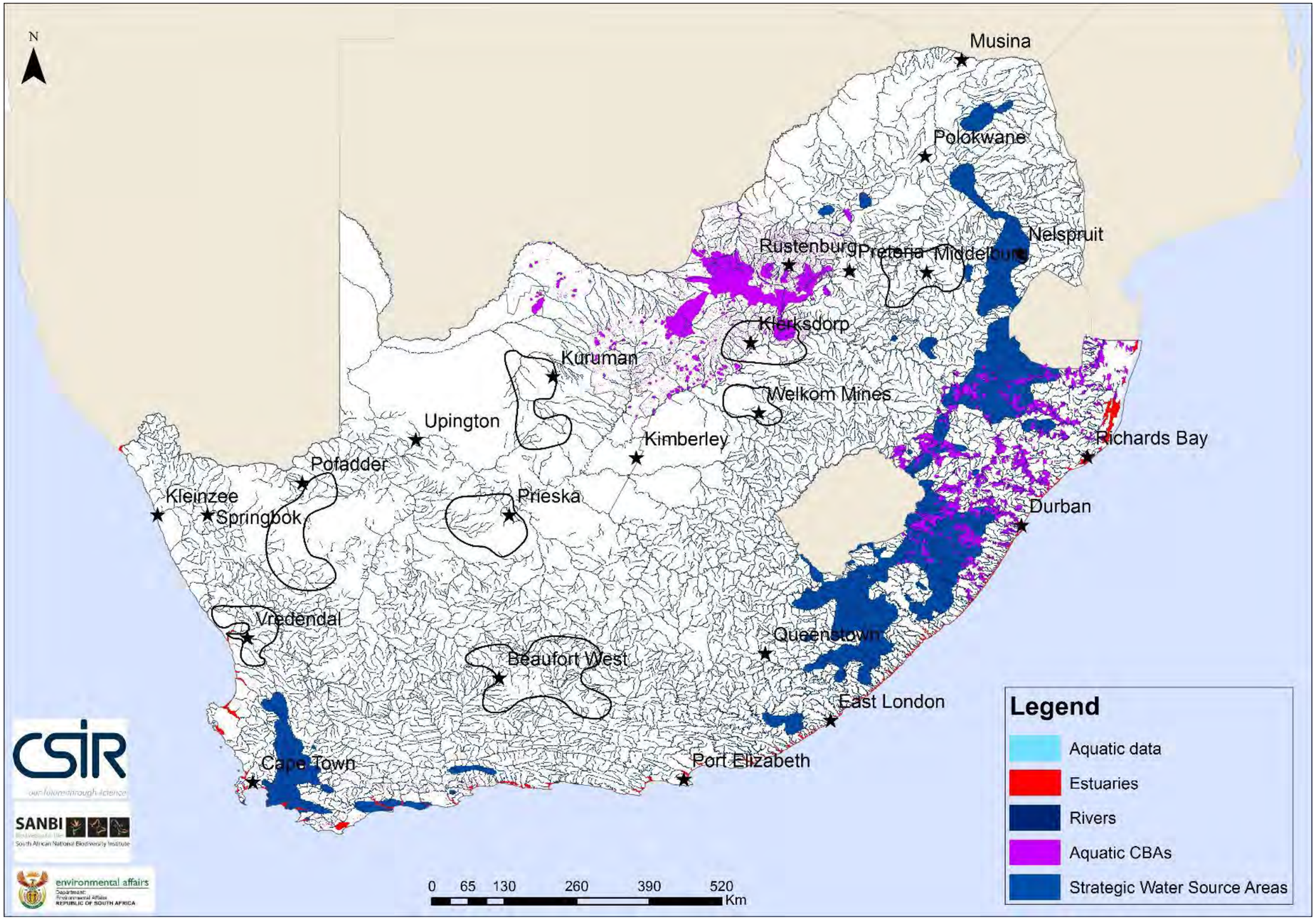

Figure 2: Focus areas overlaid onto national aquatic biodiversity features

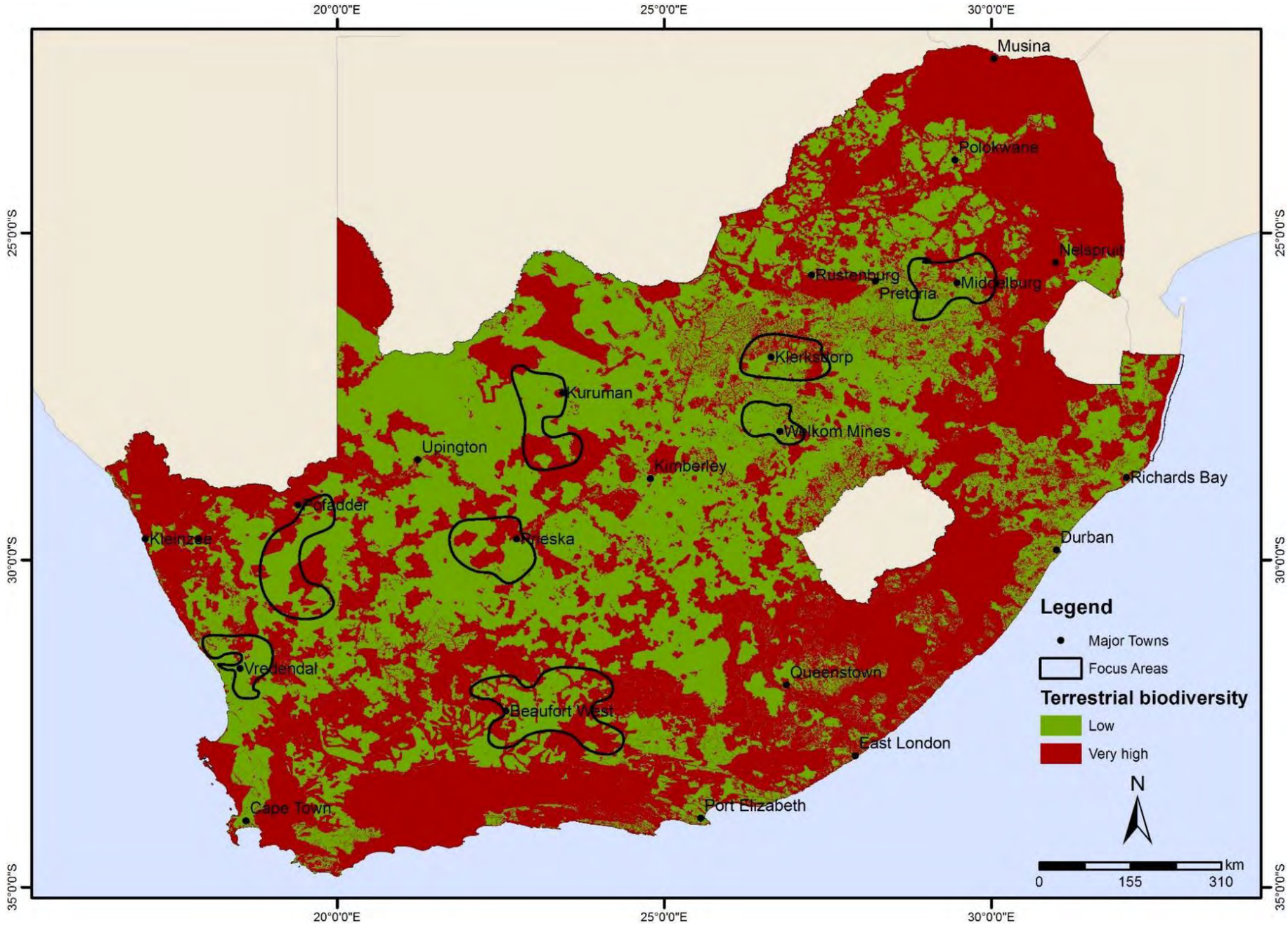

Figure 3: Terrestrial biodiversity sensitivity map for development in South Africa showing the eight Focus Areas

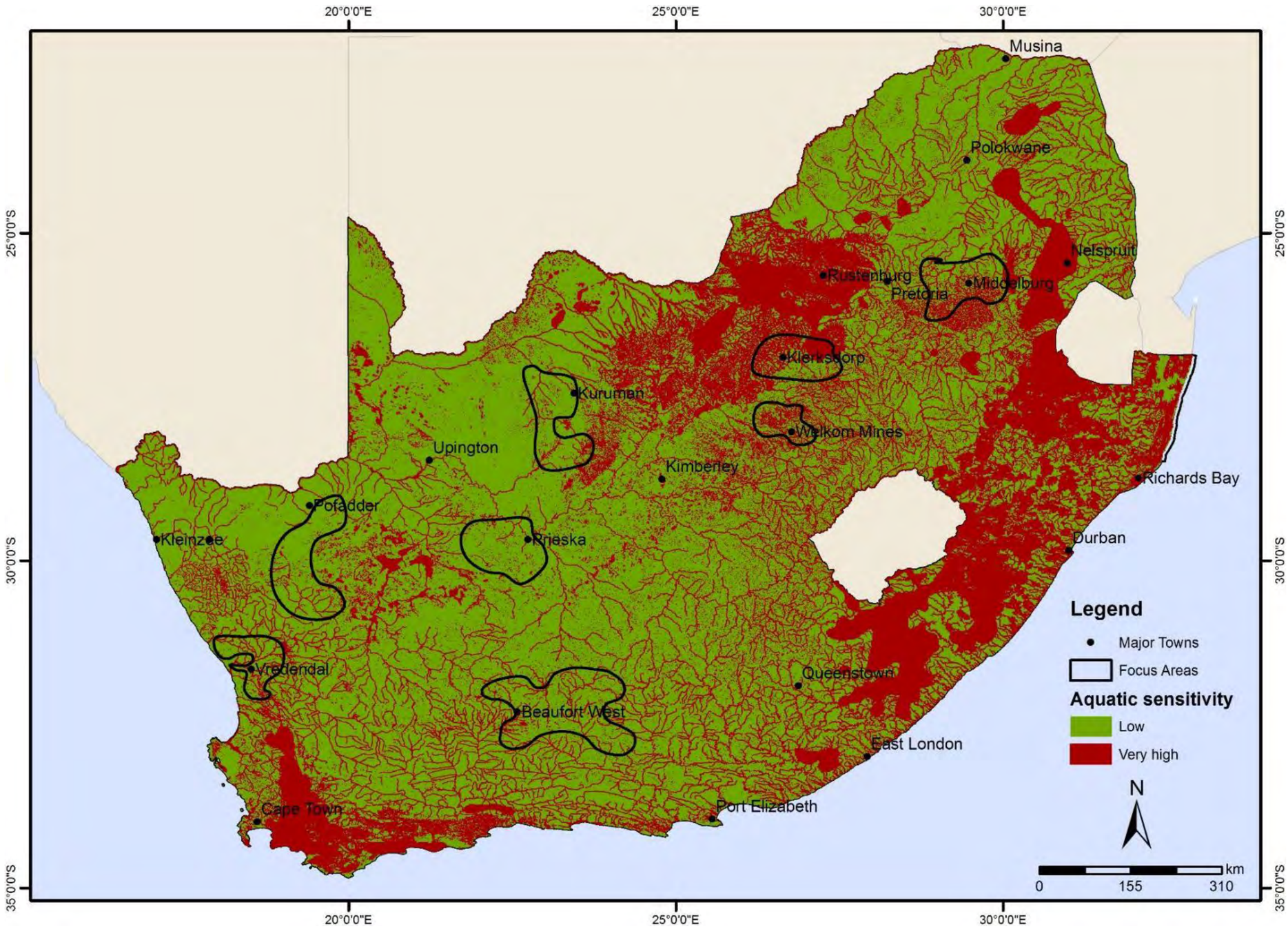

Figure 4: Aquatic biodiversity sensitivity map showing the eight Focus Areas

3.3.5 Key Potential Impacts on Biodiversity and Mitigation

The major source of impacts from the development of renewable energy facilities on biodiversity is the loss and transformation of habitats. This is attributed to the fact that the development of energy infrastructure can take up significant amounts of land, leading to habitat modification and fragmentation. Construction activities, such as vegetation clearing and removal of upper soil layers, can fragment habitats, become a barrier to species movement and impact food availability for some species. The potential impacts of solar and wind development on terrestrial and aquatic ecosystems are summarized below, including possible mitigation measures.

Key Impacts	Mitigation Measure
Habitat transformation and/or loss as a result of vegetation removal and excavations during the construction of wind and solar power plants, and poor recovery of vegetation post construction.	• Plan for development outside of Very High sensitive environments. • Rehabilitation and monitoring of vegetation following construction. • Where avoidance is not possible in Very High sensitive areas, undertake development area specific specialist assessments in order to implement area specific mitigation measures.
Transformation and loss of listed plant species.	• Avoid impact to vegetation listed as threatened, where development cannot be avoided, measure to minimise further loss of these vegetation units must be implemented. • Development planning must avoid ecosystems of high-threat status, any impact to threatened ecosystems should trigger a Specialist Study undertaken by a suitably qualified Ecologist.
Impact on sensitive habitats and protected tree species.	• Plan for development outside of Very High sensitive environments, such as aquatic features and associated buffers. • Any encroachment into these sensitive environments should trigger a specialist assessment undertaken by a suitably qualified Ecologist. • Development planning must avoid populations of protected species, such as *Aloe dichotoma*, as much as possible.
Potential impact on species or habitats of conservation concern	• Development planning to take cognisance of the potential occurrence of plant and animal species of conservation concern. • Development must avoid fauna and flora species of conservation concern. • Should development planning traverse habitats or species of conservation concern, a suitably qualified botanist or zoologist must conduct a specialist assessment to assess the significance of potential impacts on that species.
Physical disturbance to soils, flora and fauna during construction.	• Avoid unnecessary clearing of vegetation, restrict to areas of necessity. • Replace topsoil as soon as possible and implement erosion control measures. • Development activities must avoid roosts nests • Contractors must ensure that no animals are disturbed, trapped, hunted or killed during construction.
Increase of alien invasive vegetation as a result of disturbance/clearance.	• An alien invasive monitoring programme must be compiled by a suitably qualified specialist. • Regular inspections must be undertaken to identify invasive species.
Changes in water resources as a result of construction activities and maintenance activities during operation. Impact on aquatic fauna and flora, and loss of ecological function in freshwater systems.	• Plan for development outside of Very High sensitive environments, that is wetlands and watercourses should be avoided as far as possible. • The detailed design for development should take consideration of water resources and associated vegetation in close proximity. • Numerous aquatic features, including artificial wetlands, are found within the Focus Areas, these would need to be identified at site scale and avoided. • Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering onto any watercourse or wetland areas. • Avoid discharging polluted water or effluents directly into watercourse areas.
Increased sediment discharge into surface water resources.	• A stormwater management plan must be implemented to minimise impacts on water quality and quantity. • All construction activities to preferably be undertaken during the dry season, when there is minimal risk of erosion, to reduce potential impacts to watercourses. • Excavations should be backfilled and rehabilitated immediately after construction. • Implement on-going erosion control measures during construction. • Avoid soil stockpiling within 30 m of any watercourse.

3.3.6 Development Protocols

This Protocol provides the criteria for the assessment and reporting of impacts on terrestrial and aquatic biodiversity for activities requiring environmental authorisation. The assessment requirements of this Protocol are associated with a level of environmental sensitivity determined by the national web based environmental screening tool. For terrestrial and aquatic biodiversity the requirements are for landscapes or sites which support various levels of biodiversity. The requirements for the assessment and reporting of impacts of development on terrestrial and aquatic biodiversity are set out below, respectively and correlate to the sensitivity ratings contained in the DEA National web-based environmental screening tool. As mentioned previously. The relevant terrestrial and aquatic biodiversity data in the national web based environmental screening tool has been provided by the South African National Biodiversity Institute[3]. If any part of the proposed development falls within an area of "**Very High**" sensitivity, the requirements prescribed for such sensitivity apply.

3(a) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON TERRESTRIAL BIODIVERSITY

1. SCOPE

This Protocol provides the criteria for the assessment and reporting of impacts on terrestrial biodiversity for activities requiring environmental authorisation. The assessment requirements of this Protocol are associated with a level of environmental sensitivity determined by the national web based environmental screening tool. For terrestrial biodiversity the requirements are for landscapes or sites which support various levels of biodiversity. The relevant terrestrial biodiversity data in the national web based environmental screening tool has been provided by the South African National Biodiversity Institute[4]. If any part of the proposed development falls within an area of "very high" sensitivity, the requirements prescribed for such sensitivity apply.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS

Requirements for the assessment and reporting of impacts of development on terrestrial biodiversity are set out in Table 1 below, and correlate to the sensitivity ratings contained in the national web based environmental screening tool. Prior to beginning the assessment, the current use of the land and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.1 The Initial Site Sensitivity Verification must be undertaken by an Environmental Assessment Practitioner or a registered specialist with expertise in the relevant environmental theme being considered.
2.2 The Initial Site Sensitivity Verification must be undertaken through the use of:

(a) a desk top analysis, using satellite imagery and/or other available and relevant information; and
(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

2.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

3. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON TERRESTRIAL BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING - for terrestrial biodiversity features	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "very high sensitivity" for terrestrial biodiversity on the national web based environmental screening tool must submit a **Terrestrial Biodiversity Impact Assessment**. 1.2 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol or the specialist assessment differs from the designation of "very high" terrestrial biodiversity sensitivity from the national web based environmental screening tool and it is found to be of a "low" sensitivity, then a terrestrial biodiversity impact assessment is not required. 1.3 Should paragraph 1.2 apply, a **Terrestrial Biodiversity Compliance Statement** is to be provided. An Environmental Assessment Practitioner or a suitably qualified and SACNASP registered specialist, must append to the **Terrestrial Biodiversity Compliance Statement** a motivation and evidence (e.g. photographs) of the changed Terrestrial Biodiversity sensitivity. 2 The **Terrestrial Biodiversity Impact Assessment** 2.1 The assessment must be undertaken by a SACNASP registered specialist, on the preferred development site. 2.2 Description of the preferred site - the following aspects, as a minimum, must be considered in the baseline description: 2.2.1 A description of the ecological drivers/processes of the system and how the proposed development will impact these; 2.2.2 Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site; 2.2.3 The ecological corridors that the development would impede including migration and movement of flora and fauna; 2.2.4 The description of any significant terrestrial landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;

[3] The biodiversity dataset has been provided by the South African Biodiversity Institute. For details of the dataset, click on the options button to the right of the various biodiversity layers within the national web based environmental screening tool, in the Terrestrial Biodiversity theme, to view the metadata.

[4] The biodiversity dataset has been provided by the South African Biodiversity Institute. For details of the dataset, click on the options button to the right of the various biodiversity layers within the national web based environmental screening tool, in the Terrestrial Biodiversity theme, to view the metadata.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON TERRESTRIAL BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	2.2.5 A description of terrestrial biodiversity and ecosystems on the proposed development site, including – a) Main vegetation types; b) Threatened ecosystems, including Listed Ecosystems as well as locally important habitat types identified; c) Ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and d) Species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified. 2.3 Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification; 2.4 The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify: 2.5 Terrestrial Critical Biodiversity Areas (CBAs), including: 2.5.1 The reasons why an area has been identified as a CBA; 2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation; 2.5.3 The impact on species composition and structure of vegetation with an indication of 2.5.4 the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s); 2.5.5 The impact on ecosystem threat status; 2.5.6 The impact on explicit subtypes in the vegetation; 2.5.7 The impact on overall species and ecosystem diversity of the site; and 2.5.8 The impact on any changes to impact on threat status on populations of species of conservation concern in the CBA. 2.6 Terrestrial Ecological Support Areas, including; 2.6.1 The impact on the ecological processes that operate within or across the site; 2.6.2 The extent the development will impact on the functionality of the ESA; and 2.6.3 Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna. 2.7 Protected Areas as defined by the National Environmental Management: Protected Areas Act, 2004 including: 2.7.1 An opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan; 2.8 Priority Areas for Protected Area Expansion, including: 2.8.1 The way in which in which the development will compromise or contribute to the expansion of the protected area network. 2.9 The Terrestrial Component of the Strategic Water Source Areas (SWSA) including: 2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area, and 2.9.2 The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses). 2.10 The Terrestrial Component of the Freshwater Ecosystem Priority Area (FEPA) sub catchments, including: 2.10.1 The impacts of the development on habitat condition and/or species in the FEPA sub catchment. 2.11 Indigenous Forests, including: 2.11.1 Impact on the ecological integrity of the forest; 2.11.2 Percentage of natural or near natural indigenous forest area lost. 3 The findings of the **Terrestrial Biodiversity Impact Assessment** must be written up in a Terrestrial Biodiversity Impact Assessment Report. This report must include as a minimum the following information:

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON TERRESTRIAL BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae; 3.2 A signed statement of independence by the specialist; 3.3 Duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment; 3.4 A description of the methodology used to undertake the impact assessment and site inspection, including equipment and modelling used where relevant; 3.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; 3.6 Areas not suitable for development, to be avoided during construction and operation (where relevant); 3.7 Additional environmental impacts expected from the proposed development 3.8 Any direct, indirect and cumulative impacts of the development on site ; 3.9 The degree to which impacts and risks can be mitigated 3.10 The degree to which the impacts and risks can be reversed 3.11 The degree to which the impacts and risks can cause loss of irreplaceable resources 3.12 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr; and 3.13 A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected. 4 The findings of the **Terrestrial Biodiversity Impact Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Assessment Report.
LOW SENSITIVITY RATING – for terrestrial biodiversity features	**1 General Information** 1.1 An applicant, intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "low sensitivity" for terrestrial biodiversity on the national web based environmental screening tool must submit a **Terrestrial Biodiversity** Compliance **Statement** to the competent authority, unless: 1.1.1 The information gathered from the Initial Site Sensitivity Verification differs from that identified as having a "low" terrestrial biodiversity sensitivity by the national web based environmental screening tool and it is found to be of a "very high" sensitivity. 1.2 Should paragraph 1.1.1 apply, a **Terrestrial Biodiversity Impact Assessment** is to be undertaken and a report should be prepared in accordance with the requirements of a Terrestrial Biodiversity Impact Assessment. **2 Terrestrial Biodiversity Compliance Statement** 2.1 The **Terrestrial Biodiversity Compliance Statement**, must be prepared by a suitably qualified specialist in the field of ecological sciences, on the site being submitted as the preferred development site and must verify: 2.1.1 That the site is of "low" sensitivity for terrestrial biodiversity; and 2.1.2 Whether or not the proposed development will have any impact on the biodiversity feature. 3 The **Terrestrial Biodiversity Compliance Statement**, must contain, as a minimum, the following information:

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON TERRESTRIAL BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise; 3.2 A signed statement of independence by the specialist; 3.3 Baseline profile description of biodiversity and ecosystems, including the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; 3.4 Methodology used to verify the sensitivities of the terrestrial biodiversity on the national web based environmental screening; 3.5 Methodology used to undertake the site survey and prepare the Compliance Statement, including equipment and modelling used where relevant; 3.6 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; 3.7 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; and 3.8 Any conditions to which the statement is subjected. 4 A signed copy of the full **Terrestrial Biodiversity Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

3. BIODIVERSITY
3(b) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on aquatic biodiversity for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web based environmental screening tool. For aquatic biodiversity the requirements are for landscapes or sites which support various levels of biodiversity. The relevant aquatic biodiversity data in the national web based environmental screening tool has been provided by the South African National Biodiversity Institute[5]. If any part of the proposed development falls within an area of "very high" sensitivity, the requirements prescribed for such sensitivity apply.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS

Requirements for the assessment and reporting of impacts of development on aquatic biodiversity are set out in Table 1 below, and correlate to the sensitivity ratings contained in the national web based environmental screening tool. Prior to beginning the assessment, the current land use and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.1 The Initial Site Sensitivity Verification must be undertaken by an environmental assessment practitioner or a registered specialist with expertise in the relevant environmental theme being considered.

2.2 The Initial Site Sensitivity Verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery and/or other available and relevant information; and
(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

2.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

3. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING – For aquatic biodiversity features	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified as being of "very high sensitivity" for aquatic biodiversity on the national web based environmental screening tool must submit an **Aquatic Biodiversity Impact Assessment**. 1.2 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol or the specialist assessment differs from the designation of "very high" aquatic biodiversity sensitivity from the national web based environmental screening tool, and it is found to be of a "low" sensitivity, an aquatic biodiversity impact assessment is not required. 1.3 Should paragraph 1.2 apply, an **Aquatic Biodiversity Compliance Statement** is to be provided. An Environmental Assessment Practitioner or a suitably qualified and SACNASP registered specialist, as appropriate, must append to the **Aquatic Biodiversity Compliance Statement** a motivation and evidence (e.g. photographs) of the changed Aquatic Biodiversity sensitivity. **2 The Aquatic Biodiversity Impact Assessment** 2.1 The assessment must be undertaken by a suitably qualified and SACNASP registered specialist, within the preferred development site and on the preferred development[6] footprint. 2.2 Description of the preferred development site - The following aspects as a minimum must be considered in the baseline description:

[5] The biodiversity dataset has been provided by the South African Biodiversity Institute. For details of the dataset, click on the options button to the right of the various biodiversity layers within the national web based environmental screening tool, in the Aquatic Biodiversity theme to view the metadata.

[6] Development footprint means the area within the site on which the development will take place and includes all ancillary developments for example roads and power lines which require vegetation clearance or which will be disturbed and for which the application has been submitted.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	2.2.1 A description of the aquatic biodiversity and ecosystems on the site, including: a. Aquatic ecosystem types; b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns; Threat status, according to the national web based environmental screening tool of the species and ecosystems, including the NEMBA Listed Ecosystems, as well as locally important habitat types identified; 2.2.2 National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status; and 2.2.3 A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater). 2.3 Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification; 2.4 Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features: 2.4.1 Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? 2.4.2 Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present? 2.4.3 How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); and b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities. 2.4.4 How will the development impact on the functionality of the aquatic feature, including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system);

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river) c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland). d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication) e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). f. The loss or degradation of all or part of any unique or important features (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.) associated with or within the aquatic ecosystem. 2.4.5 How will the development impact on the functionality of the aquatic feature, including: a. water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river) b. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland). c. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication) d. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). e. The loss or degradation of all or part of any unique or important features (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.) associated with or within the aquatic ecosystem. 2.4.6 How will the development impact on key ecosystem regulating and supporting services especially: a. Flood attenuation; b. Streamflow regulation; c. Sediment trapping; d. Phosphate assimilation; e. Nitrate assimilation f. Toxicant assimilation; g. Erosion control; and h. Carbon storage. 2.4.7 How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site? 2.4.8 In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: a. Size of the estuary; b. Availability of sediment; c. Wave action in the mouth; d. Protection of the mouth; e. Beach slope; f. Volume of mean annual runoff (MAR); g. Extent of saline intrusion (especially relevant to permanently open systems). 2.4.9 A motivation must be provided if there were development footprints identified as per paragraph 2.3 above that were identified as having a "low" biodiversity sensitivity and were not considered appropriate.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3 The findings of the **Aquatic Biodiversity Impact Assessment** must be written up in an Aquatic Biodiversity Impact Assessment Report. This report must contain as a minimum the following information: 3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae; 3.2 A signed statement of independence by the specialist; 3.3 The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment; 3.4 The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant; 3.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; 3.6 Areas not suitable for development, to be avoided during construction and operation (where relevant); 3.7 Additional environmental impacts expected from the proposed development 3.8 Any direct, indirect and cumulative impacts of the development on site ; 3.9 The degree to which impacts and risks can be mitigated 3.10 The degree to which the impacts and risks can be reversed 3.11 The degree to which the impacts and risks can cause loss of irreplaceable resources 3.12; 3.13 A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol; 3.14 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr; 3.15 A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being not considered; and 3.16 A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected. 4 The findings of the **Aquatic Biodiversity Impact Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING – For aquatic biodiversity features	**1 General Information** 1.1 An applicant, intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "low sensitivity" for aquatic biodiversity on the national web based environmental screening tool must submit an **Aquatic Biodiversity Compliance Statement** to the competent authority.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY FOR ACTIVITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	1.2 Where the information gathered from the Initial Site Sensitivity Verification differs from that identified as having a "low" aquatic biodiversity sensitivity by the national web based environmental screening tool and it is found to be of a "very high" sensitivity an Aquatic Biodiversity Compliance Statement is not required. 1.3 Should paragraph 1.2 apply, an **Aquatic Biodiversity Impact Assessment** is to be undertaken and a report prepared in accordance with the requirements of an Aquatic Biodiversity Impact Assessment. **2 Aquatic Biodiversity Compliance Statement** 2.1 The **Aquatic Biodiversity Compliance Statement**, must be prepared by a suitably qualified specialist in the field of aquatic sciences and must verify: 2.1.1 That the site is of "low" sensitivity for aquatic biodiversity; and 2.1.2 Whether or not the proposed development will have an impact on the aquatic features. 3 The **Aquatic Biodiversity Compliance Statement**, must contain, as a minimum, the following information: 3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise; 3.2 A signed statement of independence by the specialist; 3.3 Baseline profile description of biodiversity and ecosystems, including the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; 3.4 Methodology used to verify the sensitivities of the aquatic biodiversity features on the national web based environmental screening tool; 3.5 Methodology used to undertake the Initial Site Sensitivity Verification and preparation of the Compliance Statement, including equipment and modelling used, where relevant; 3.6 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; 3.7 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; and 3.8 Any conditions to which the statement is subjected. 4 A signed copy of the full Aquatic Biodiversity Compliance Statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

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

PART 3.4

BIRDS









environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
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3.4 BIRDS

The following section is informed by the scoping level specialist bird pre-assessment of the eight focus areas (FAs) for which the complete report is provided as Appendix A2.

3.4.1 Renewable Energy and Birds

3.4.1.1 Wind Energy

Documented impacts of wind farms on birds include:

- disturbance of resident (and possibly breeding) birds by the construction of the wind farm and/or the appearance and sound of the operating facility, which may result in displacement of populations and/or depress feeding rates and breeding success at local nests;
- 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; and
- 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.

While the nature and severity of wind farm impacts can be highly site and taxon-specific, they are simultaneously very difficult to predict. Poorly sited wind farms, or even just one or two badly-placed turbines, can have significant detrimental impacts on birds at a population level. These impacts can also threaten the regional, national or global conservation status of particularly impact susceptible species. 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 into construction.

Multiple factors influence the number of birds killed in collisions at wind energy facilities. These can be classified into three broad categories:

- Avian variables;
- Location variables; and
- Facility-related variables.

Although only one study[1] has so far shown a direct relationship between the abundance of birds in an area and the number of collisions, 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. Species-specific variations in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision. There may also be seasonal and temporal differences in behaviour, for example breeding males engaging in aerial displays may be particularly at risk.

Collision-prone birds can generally be described as:

- Large species and species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (e.g. cranes, bustards, vultures);
- Species which fly at high speeds (e.g. raptors, gamebirds, waterfowl, and aerial insectivores);
- Species which are distracted in flight, like predators or species with aerial displays (e.g. many raptors, aerial insectivores and some open country passerines);
- Species which habitually fly in low light conditions; and
- Species with narrow fields of forward binocular vision.

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. Exposure is greatest for:

- Species that are particularly aerial;
- Species inclined to make regular and long distance movements (e.g. migrants as well as any species with widely separated resource areas for food, water, roost and nest sites); and
- Species that regularly fly in flocks which increases 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 (e.g. vultures, storks, cranes and most raptors) for cross-country flying. Large soaring birds (e.g. many raptors and storks) depend heavily on external sources of energy for sustainable flight. 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 or differentially heated air (i.e. thermal soaring), or in the form of wind forced up over rises in the landscape and creating waves of rising turbulence (i.e. slope soaring). Certain species are morphologically specialised 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 include Cape Vulture *Gyps coprotheres*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Peregrine Falcon *Falco peregrinus*, Lanner Falcon *Falco biarmicus*, 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.

3.4.1.2 Solar PV Energy

The environmental impacts of solar photovoltaic (PV) developments globally have not been well-researched and the impacts of these plants on birds are poorly understood. Solar PV facilities cover large areas and in many cases require the complete removal of vegetation from the inclusive footprint of the installed plant. It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that cause most concern with regard to avifauna impact from large-scale solar PV development, particularly in relation to species with restricted ranges and very specific habitat requirements.

3.4.1.3 Associated Infrastructure

The construction and maintenance of substations, power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance. Overhead power lines also pose a collision and possibly an electrocution threat to certain species. 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 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. Power line collision risk affects a particular suite of susceptible species, mainly comprising large, heavy birds (e.g. bustards, cranes and large raptors), and smaller, fast-flying birds (e.g. gamebirds, waterfowl and small raptors). Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where gaps between lines are relatively small), and mainly affects larger, perching species (e.g. vultures, eagles and storks) easily capable of spanning the spaces between energised components.

[1] Everaert, J. 2003. Wind turbines and birds in Flanders: Preliminary study results and recommendations. *Natuur. Oriolus* 69: 145-155.

3.4.2 Sensitivity Mapping

3.4.2.1 Data Sources

Based predominantly on desk-top integration and interpretation of existing data, avian impact sensitivities were mapped within the eight FAs. Sensitivity Maps 1 to 11 were generated based on the interpretation of spatial data as described in Table 1.

Table 1: Spatial data used for bird sensitivity mapping

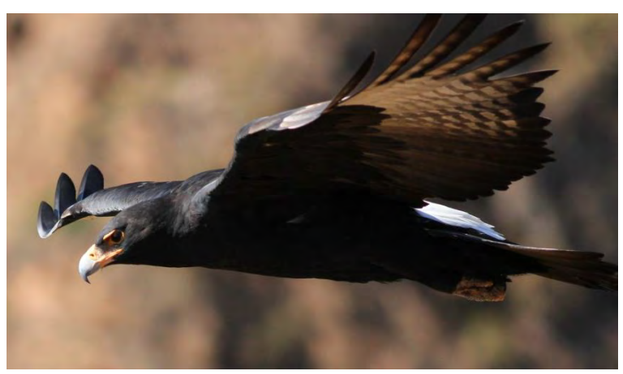
Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Relevant to all Focus Areas	*Solar PV*	All wetlands with a surface area >20 000 m²	Improved wetlands layer from SEA project freshwater specialist team: WSSEA Wetlands, 2014	Medium: 1 km from edge
		All protected areas	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 freshwater specialist team: WSSEA Wetlands, 2014	Medium:2 km from edge
		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 PV*	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
		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

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		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 / Klerksdorp Focus Area 2	*Solar PV*	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 PV*	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
		Modelled Verreaux's Eagle nesting distribution: areas of medium probability of occurrence	Robin Colyn, BLSA	Medium: 0 km
Welkom Focus Area 4	*Solar PV*	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 / Beaufort West 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
		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	Very High: 1 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
			2012, Jenkins & du Plessis 2014, 2015b, 2016	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 PV*	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
		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
		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

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		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 PV*	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 Database, ARJ unpublished data, Jenkins *et al.* 2013b,	Very High: 1 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: 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
		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 PV*	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

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, 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
		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



3.4.2.2 Sensitivity Maps

Wind and solar PV sensitivity maps were produced for each FA according to the criteria set out in Table 1 to classify bird sensitivities spatially into four tiers of Very High, High, Medium and Low (see Maps 1 to 16).

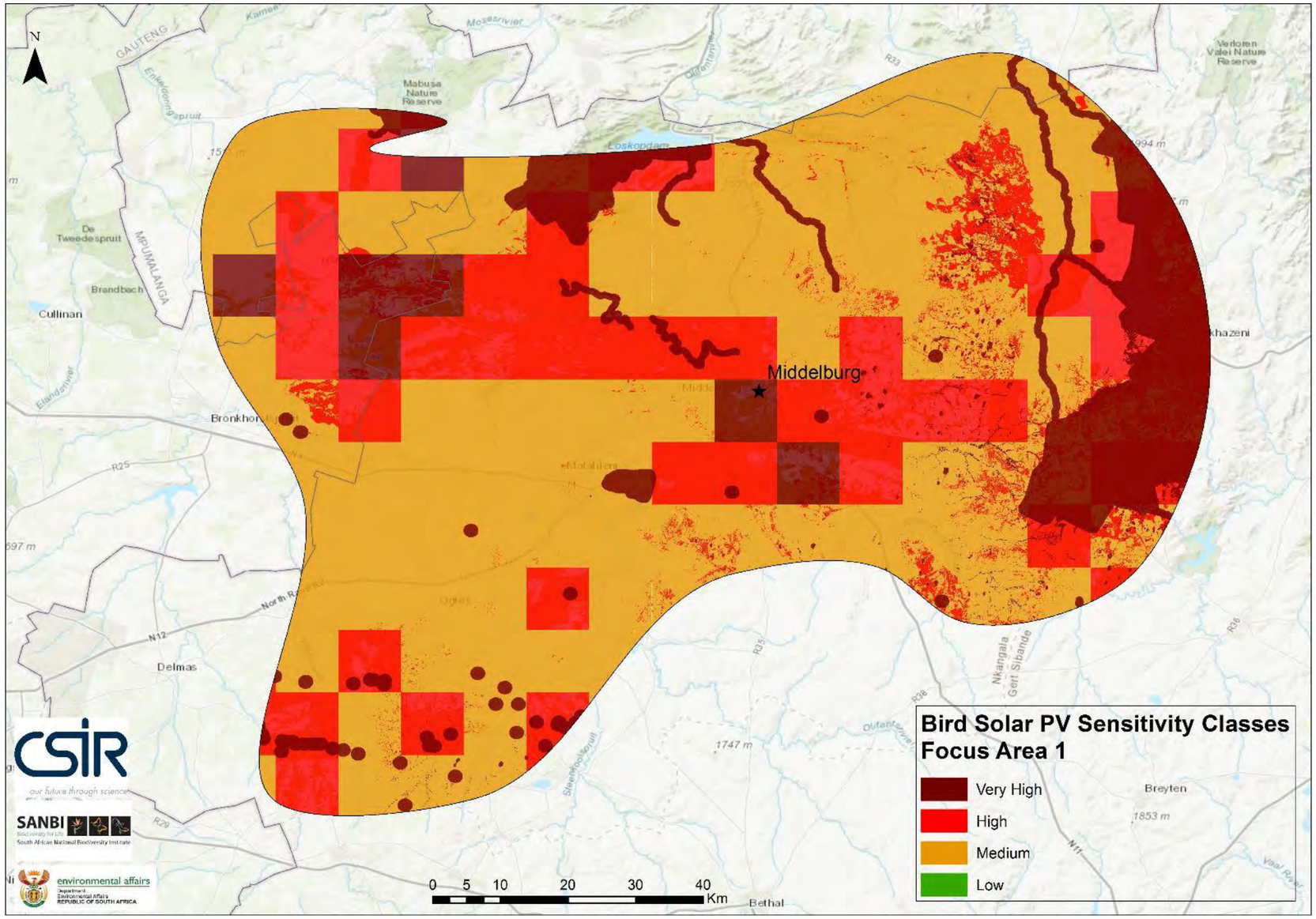


Figure 1: Bird sensitivity map for solar PV development in FA1

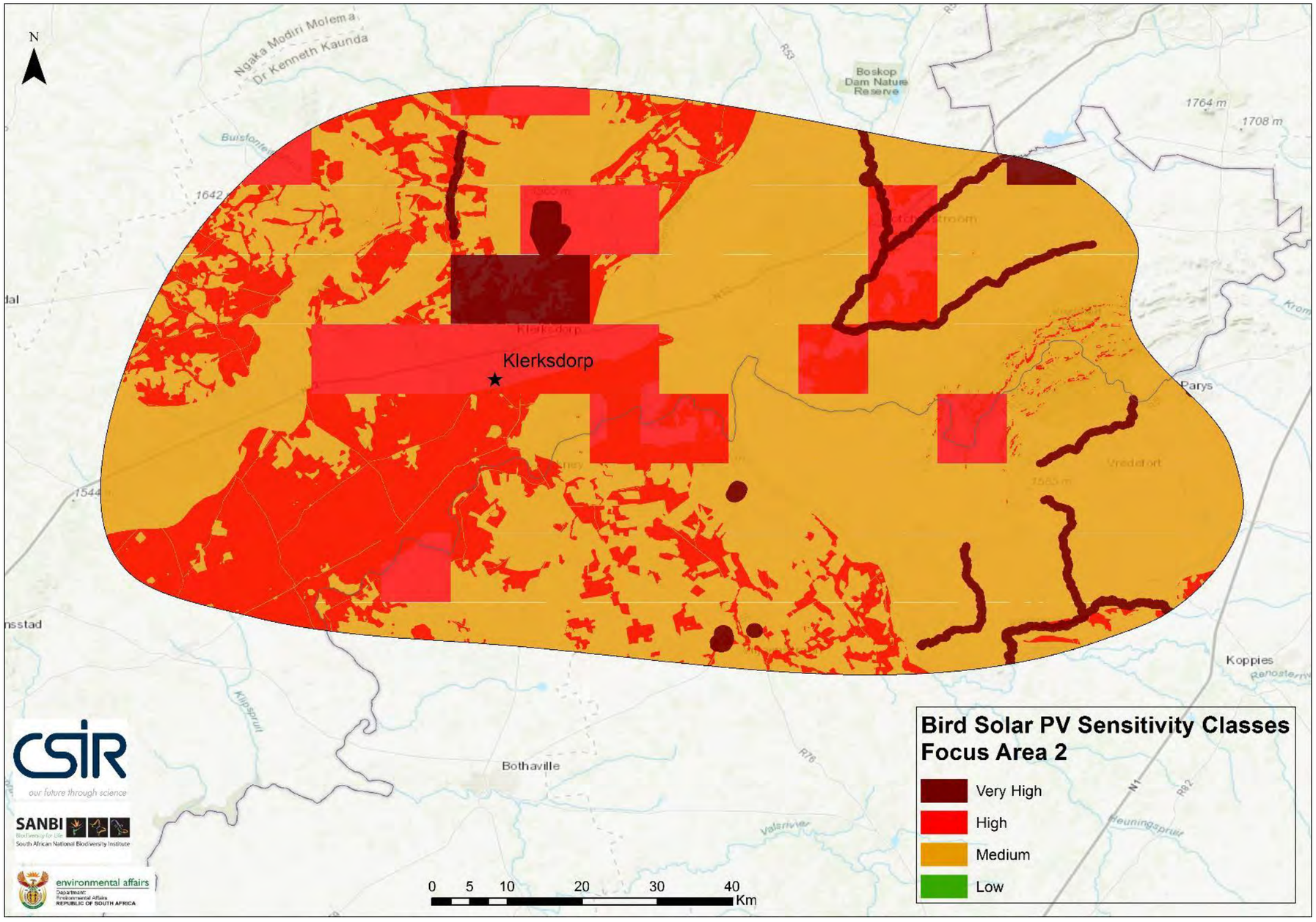


Figure 2: Bird sensitivity map for solar PV development in FA2

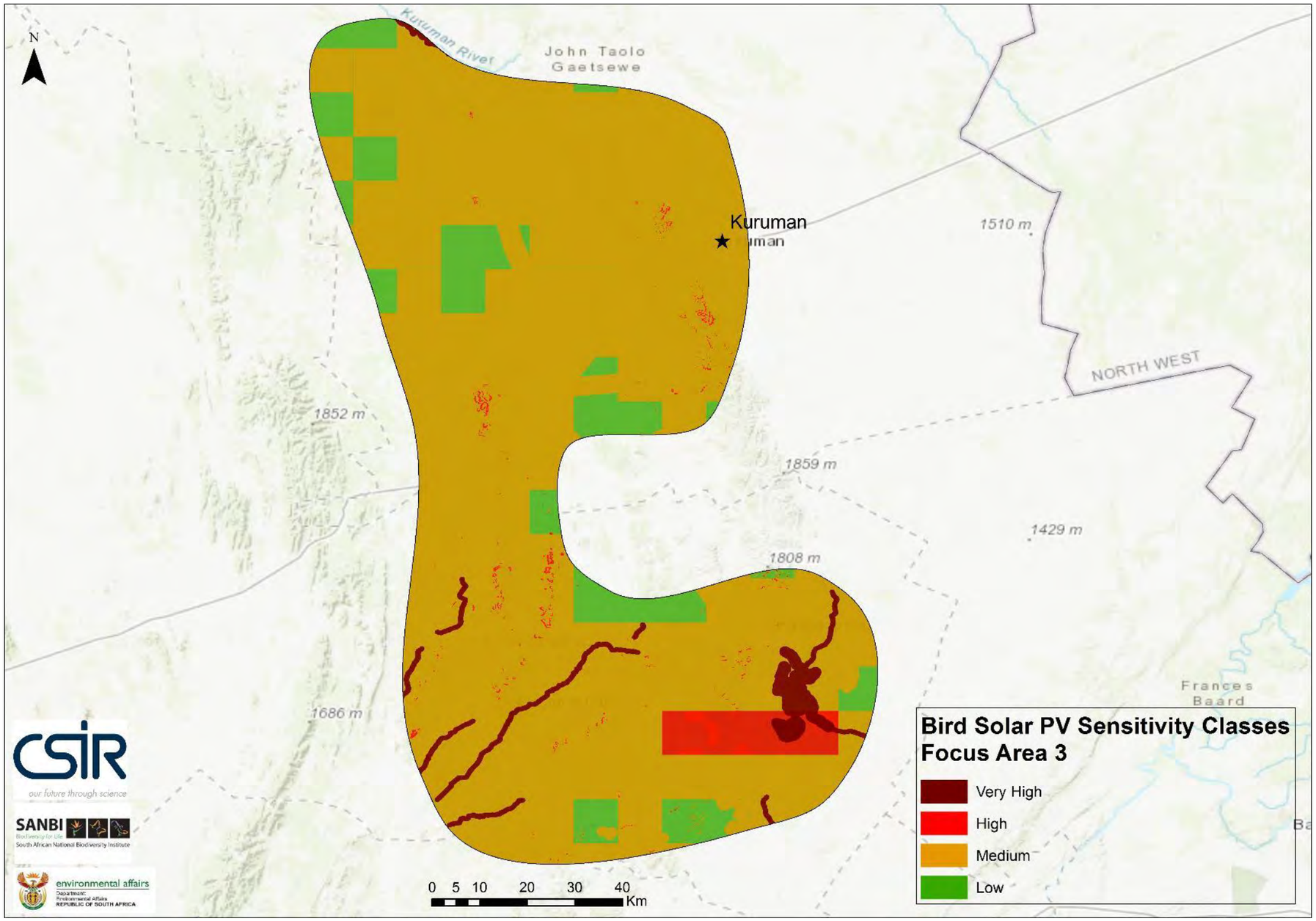


Figure 3: Bird sensitivity map for solar PV development in FA3

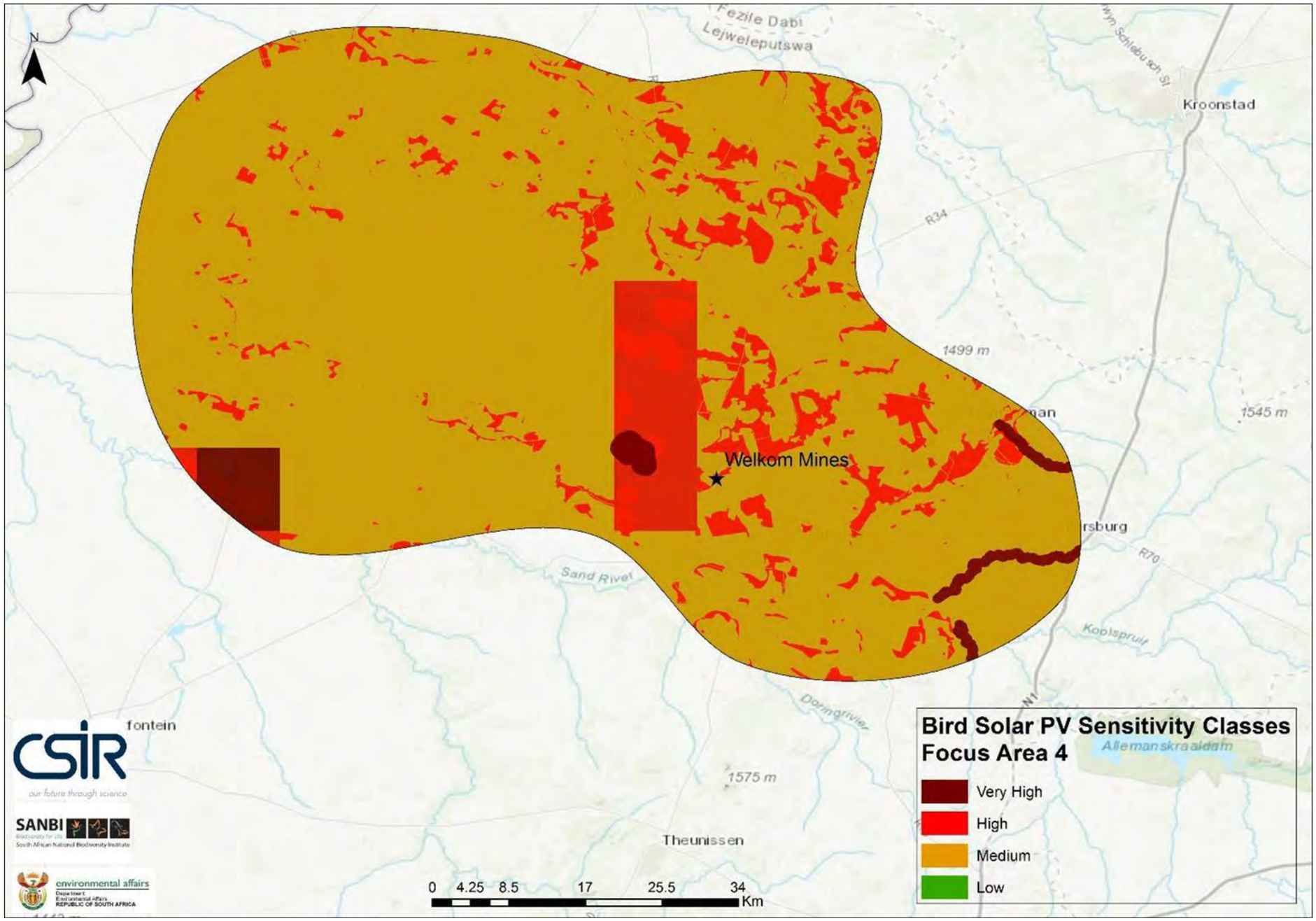


Figure 4: Bird sensitivity map for solar PV development in FA4

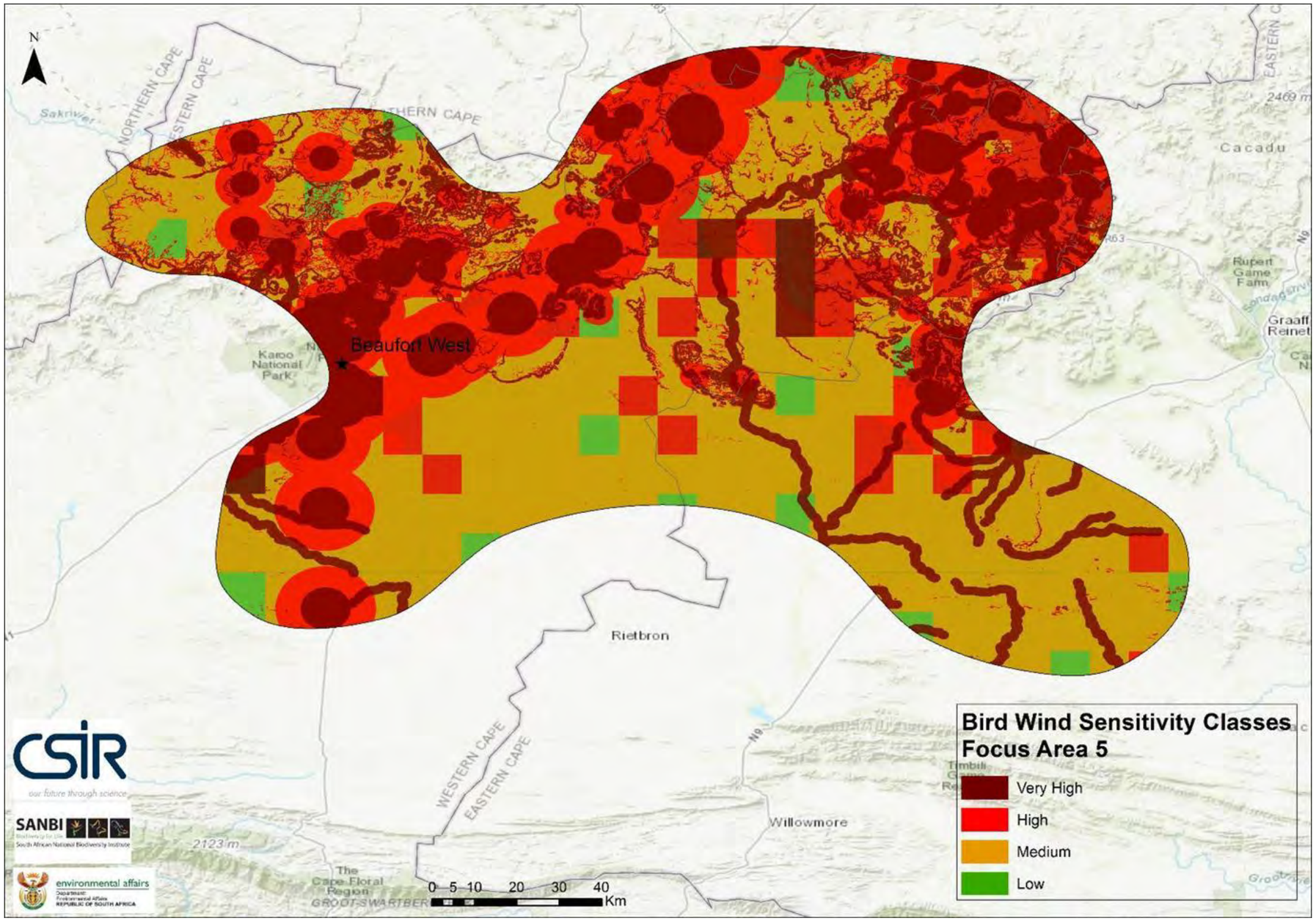


Figure 5: Bird sensitivity map for wind development in FA5

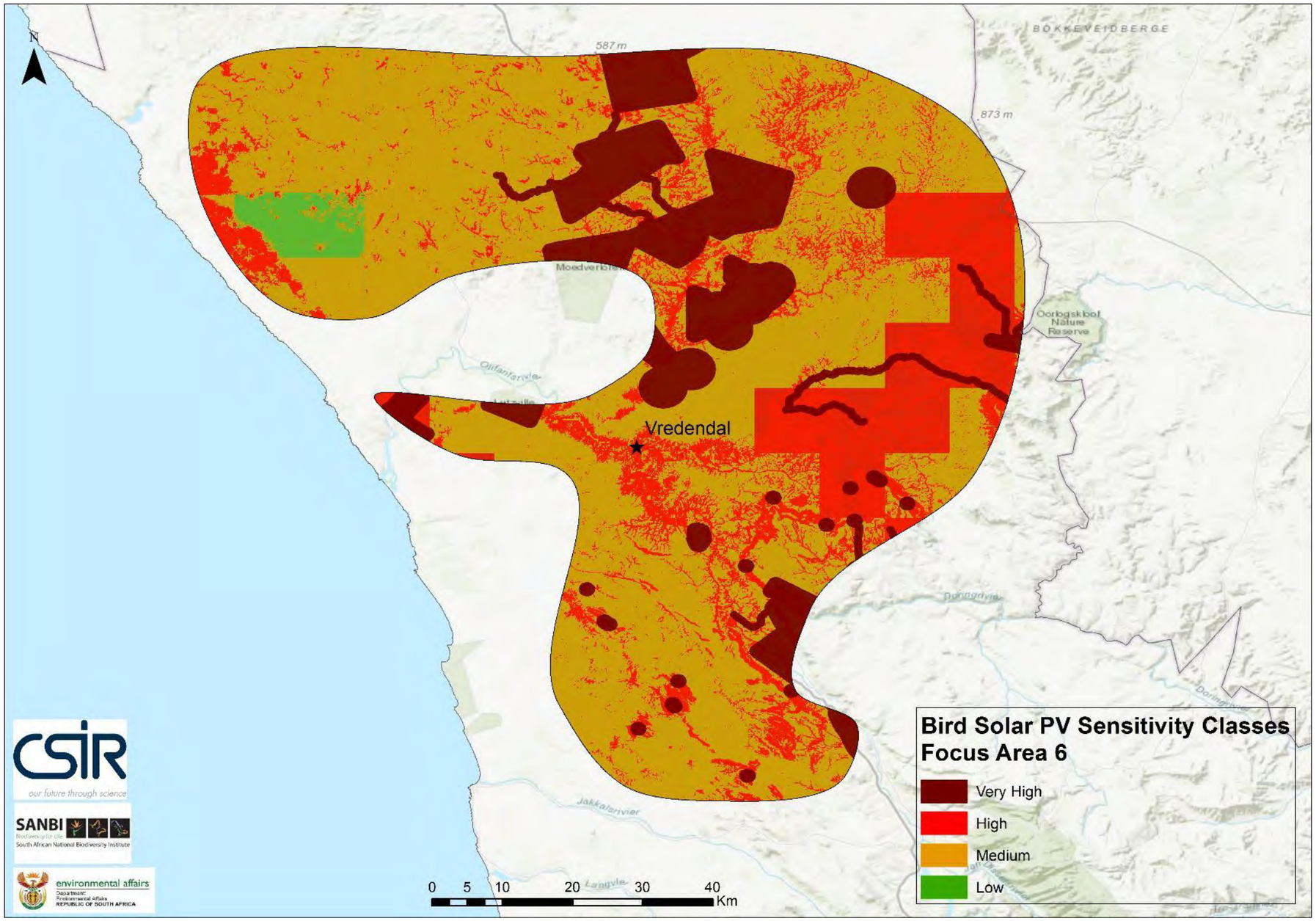


Figure 6: Bird sensitivity map for solar PV development in FA6

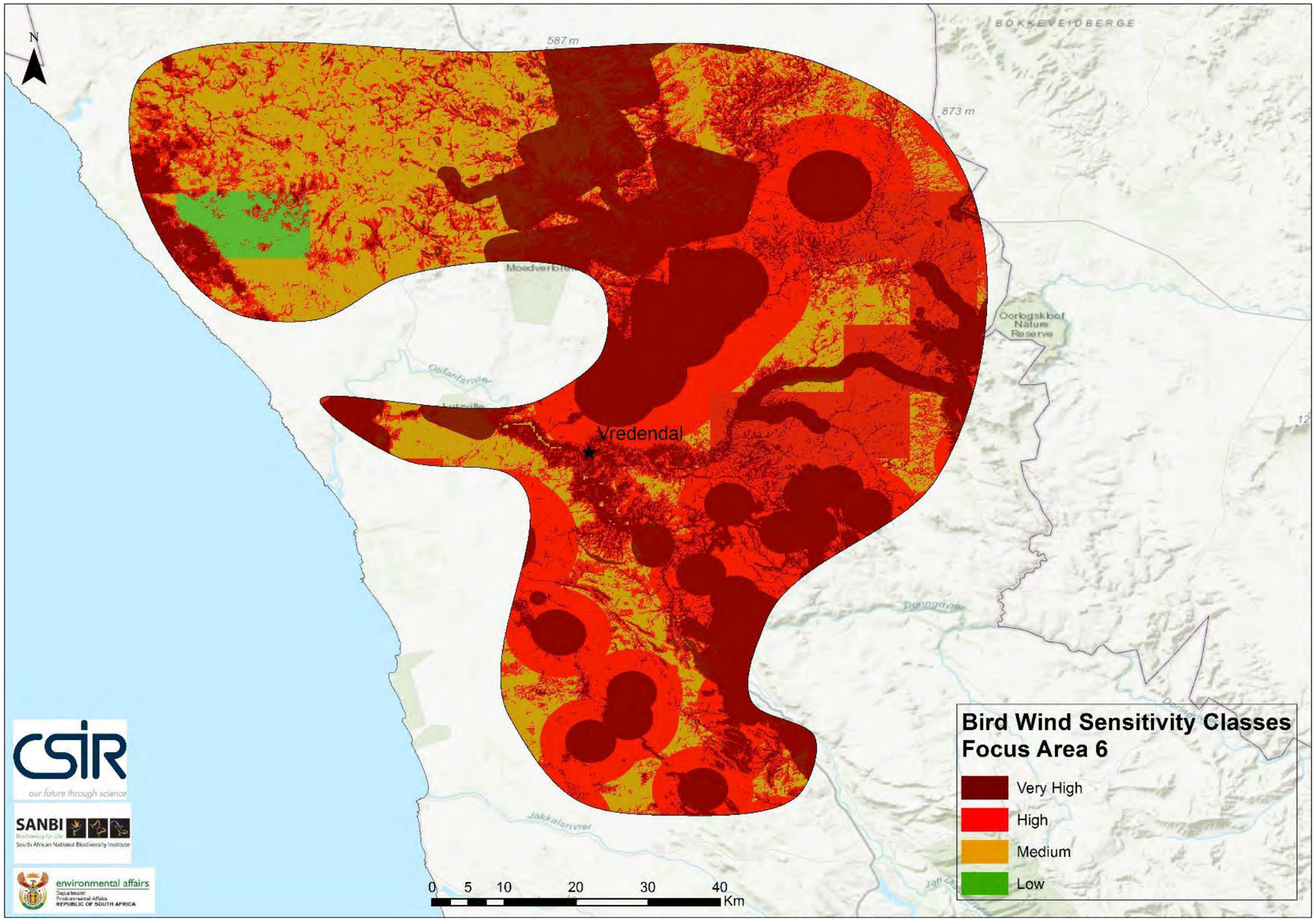


Figure 7: Bird sensitivity map for wind development in FA6

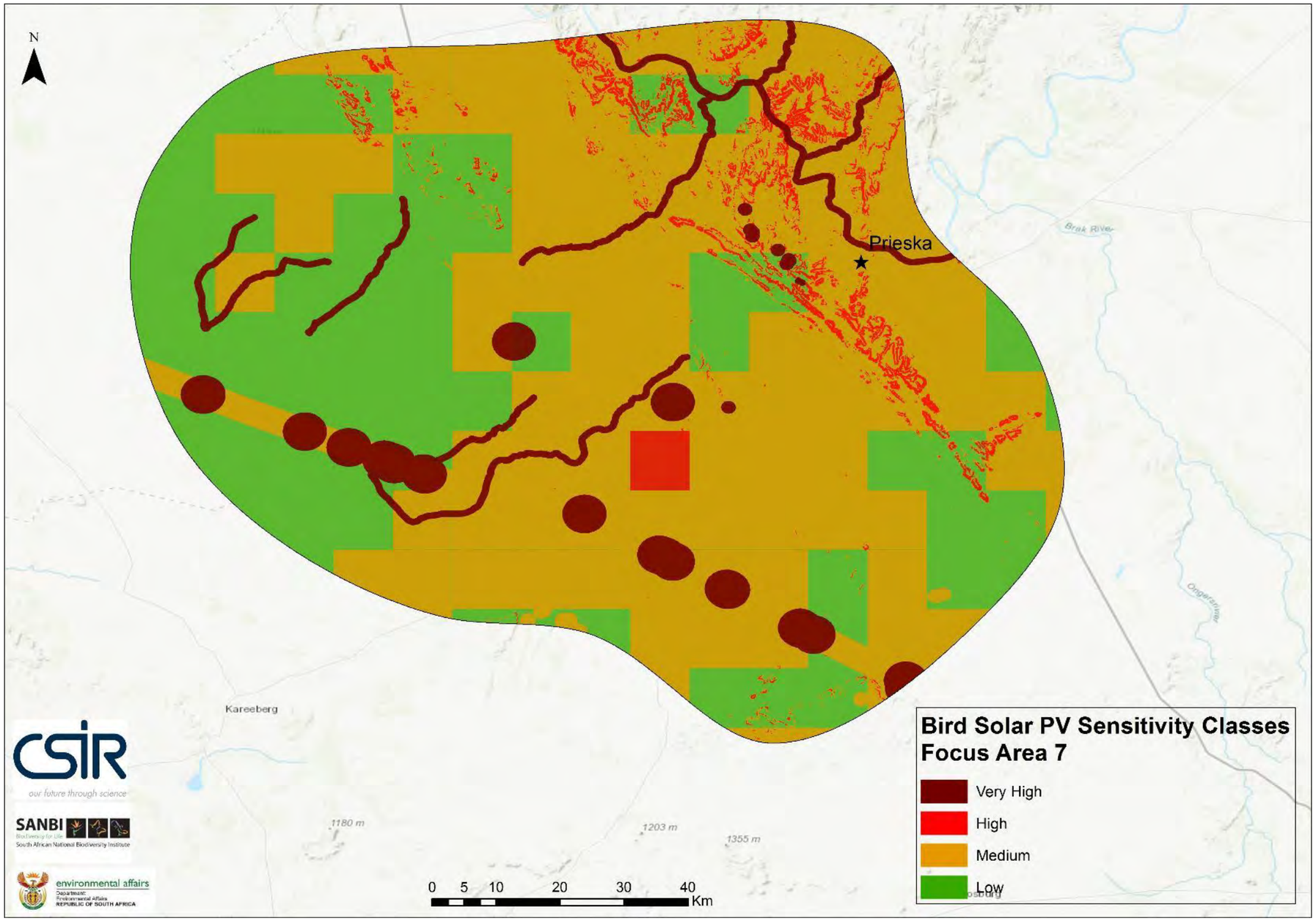


Figure 8: Bird sensitivity map for solar PV development in FA7

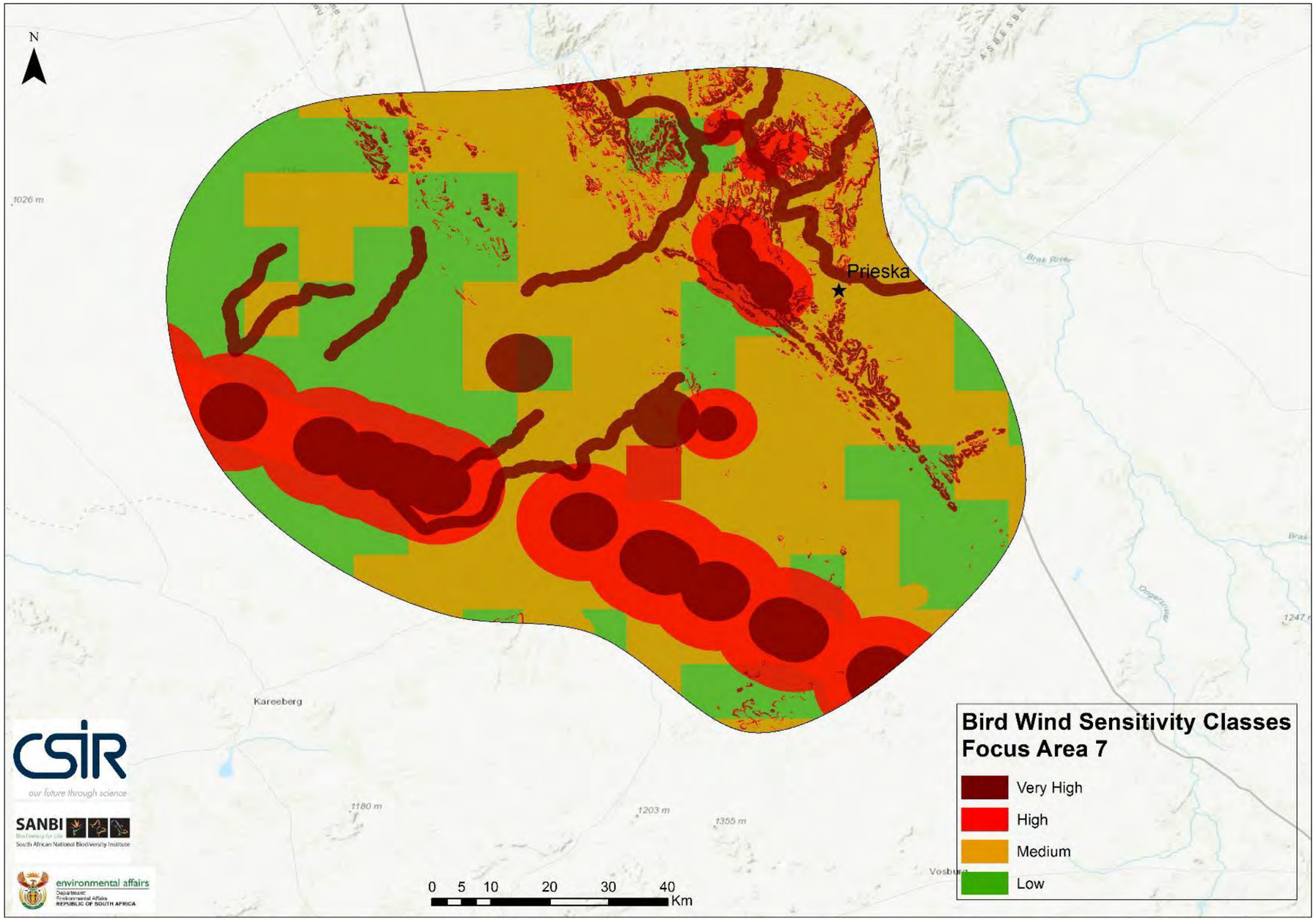


Figure 9: Bird sensitivity map for wind development in FA7

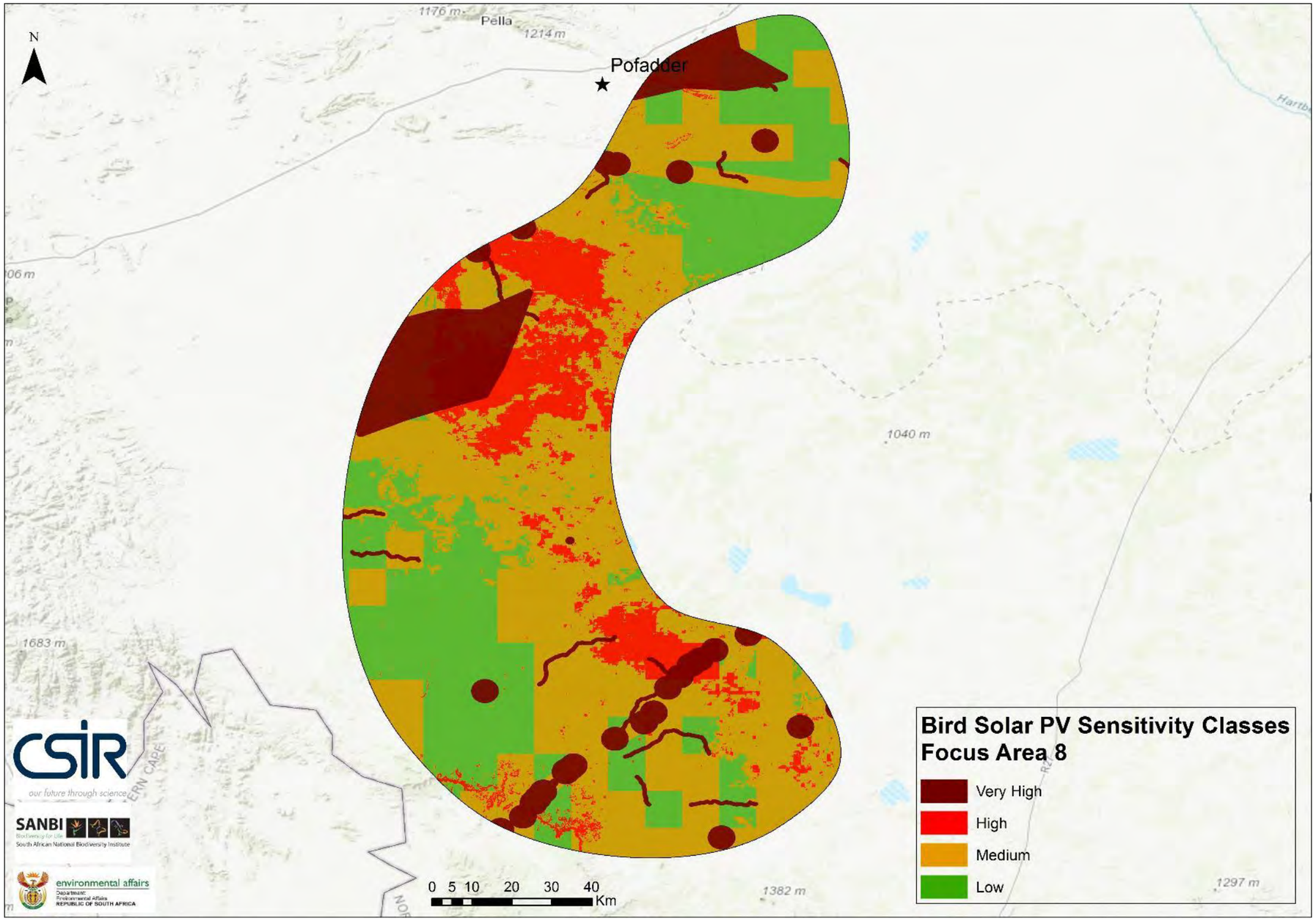


Figure 10: Bird sensitivity map for solar PV development in FA 8

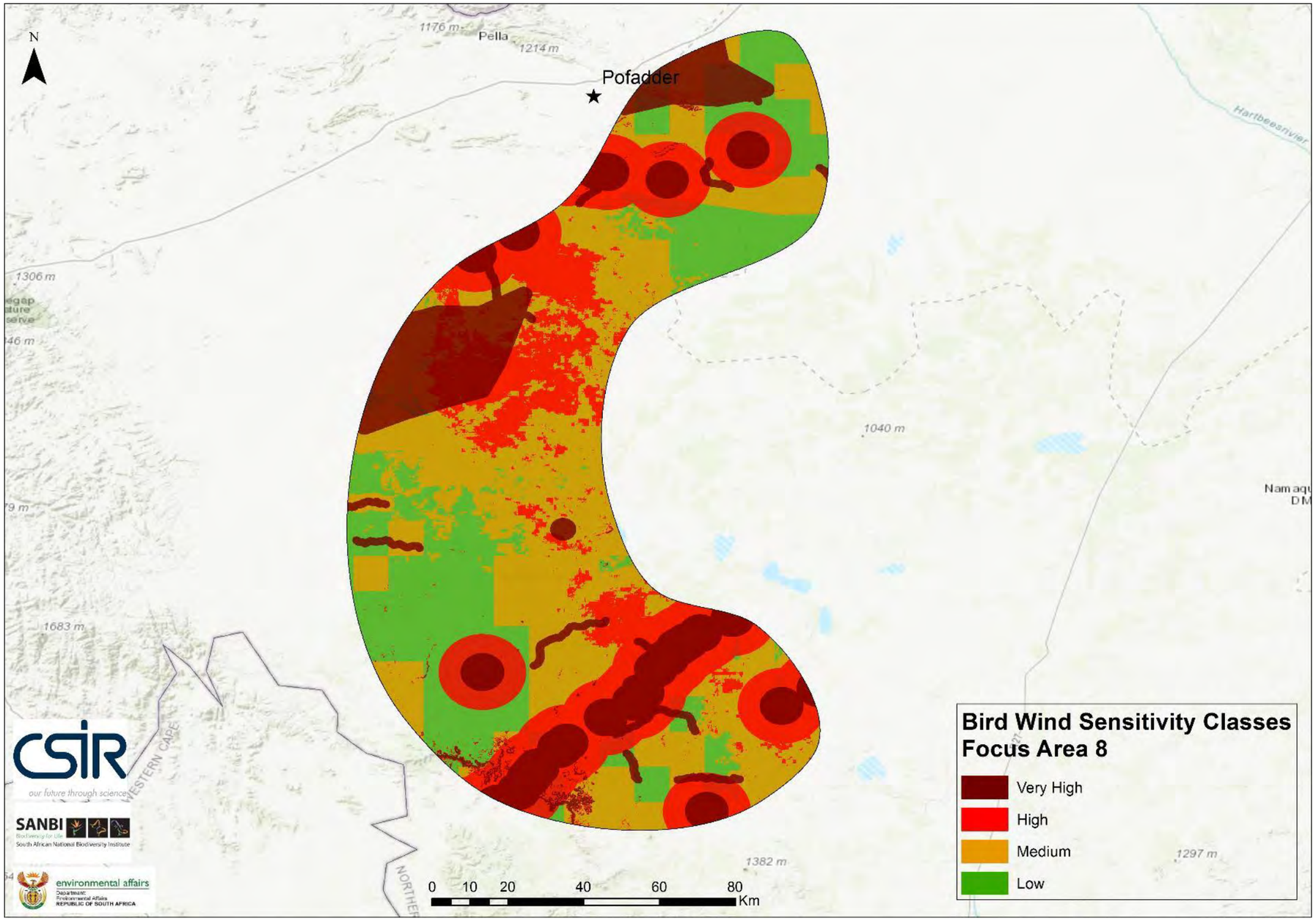


Figure 11: Bird sensitivity map for wind development in FA8

3.4.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts birds by wind developments. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

AVIFAUNA
2(a) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON AVIFAUNA SPECIES BY ONSHORE WIND ENERGY GENERATION FACILITIES

1. SCOPE

This Protocol provides the criteria for the assessment and reporting of impacts on avifauna species associated with the development of onshore wind energy generation facilities that require environmental authorisation. This applies within and outside of the Renewable Energy Development Zones (REDZs) as published under Government Notice No. 114, Gazette No. 41445 on 16 February 2018. The assessment requirements of this Protocol are based on national and international best practice for the avoidance and mitigation of impacts on avifauna species.

2. REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS

Requirements for the assessment and reporting of impacts on avifauna species for onshore wind energy generation facilities are set out in Table 1 below and correlate to the sensitivity ratings contained in the national web based environmental screening tool.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AVIFAUNA FOR ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

VERY HIGH SENSITIVITY RATING – Very high sensitivity areas are likely to provide critical habitat for priority bird species[2] sensitive to wind energy development[3] and/or whose population is reliant on highly localized and unique roosting, nesting and/or foraging sites.	**1. General Information** 1.1 An applicant intending to undertake an activity as identified in the Scope of this Protocol must undertake an **Avifaunal Impact Assessment** based on the potential significance of the impact that the identified activity could have on bird species. 1.2 An **Avifaunal Impact Assessment** is to be undertaken irrespective of the sensitivity rating provided by the national web based environmental screening tool, as the present level of knowledge on bird behaviour and species population precludes confident predictions on the sustainability of priority or threatened species nationally. 1.3 The information provided by the national web based environmental screening tool includes known nests, roosts, vulture restaurants and areas likely to support priority bird species including threatened or rare species, especially those that may be susceptible to wind energy development. Precautionary buffers to these sensitivities as well as to the specific feature have been added. The data is, however, unverified and incomplete and therefore these features and buffers are to be used only as a guide to assist focus the **Avifaunal Impact Assessment.** 1.4 The process for undertaking the **Avifaunal Impact Assessment** comprises three phases: 1.4.1 Reconnaissance Study 1.4.2 Pre-application Avifaunal Monitoring Plan 1.4.3 Avifaunal Impact Assessment and report. 1.5 All tasks of the **Avifaunal Impact Assessment** must be undertaken by a SACNASP registered avifauna specialist. 1.6 All tasks are to be undertaken on the site being submitted as the preferred development site and at a control site located in accordance with the latest version of the BirdLife South Africa (BLSA)/Endangered Wildlife Trust (EWT) *Bird and Wind-Energy Best-Practice Guideline*[4], and must identify: 1.6.1 the extent of impact of the facility on priority bird species; 1.6.2 whether the proposed development will have an unacceptable negative impact on priority or threatened bird species. 1.7 The **Avifaunal Impact Assessment** must be undertaken based on the results of a **site specific Pre-Application Avifaunal Monitoring Plan** that is informed by a **Reconnaissance Study**, as well as data collected over four seasons (i.e. summer, autumn, winter and spring) on the proposed development site and the control site. **2 Reconnaissance Study** 2.1 The **Reconnaissance Study** is to be based on a desktop study of relevant information as well as a 2 to 4 day on-site inspection of both sites; 2.2 The occurrence of target species is to be identified, including seasonality of occurrence and migratory patterns of the species; 2.3 The study must define the study area (avifaunal impact zone); and 2.4 The study is to produce a **site specific Pre-Application Avifaunal Monitoring Plan.** **3 Pre-application Avifaunal Monitoring Plan** 3.1 The plan as a minimum must include: 3.1.1 The study area and its characteristics which must be mapped including the extent, habitat, special features including topographical and water features, quarries, drainage lines, known breeding sites, existing land uses, existing infrastructure such as power lines and roads, and existing wind energy facilities within 30 km of the proposed development site; 3.1.2 Target avifaunal species that are likely to occur on the proposed development site and for which monitoring is required; 3.1.3 Pre-application monitoring requirements for both the development site as well as the control site, that must include the following:[5] a. the monitoring intervals including the number and duration of monitoring events which must be based on the *BirdLife South Africa Bird and Wind-Energy Best-Practice Guideline* or a motivation provided for the deviation; b. the location of monitoring points; c. aspects to be monitored (for example, bird abundance and flight activity,

[2] Priority bird species sensitive to wind energy developments include those identified by BirdLife South Africa as well as those listed on South Africa's National Red List website 42, 43 as Critical Endangered, Endangered, Vulnerable, Threatened or near Threatened according to the IUCN Red List 3.1
[3] https://www.birdlife.org.za/conservation/terrestrial-bird-conservation/birds-and-renewable-energy/wind-farm-map

[4] The Best Practice Guidelines for assessing and monitoring the impact of wind energy facilities on birds in Southern Africa is available from: https://www.birdlife.org.za/documents
[5] It is advisable to discuss the content of the plan with BirdLife South Africa before its implementation.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AVIFAUNA FOR ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

	presence of target species, proportion of flying time each target species spends at turbine rotor height, preferred flight paths, risk of identified target species to collision, areas for specific monitoring if any, etc.); d. equipment to be used; e. monitoring methodology. For the abundance/activity monitoring and for direct observation/vantage point surveys, the latest version of the *BirdLife South Africa Bird and Wind-Energy Best-Practice Guideline* must be followed or a motivation provided for the deviation; f. numbers of observers to be used; g. data to be captured including a pro-forma data capturing template. **3.2** Implementation of **site specific Pre-Application Avifaunal Monitoring Plan** 3.2.1 The site specific Pre-Application Avifaunal Monitoring Plan is to be carried out according to its requirements for a period of not less than four seasons. 3.2.2 Data on pre-application monitoring must be captured on the national bird monitoring data base accessed at https://www.environment.gov.za/birddatabase, once operational. **4. Avifaunal Impact Assessment** Based on the outcome of the Reconnaissance Study and the findings of the Pre-Application Avifaunal Monitoring, an **Avifaunal Impact Assessment** must be undertaken. The assessment as a minimum must consider the following aspects: 4.1 Discussion on bird abundance and movement within the site; 4.2 Discussion on presence of target/threatened species and their occurrence on the site at heights which could pose risks to collision; 4.3 Assessment of risk of identified target species to collision including the expected fatality rates of the target species based on a suitable model commonly used for risk determination, per species and for the site; 4.4 Identification and mapping where relevant, of any migratory or preferential bird routes/corridors; 4.5 Where relevant, discussion on the risk of displacement; 4.6 Where relevant, areas identified within the site as having a very high sensitivity for bird collision or displacement and in which the development of turbines should be avoided, with these areas to be mapped; 4.7 In areas where existing operational wind energy generation facilities have been identified within a 30 km radius, a cumulative impact assessment must be undertaken which includes: 4.7.1 the fatality rates for target species at the wind energy generation facilities within a 10 km radius; 4.7.2 the possible additional fatalities from the proposed wind energy generation facility for target species as well as general avifaunal species; 4.7.3 a discussion on the possible cumulative impact of the facility on regional populations of target species; 4.8 Where no existing operating wind energy generation facilities within the 10 km radius, the specialist must include a discussion on possible cumulative impacts on target species from the proposed facility; 4.9 The plan for post construction monitoring (on both the proposed development site as well as the control site) and reporting which must include: 4.9.1 timeframes and intervals for monitoring; 4.9.2 number of turbines to be monitored, including any specific area for monitoring; 4.10 methodology for searcher efficiency and scavenger removal; 4.10.1 method for monitoring, i.e. transects or radial as well as extent of

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON AVIFAUNA FOR ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

	monitoring area; 4.10.2 results of monitoring compared against expected fatality rates per target species as well as general species; 4.10.3 reporting requirements, including organisations for submission of reports; 4.10.4 years and intervals for monitoring to occur; and 4.10.5 all methods used to estimate bird numbers and movements during reconnaissance and pre-application monitoring, which should be applied in exactly the same order to ensure the comparability of these two data sets. 5. The findings of the **Avifaunal Impact Assessment** must be written up in an Avifaunal Impact Assessment Report which must contain, as a minimum, the following information: 5.1 The SACNASP registration number of the avifaunal specialist/s preparing the assessment and their curriculum vitae; 5.2 A signed statement of independence by the specialist; 5.3 A description of the study area including a map of all the aspects identified in the duration, dates and seasons of the site investigation and the relevance of the season to the outcome of the assessment; 3.3 The outcome of the Reconnissance Study and the resultant site specific Pre-Application Avifaunal Monitoring Plan; 5.4 A description of the methodology used to undertake the site specific pre-application avifaunal monitoring program inclusive of the equipment used; 5.5 A map showing the GPS coordinates for each of the monitoring points for both the development site as well as the control site; 5.6 The monitoring intervals for both sites; 5.7 Where relevant, a map showing the areas to be avoided; 5.8 Fatality prediction for target species and general species on the sites; 5.9 A map showing the approved renewable energy applications within a 10 km radius of the proposed project; 5.10 Where relevant, the outcomes of the cumulative impact assessment; 5.11 A discussion based on the pre-application monitoring of the expected impact of the proposed development on avifaunal species; 5.12 A substantiated statement from the registered avifauna specialist, indicating the acceptability of the development and a recommendation on the approval or not of the development; 5.13 Any conditions to which the statement is subjected; 5.14 A detailed post construction monitoring programme; 5.15 The outcomes of the post-construction monitoring, including data and specialists reports, must be uploaded onto the national bird monitoring database, to be accessed at https://www.environment.gov.za/birddatabase, once operational; 5.16 Where required, proposed mitigation measures or any monitoring requirements for inclusion in the EMPr; and 5.17 A description of the assumptions made and any uncertainties or gaps in knowledge or data. 6. The findings of the **Avifaunal Impact Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Avifaunal Impact Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

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

PART 3.5

CIVIL AVIATION

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.5 CIVIL AVIATION

The South African Civil Aviation Authority (SA CAA) is body which is governed by the Civil Aviation Act, 2009, (Act No.13 of 2009). The main mandate of this body is to ensure safety and security amongst other in civil aviation operations of South Africa. The SA CAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). All developments or activities that have the potential to impact civil aviation must be assessed by SA CAA in terms of the SA CARs and South African Civil Aviation Technical Standards (SA CATS) in order to ensure aviation safety.

The Obstacle Evaluation Committee (OEC) which consists of members from both the SA CAA and South African Air Force (SAAF) is responsible for the review and commenting on proposed developments which have the potential to negatively impact civil aviation.

3.5.1 Renewable Energy and Civil Aviation

The Civil Aviation Regulations, 2011, regulation 139.01.30(3) stipulates that the of the Director of the Civil Aviation Authority must give approval for the erection of any structure in the vicinity of an aerodrome which could that will impact the functioning of radio navigation or landing systems or cause any type of construction. It is therefore a legal requirement to obtain comment from SA CAA on any construction of an obstacle constructed near an aerodrome.

In the Civil Aviation Act, an obstacle is defined as all fixed or mobile objects (whether temporary or permanent) or parts thereof, that are located on an area intended for the surface movement of aircraft; or extend above a defined surface intended to protect aircraft in flight; or stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

In South Africa all structures higher than 15 metres above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). With wind turbines potentially protruding beyond 150 m above ground level, they present a danger to aviation if sited in close proximity to aerodromes. It is for this reason that the safeguarding of the areas around aerodromes is important and that specific safety requirements (e.g. lighting and markings) are applicable to all wind turbines.

Wind turbines have large radar cross section and the blades generate a Doppler frequency shift. This frequency shift causes interference on radar systems. Turbines may cause radar echo which is energy transmitted by the radar and returned by the turbines . The returned energy can result in the false detection of aircraft (i.e. clutter) or create blind spots behind wind facilities. The location, size and speed at which the turbines blades are rotating are some of the characteristics that influence the impact on radar systems. The distance from the radar station further determines the magnitude of the impact. It is generally unlikely for this impact to occur if development is further than 35 km from the radar station.

In terms of solar PV development the impact on aviation is limited and internationally there is a growing interest for airports to install this technology in order to reduce operating cost and show a commitment to sustainable development. The main potential impact of PV development on civil aviation would be the height and routing of power lines in the vicinity of aerodromes, especially where these may cross through the approach or departure path

3.5.2 Sensitivity Mapping

The SA CAA sensitivity criteria follows that determined for the 2015 Phase 1 SEA (DEA, 2015). It includes a spatial representation of South Africa's CAA aerodromes and Civil Aviation radars. The sensitivity criteria presented in Table 1was determined in accordance with submissions by the SACAA and the Air Traffic and Navigation Control Services (ATNS), civil aviation sensitivities with appropriate buffers were mapped as per Table 1. The sensitivity data were available at a national scale and used to produce national wind and solar PV sensitivity maps (see Figure 1and Figure 2). Sensitivities were also mapped for each FA (see Figure 3and Figure 13).

Table 1: Civil aviation sensitivity criteria.

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Major Civil Aviation Aerodromes	- SA CAA	- **Very high sensitivity** within 8 km - **High sensitivity** between 8 and 15 km - **Medium sensitivity** between 15 and 35 km	- **Medium sensitivity** within 8 km
Other Civil Aviation Aerodromes	- SA CAA	- **High sensitivity** within 8 km - **Medium sensitivity** between 8 and 15 km	- **Medium sensitivity** within 8 km
Civil Aviation Radars	- SA CAA	- **High sensitivity** within 15 km - **Medium sensitivity** between 15 and 35 km	N/A
Air Traffic Control and Navigation Sites	- ATNS	- **Medium sensitivity** within 5 km	N/A
Danger and Restricted Airspace	- SA CAA	- **High sensitivity** as demarcated	N/A

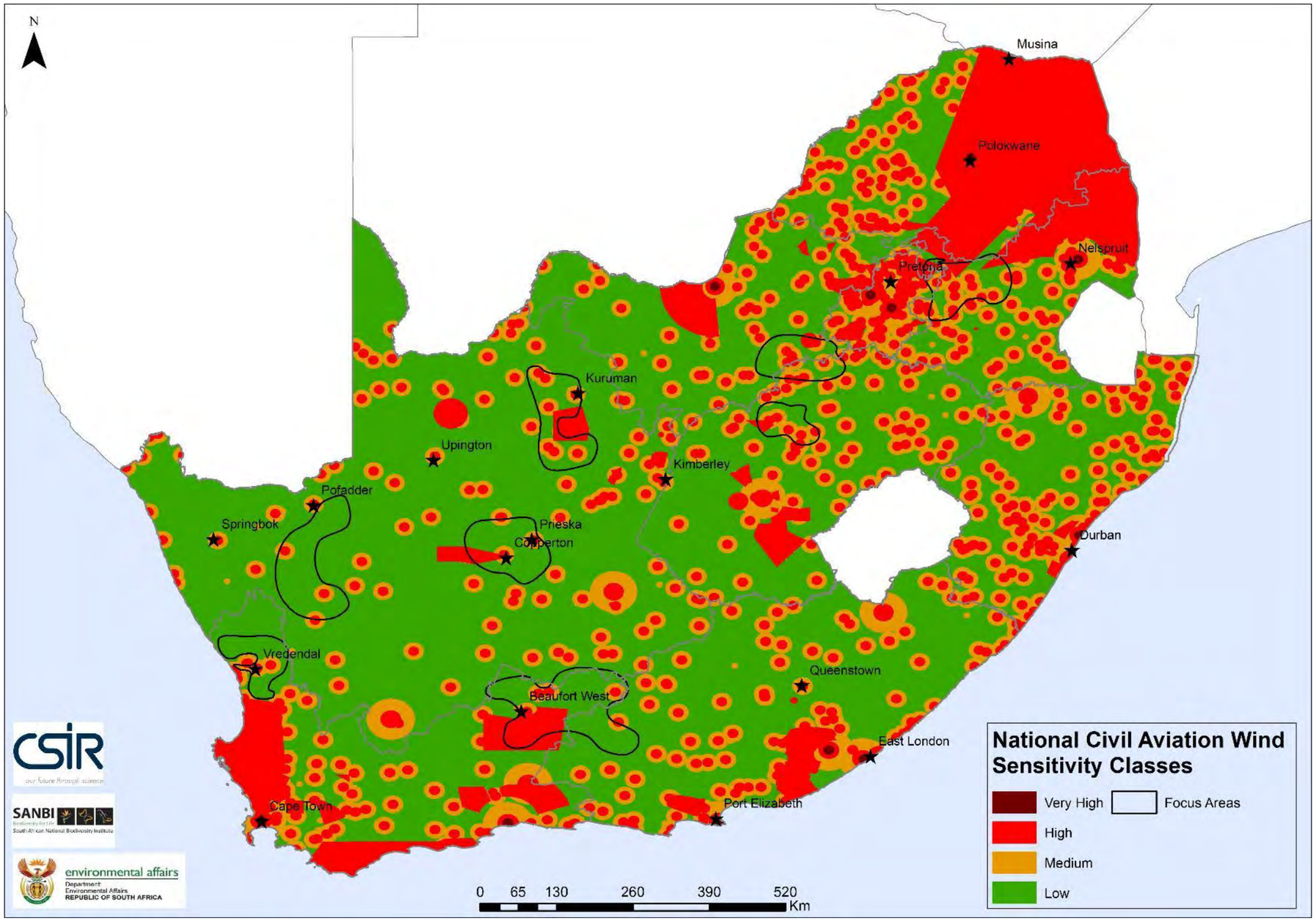

Figure 1: National civil aviation sensitivity map for wind development

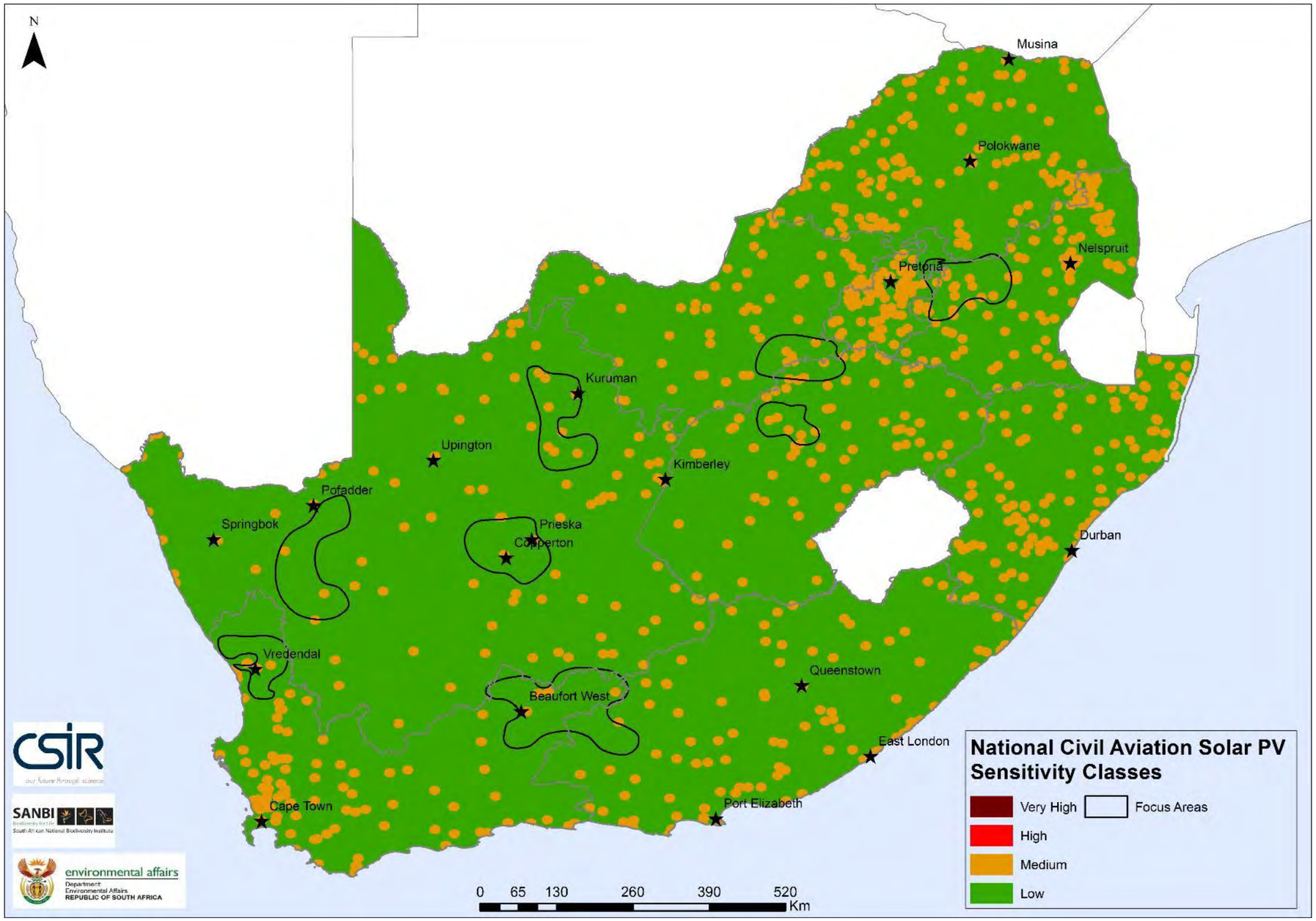

Figure 2: National civil aviation sensitivity map for solar PV development

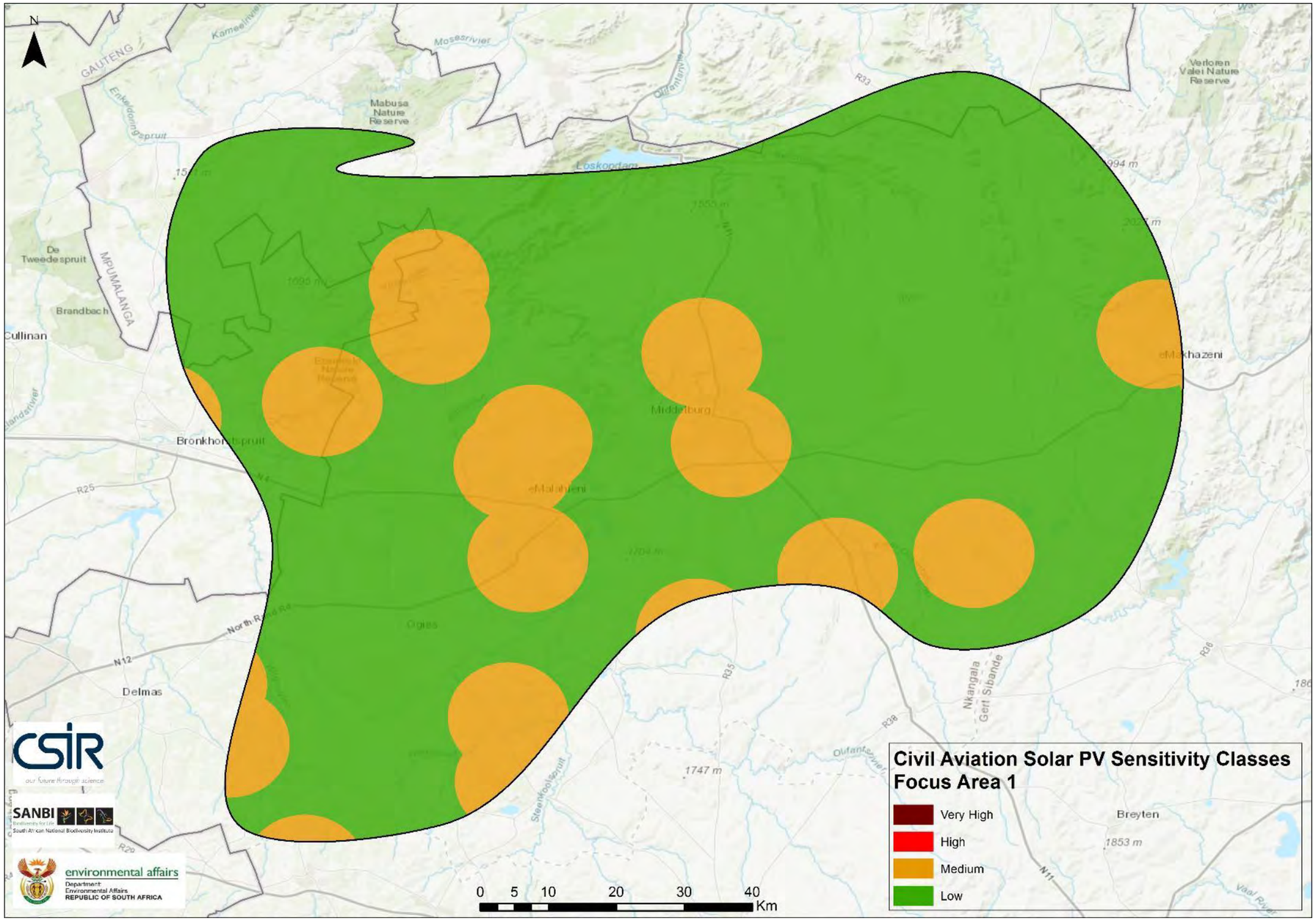

Figure 3: Civil aviation sensitivity for solar PV energy development in FA 1

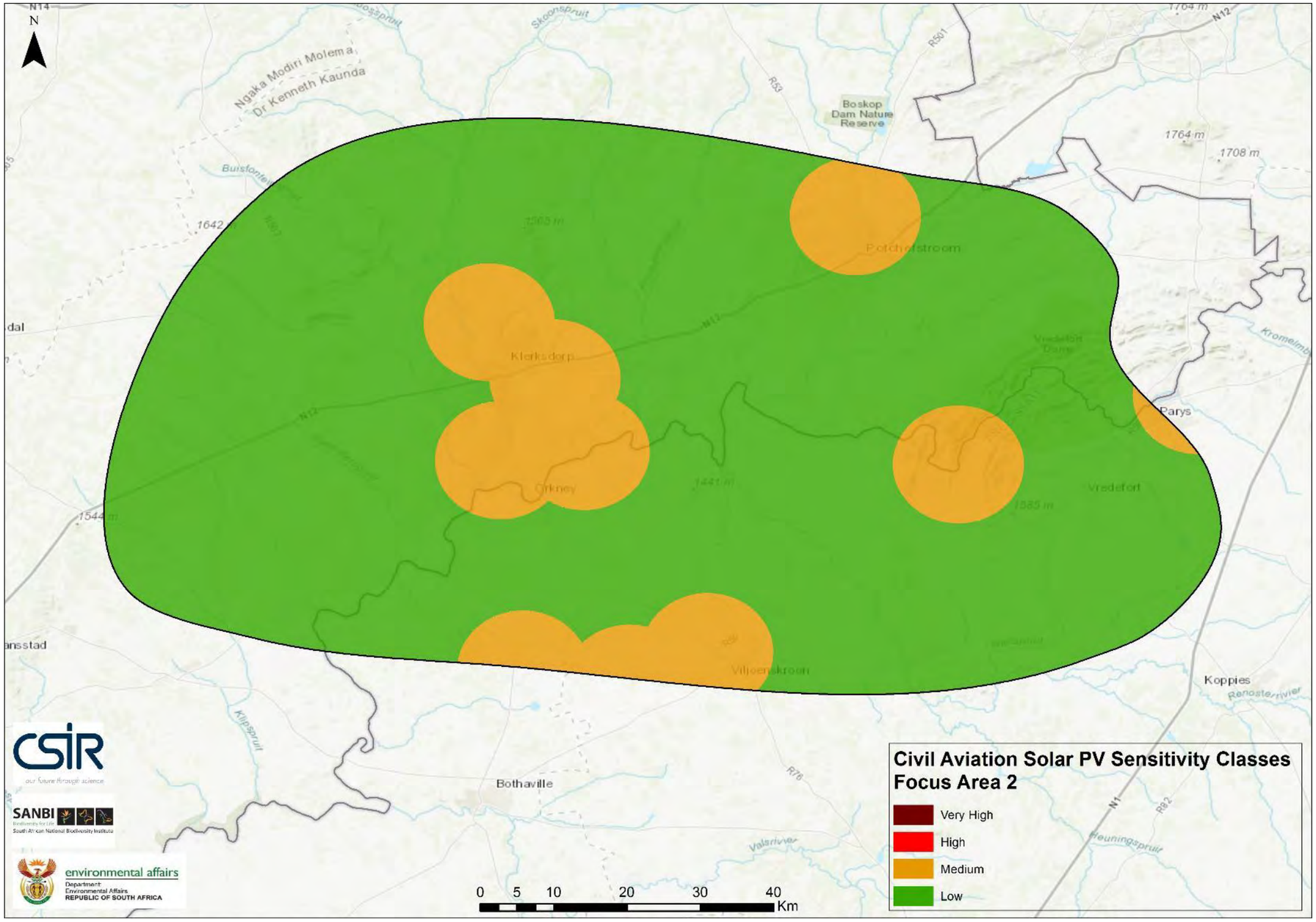

Figure 4: Civil aviation sensitivity for solar PV energy development in FA2

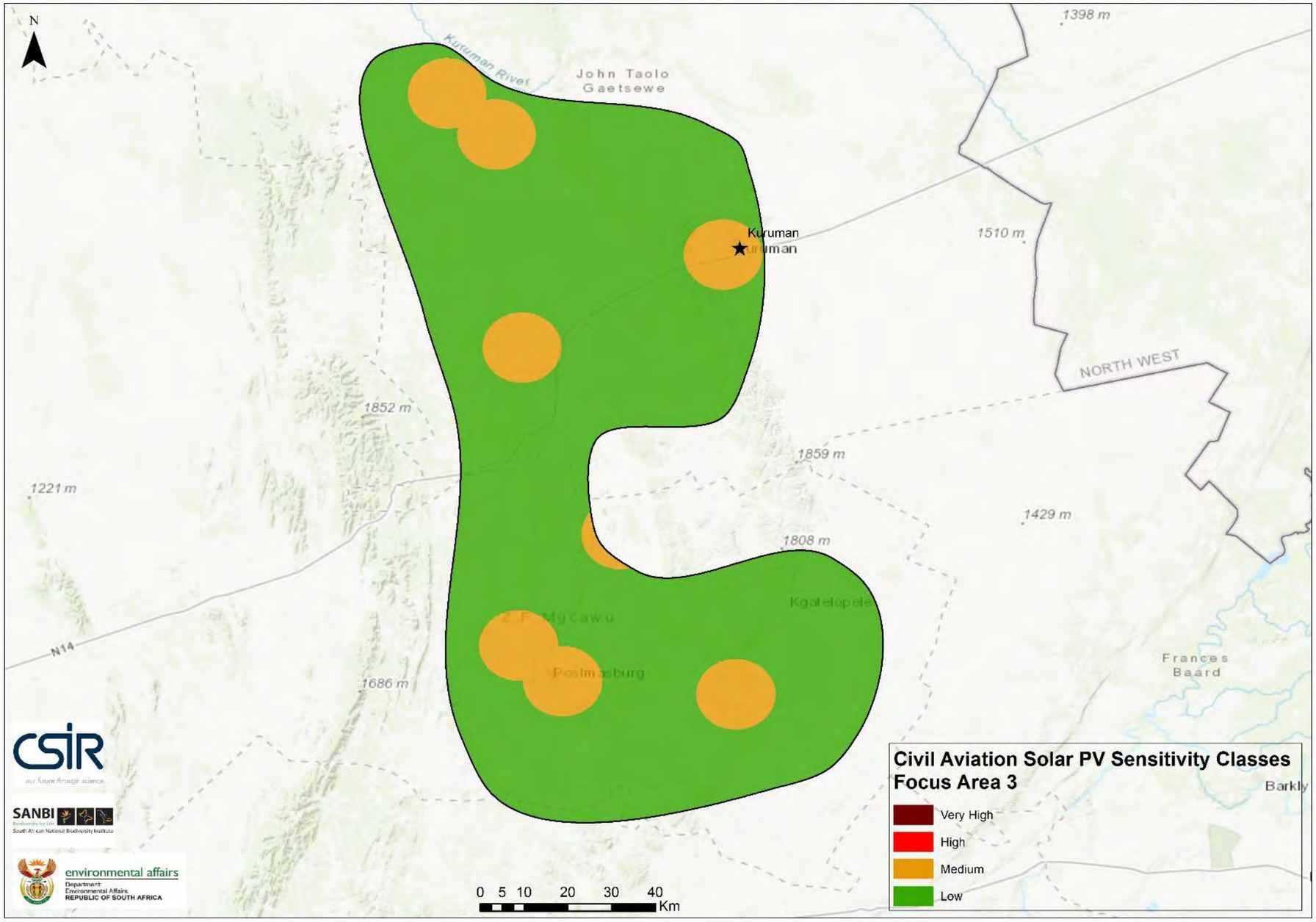

Figure 5: Civil aviation sensitivity for solar PV energy development in FA3

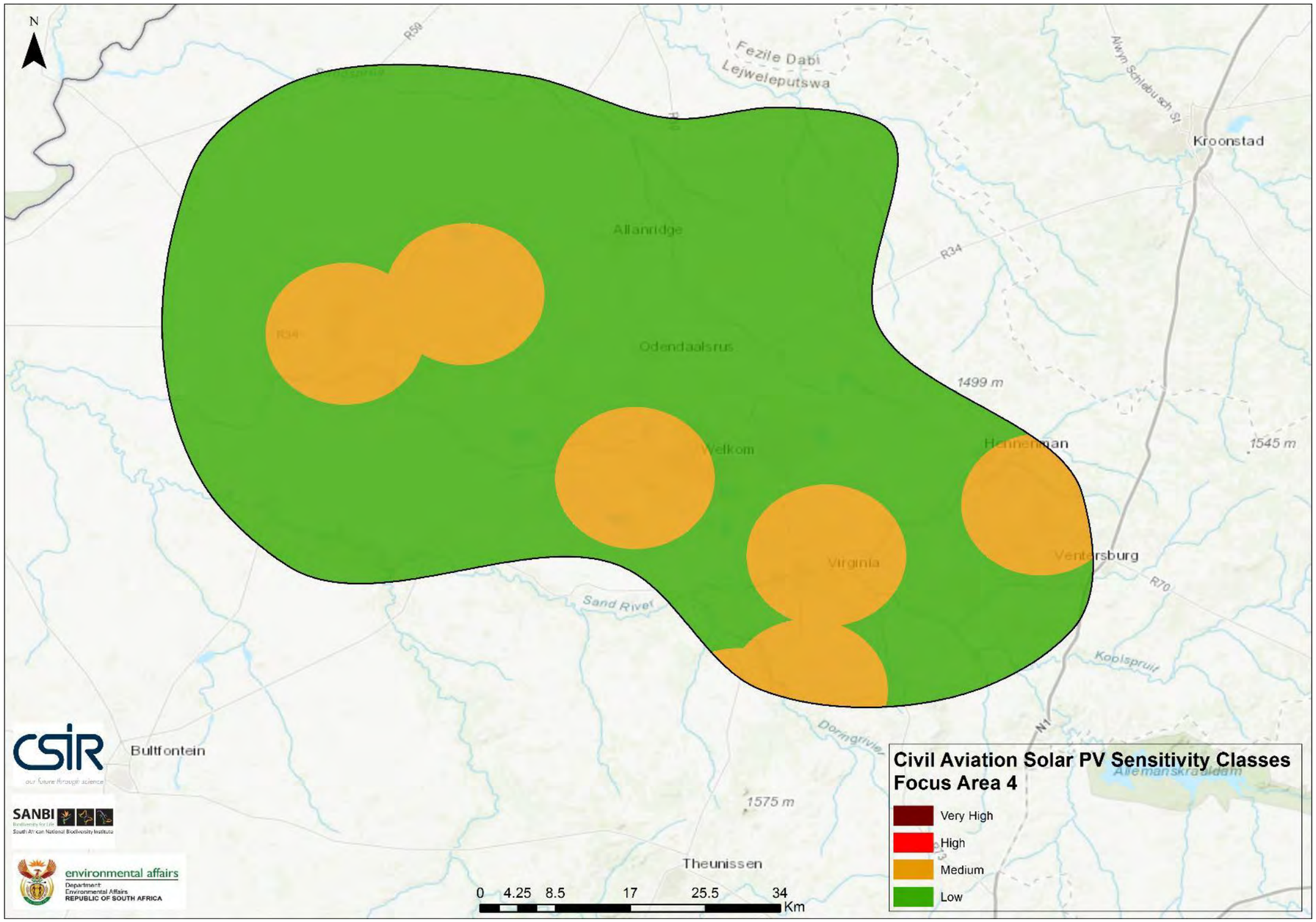

Figure 6: Civil aviation sensitivity for solar PV energy development in FA4

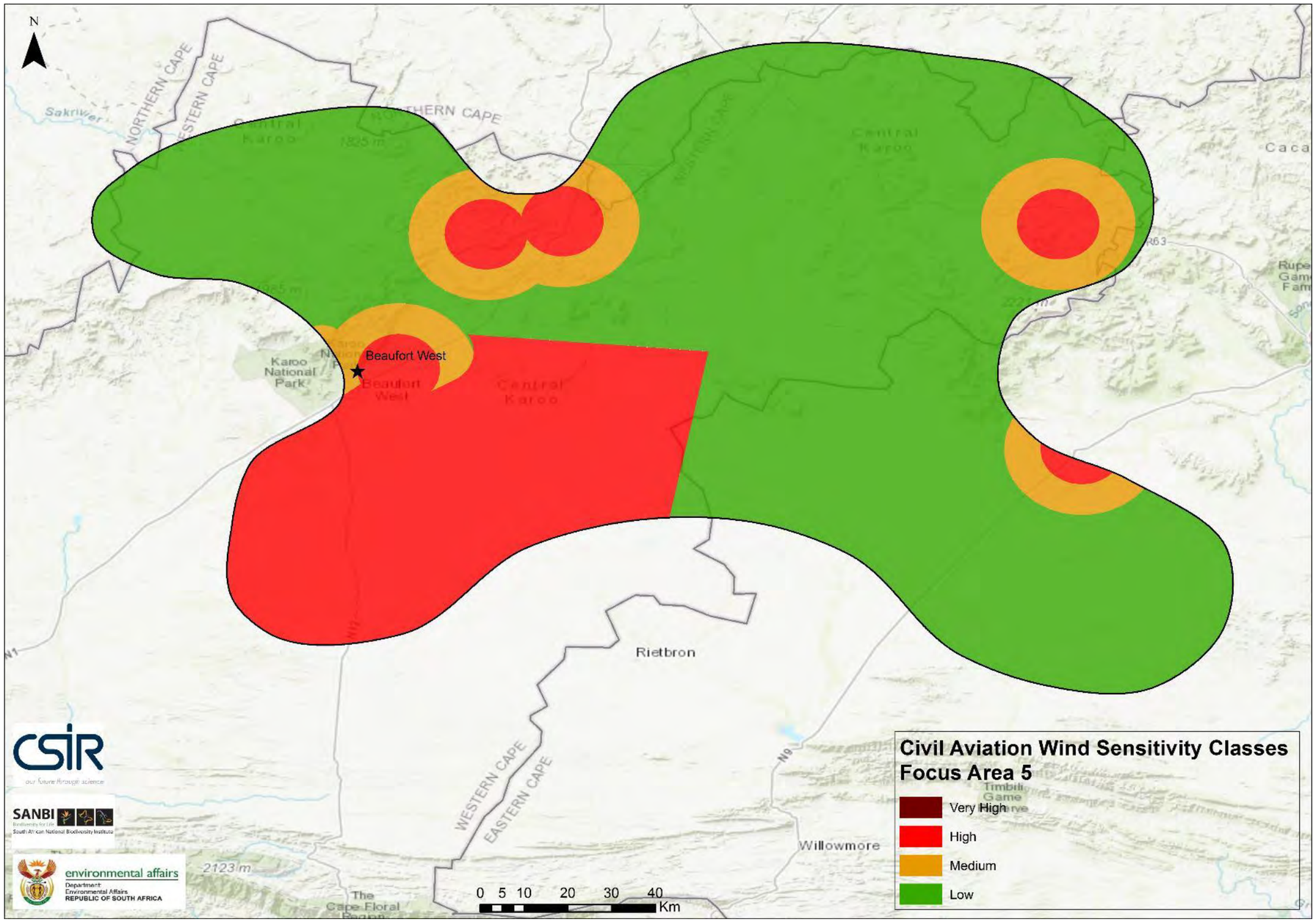

Figure 7: Civil aviation sensitivity for wind energy development in FA5

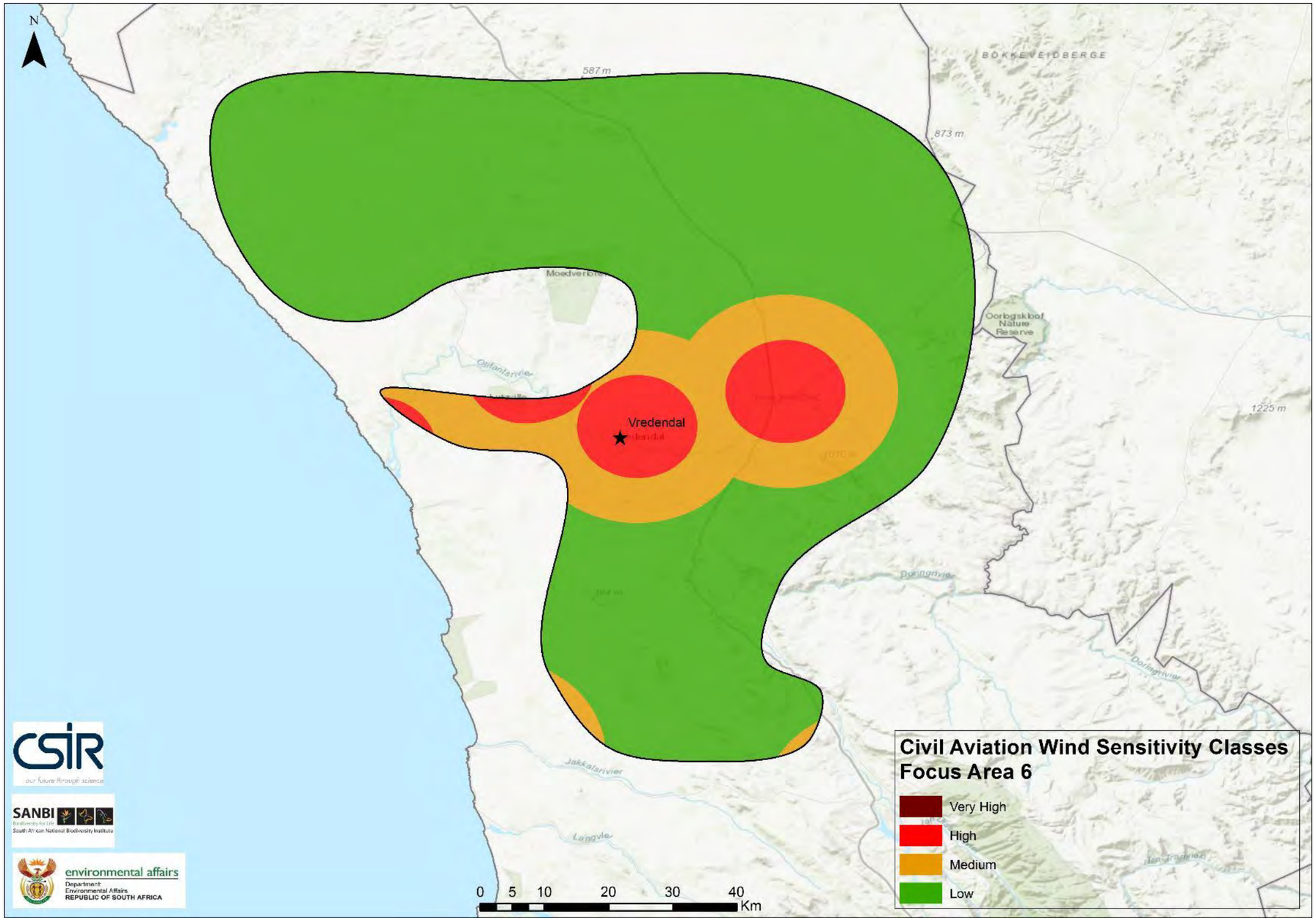

Figure 8: Civil aviation sensitivity for wind energy development in FA6

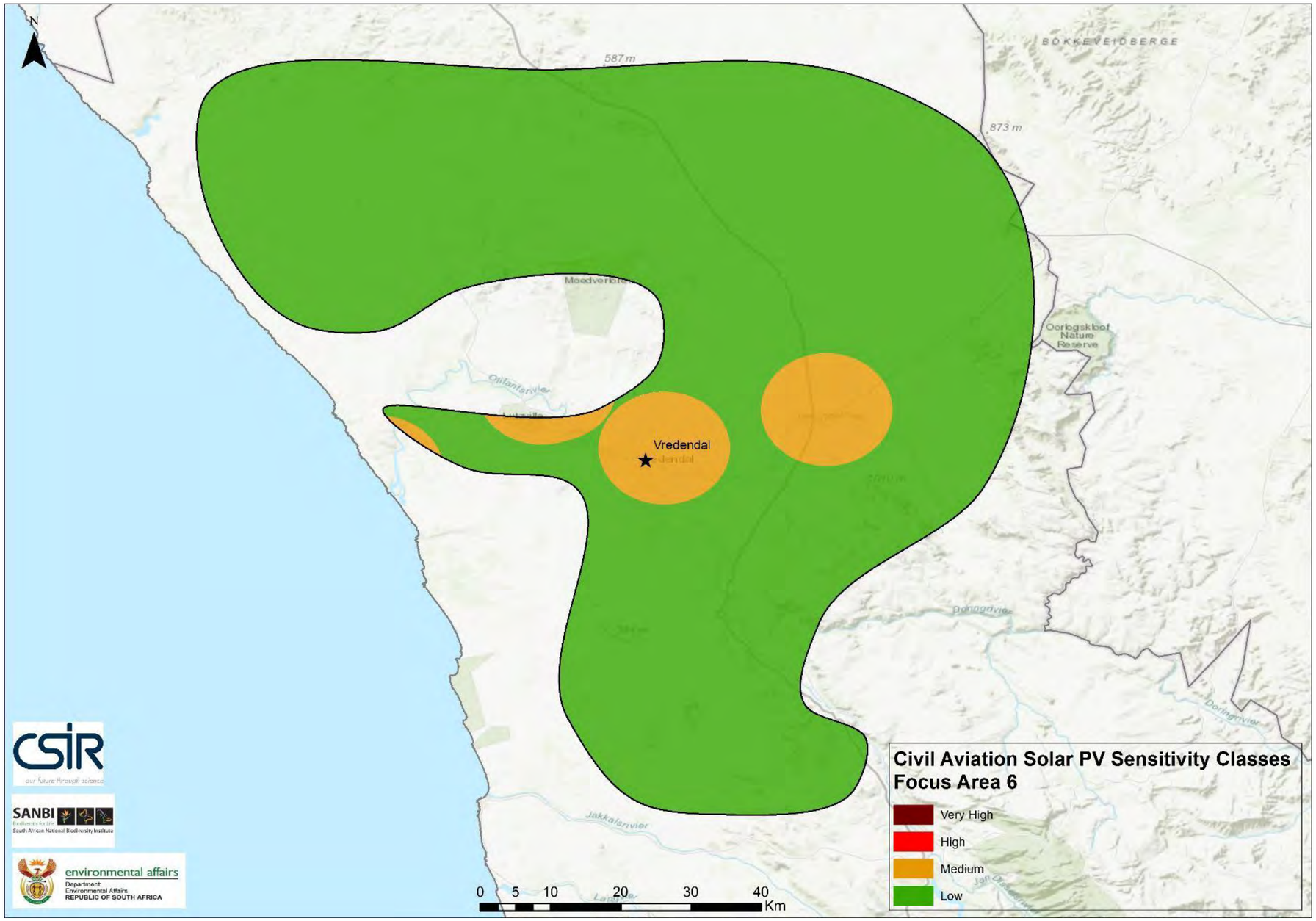

Figure 9: Civil aviation sensitivity for solar PV energy development in FA6

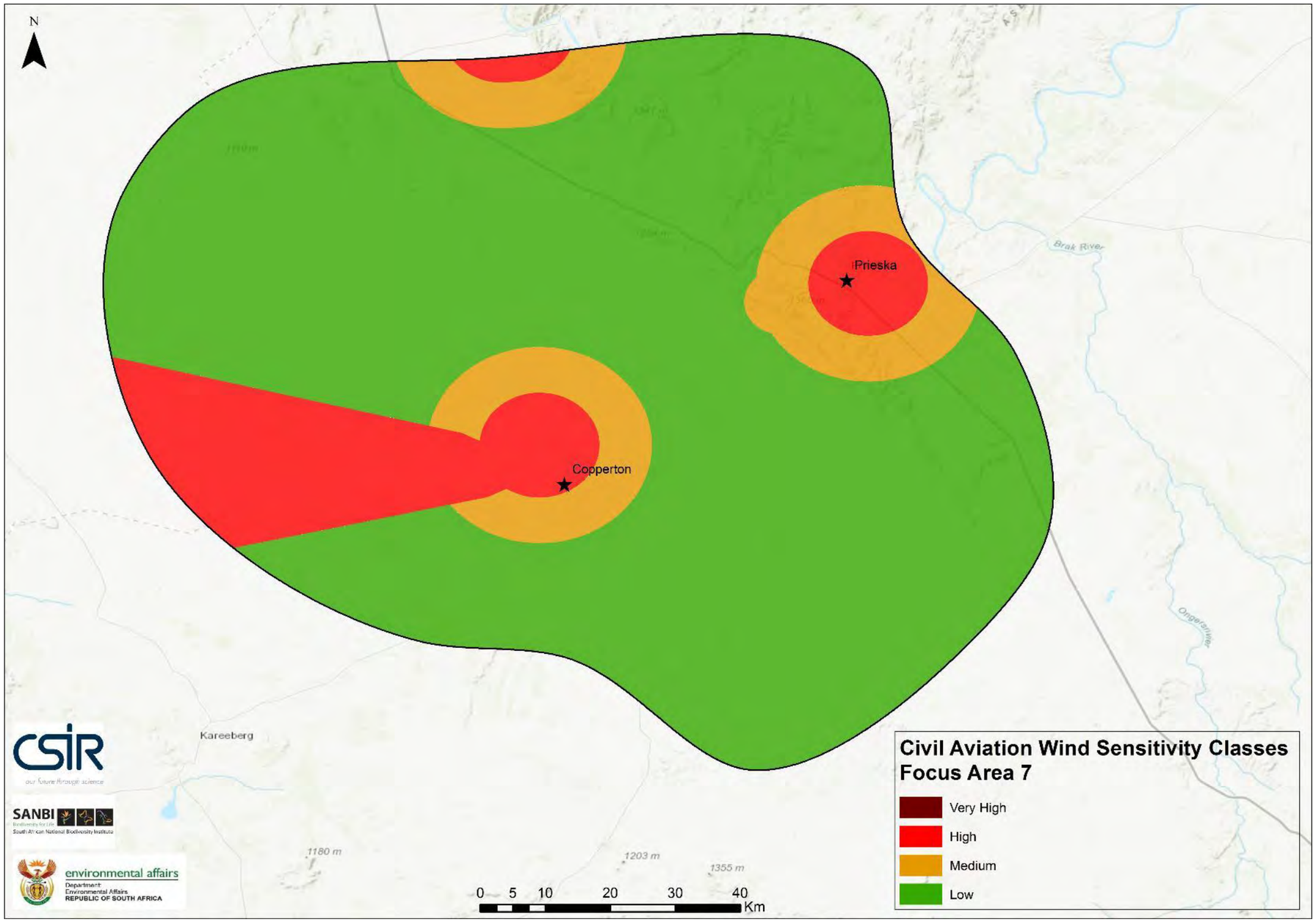

Figure 10: Civil aviation sensitivity for wind energy development in FA7

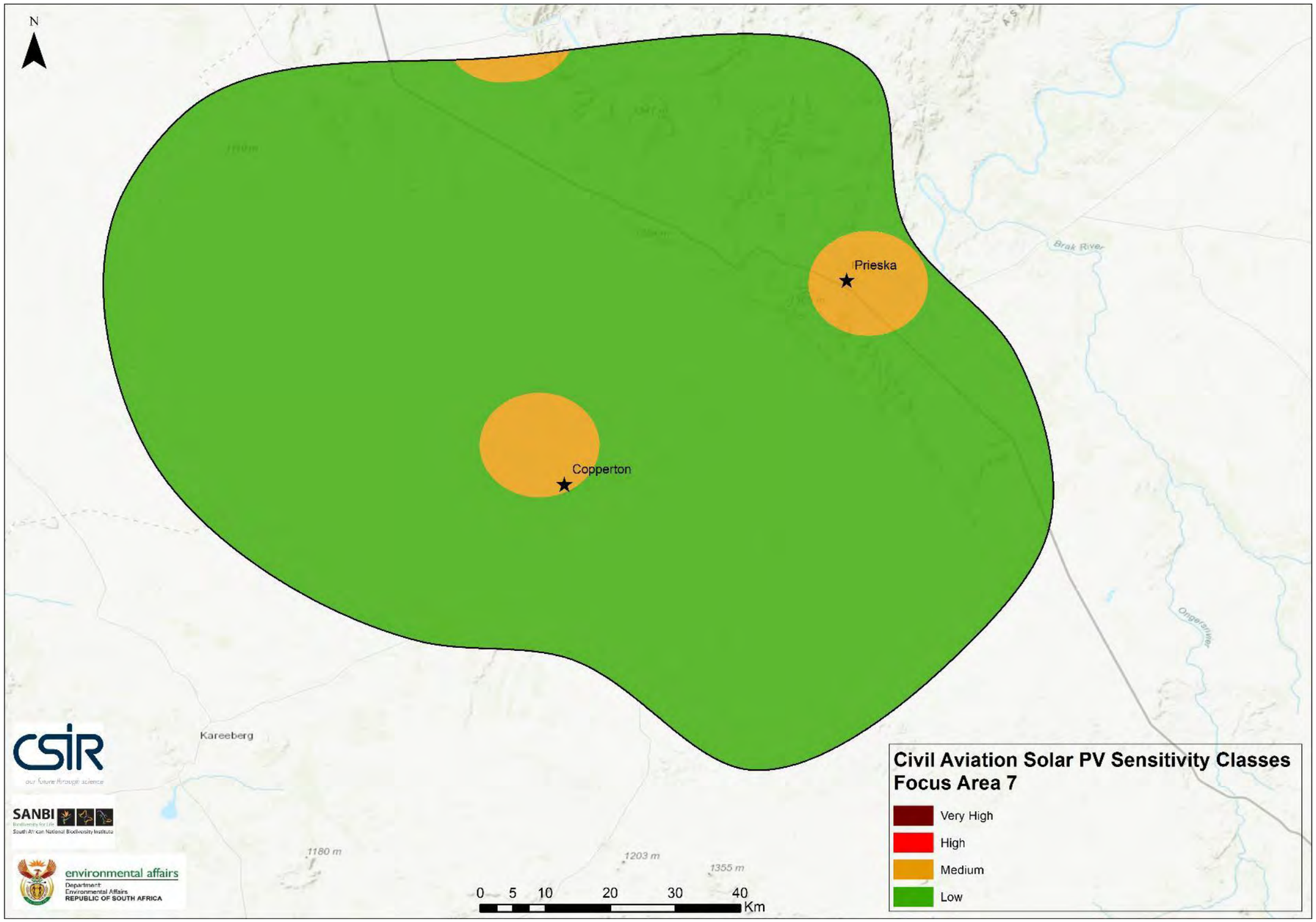

Figure 11: Civil aviation sensitivity for solar PV energy development in FA7

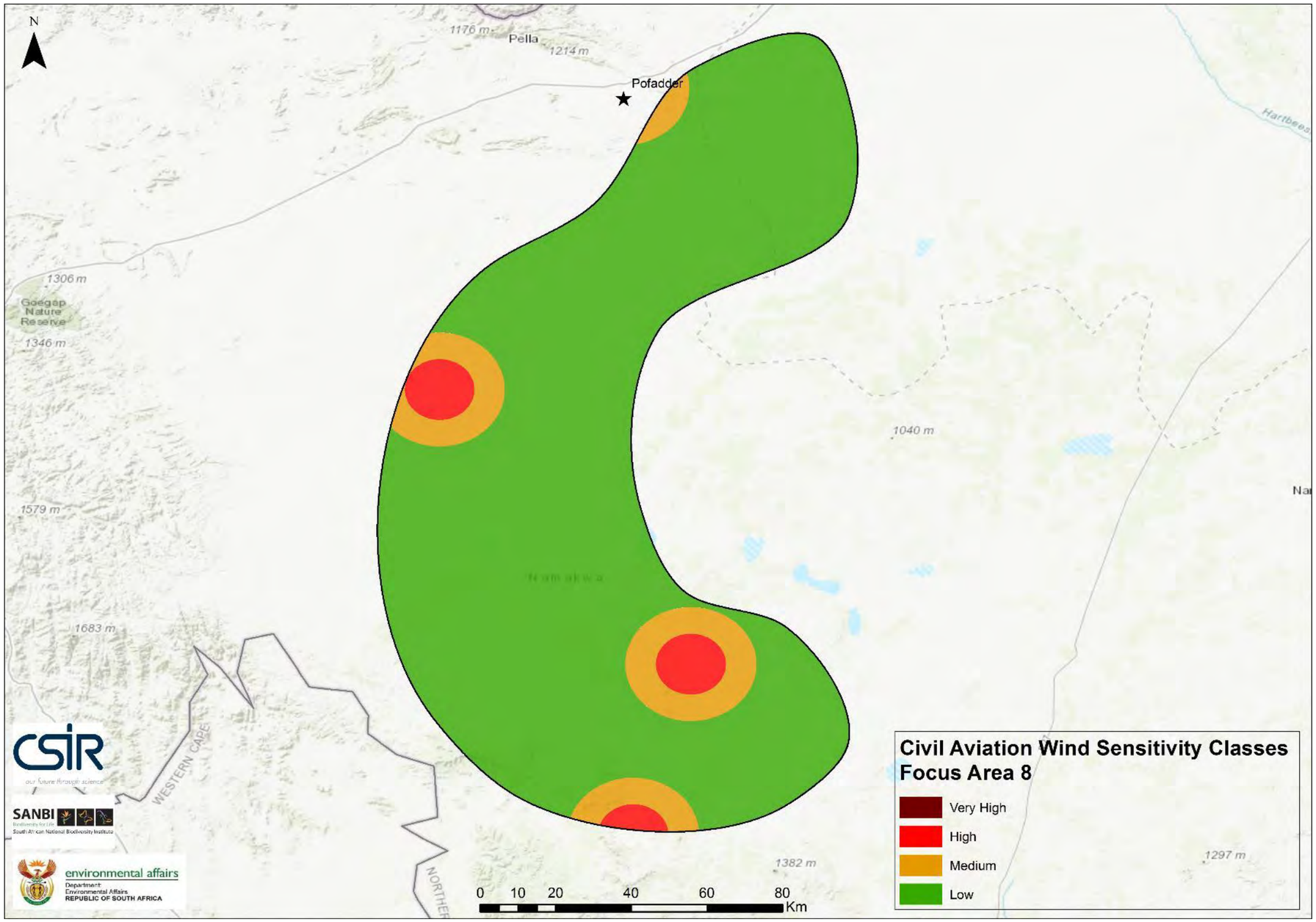

Figure 12: Civil aviation sensitivity for wind energy development in FA8

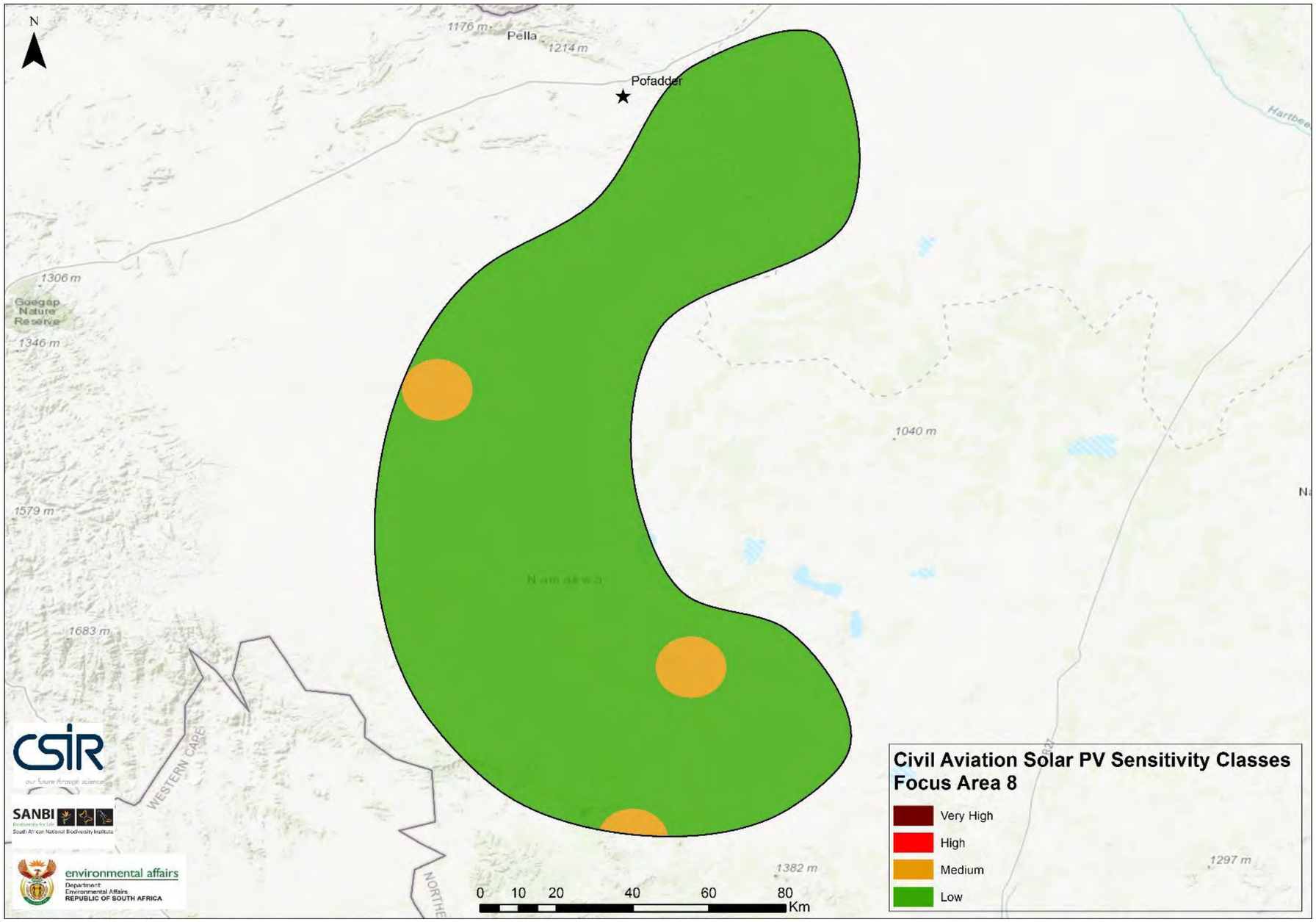

Figure 13: Civil aviation sensitivity for solar PV energy development in FA8

3.5.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts of Shadow Flicker by wind developments. Since solar PV does not result in any flicker impacts, such developments do not require any assessment or authorisation in this regard. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

1. CIVIL AVIATION

6(a) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON CIVIL AVIATION INSTALLATIONS BY ONSHORE WIND ENERGY GENERATION FACILITIES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on civil aviation installations for activities associated with the development of onshore wind energy generation facilities which require environmental authorisation. This applies within and outside of the Renewable Energy Development Zones (REDZs) as published under Government Notice No. 114, Gazette No. 41445 on 16 February 2018. Requirements for the assessment and reporting of impacts on civil aviation installations are set out below, which shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON CIVIL AVIATION FACILITIES FOR ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

VERY HIGH SENSITIVITY RATING - high likelihood for significant negative impacts on the civil aviation installation that cannot be mitigated. In-depth assessment of the potential impacts are likely to be required before development can be considered in these areas. **HIGH SENSITIVITY RATING –** potential for negative impacts on the civil aviation installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures. **MEDIUM SENSITIVITY RATING -** low potential for negative impacts on the civil aviation installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required. **LOW SENSITIVITY RATING -** No significant impacts on the civil aviation installation are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol, proposed on a site identified by the national web based environmental screening tool as being of "very high", "high", "medium" or "low" sensitivity for civil aviation must submit a Civil **Aviation Compliance Statement.** **2. Civil Aviation Compliance Statement** The **Civil Aviation Compliance Statement** must be prepared by an Environmental Assessment Practitioner for the site being submitted as the preferred development site and must indicate whether or not the proposed development will have an unacceptable negative impact on civil aviation installations. 3. The **Civil Aviation Compliance Statement** must contain, as a minimum, the following information: 3.1 A comment, in writing, from the South African Civil Aviation Authority (SACAA), which may include inputs from the Obstacle Evaluation Committee (OEC), if appropriate, confirming no unacceptable impact on civil aviation installations. If no inputs are provided by the OEC within the prescribed timeframes, then the EAP must provide evidence of engagement with the relevant officials at the OEC and timeous requests for inputs as part of the compliance statement. 3.2 Should comment from the SACAA require further assessment, a copy of the assessment report and mitigation measures is to be attached with the Compliance Statement as part of the Basic Assessment Report (BAR) or Environmental Impact Assessment Report (EIAR). The assessment must be in accordance with the requirements stipulated by the SACAA. 4. A signed copy of the **Civil Aviation Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
FOR WIND AND SOLAR PHOTOVOLTAIC
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PART 3.6

DEFENCE

environmental affairs
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Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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3.6 DEFENCE

This section of the report details the sensitivities related to defence installations in the focus areas. The Department of Defence (DoD) overseas the aspects related to national security for South Africa. There are a number of divisions in DoD including the South African National Defence Force (SANDF).

The SANDF is further broken up into SA Airforce, SA Army, Joint Operations, SA Navy, Military Health Service, Defence Intelligence and Corporate Staff.

3.6.1 Renewable Energy and Defence

Impacts of renewable energy development on defence activities could ensue from an interference with surveillance radars and communication systems, or if any structures associated with the development constitute potential obstacles for military aviation or ground activities.

Wind turbines may cause the following impacts:

- Interference to airborne radar systems for operations linked to the Airforce
- Interference to ground radar systems
- Create thermal readings that are reactive to sensitive weapons
- Pose physical risk on airspace used for military operations as a result of the height of the turbines.

Solar PV impacts are not as pronounced as the impacts related to wind turbines, with the biggest concern for this type of technology being the amount of land required for construction and operation of these facilities. Solar PV facilities generally have large footprints and can impact on air to ground and ground training activities if located inside military training areas.

As military operations involves the use of airspace, radar and land for training and testing of weapons, it is important to identify areas where renewable energy may pose a threat to defence operations.

3.6.2 Sensitivity Mapping

The sensitivity mapping depicted in this section of the report is based on updated buffers of the Phase 1 SEA submitted by SANDF. The main divisions of SANDF that could be impacted by large scale wind and solar PV developments are specific military bases, training areas and the Air Force. In accordance with these submissions the military areas of interest were mapped and appropriately buffered as per Table 1. Data for Air Force bases and training ranges were available at a national scale and used to produce a national sensitivity map (see Figure 1). Other military areas of interest were only available inside the FAs. All sensitivities were combined to create sensitivity maps for each FA (see Figure 2 to Figure 9).

Table 1: Military areas of interest sensitivity criteria.

Sensitivity Feature	Sensitivity Mapping Application
	Wind and Solar PV
Air Force Bases - Including air force training ranges	- **Very High Sensitivity** 28 km - **High Sensitivity** 56 km - **Medium Sensitivity** 111 km
High Sites - High elevation sites used for the placing of communication or surveillance equipment	- **Very High Sensitivity** 10 km - **High Sensitivity** 15 km
Telecommunication transmission links	- **Very High Sensitivity** 10 km
Military Bases	- **Very High Sensitivity** 1 km - **High Sensitivity** 10 km
Operational Military Facilities	- **Very High Sensitivity** 5 km
Shooting Ranges	- **Very High Sensitivity** 1 km - **High Sensitivity** 10 km
Military Training Areas	- **Very High Sensitivity** 1 km - **High Sensitivity** 10 km
Demolition Ranges	- **Very High Sensitivity** 1 km - **High Sensitivity** 10 km
Ammunition Depots	- **Very High Sensitivity** 28 km
Bombing Ranges	- **Very High Sensitivity** 1 km - **High Sensitivity** 10 m
All other DoD features (including Naval Bases, Housing, Offices etc.)	- **Very High Sensitivity** 100m

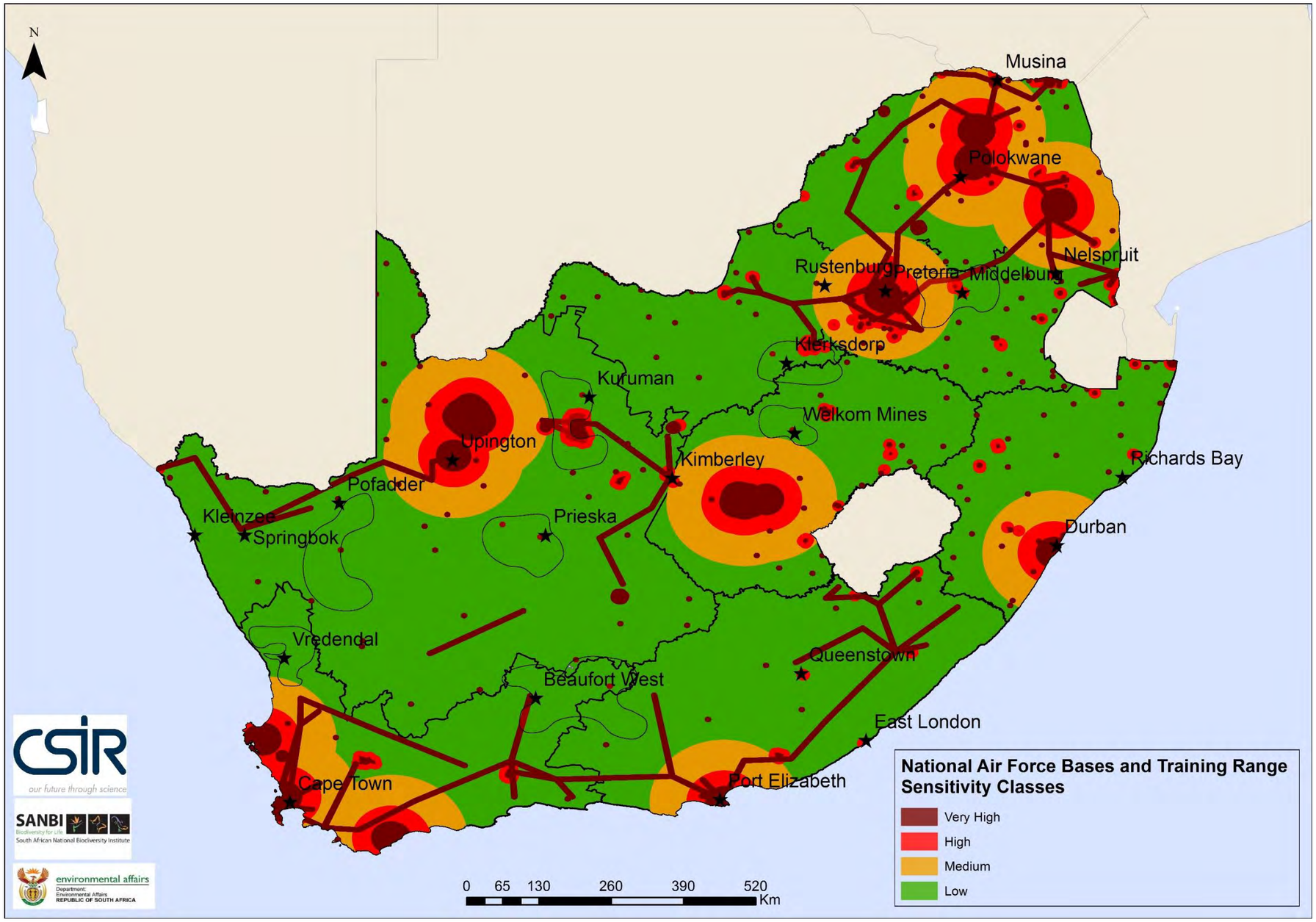

Figure 1: National Air Force bases and training range sensitivity map for wind and solar PV development

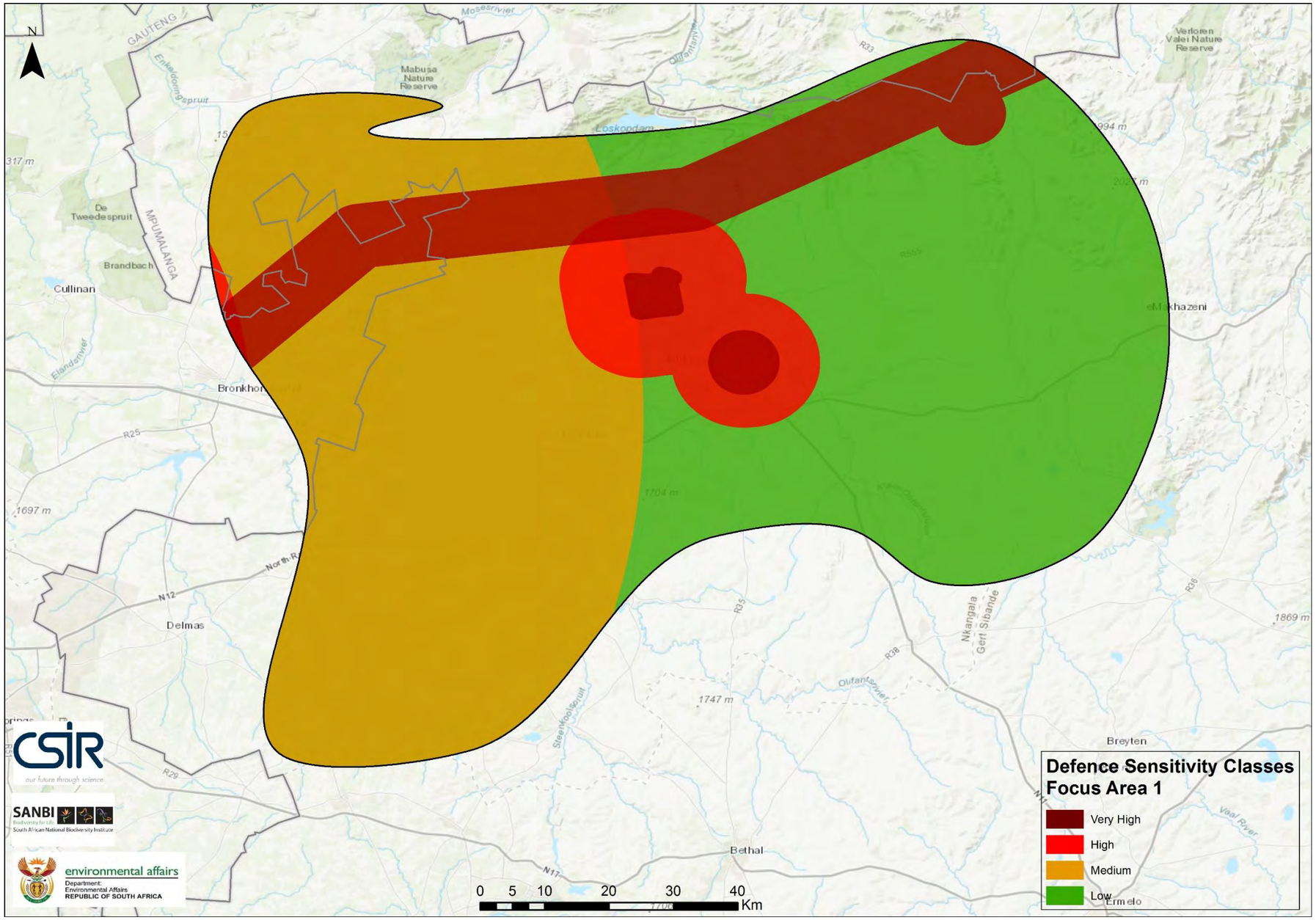

Figure 2: Military sensitivity for wind and solar PV energy development in FA1

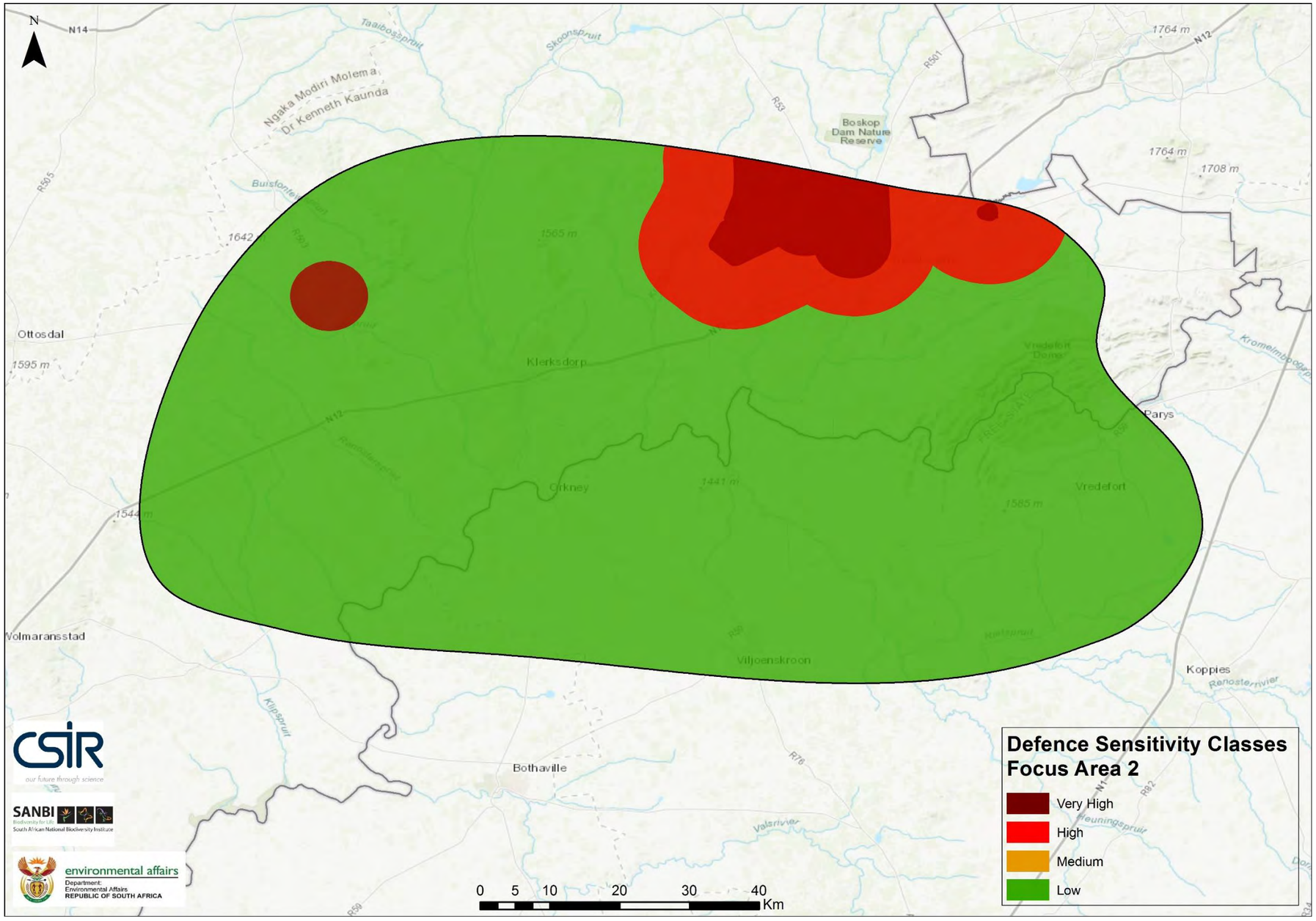

Figure 3: Military sensitivity for wind and solar PV energy development in FA2

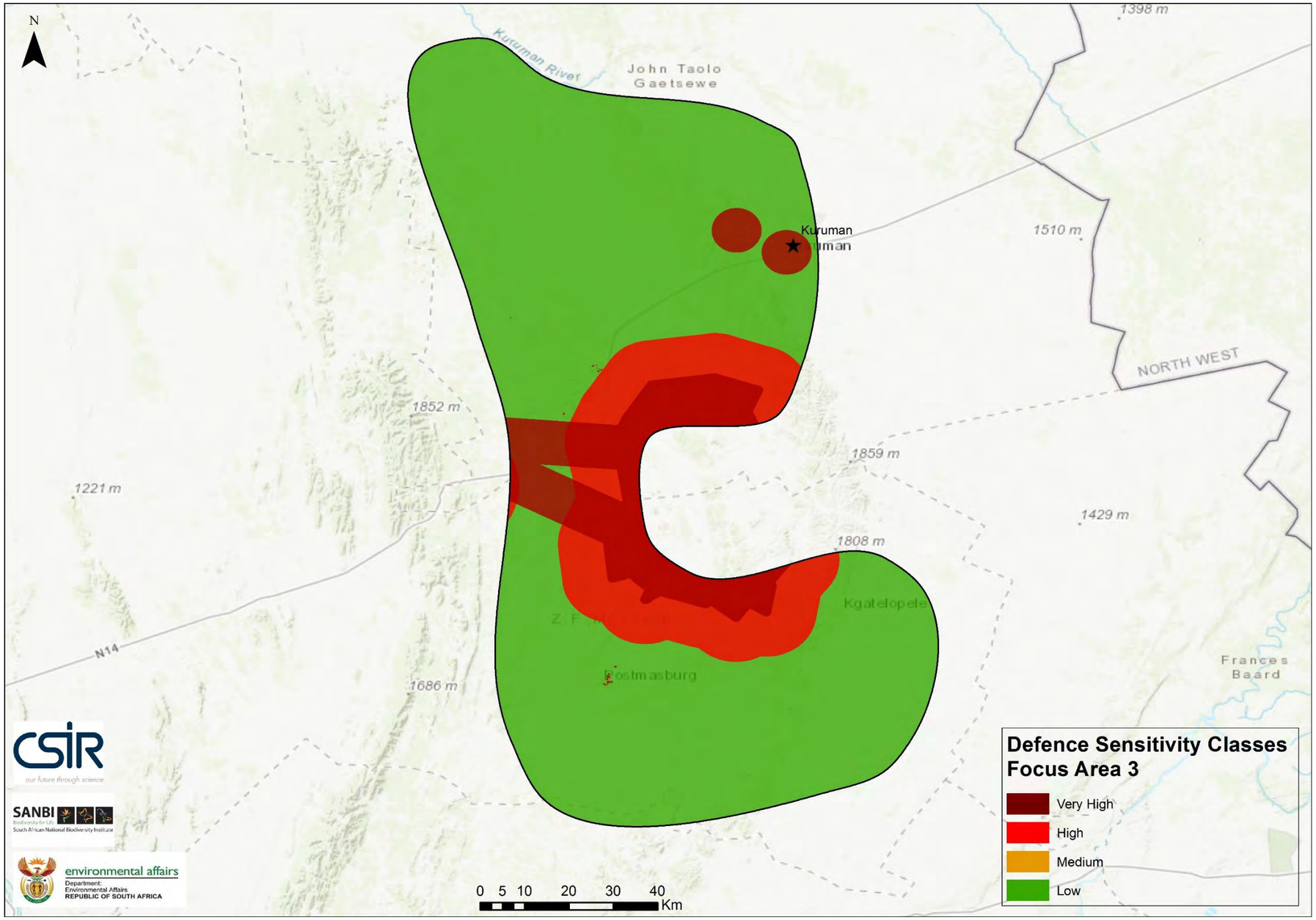

Figure 4: Military sensitivity for wind and solar PV energy development in FA3

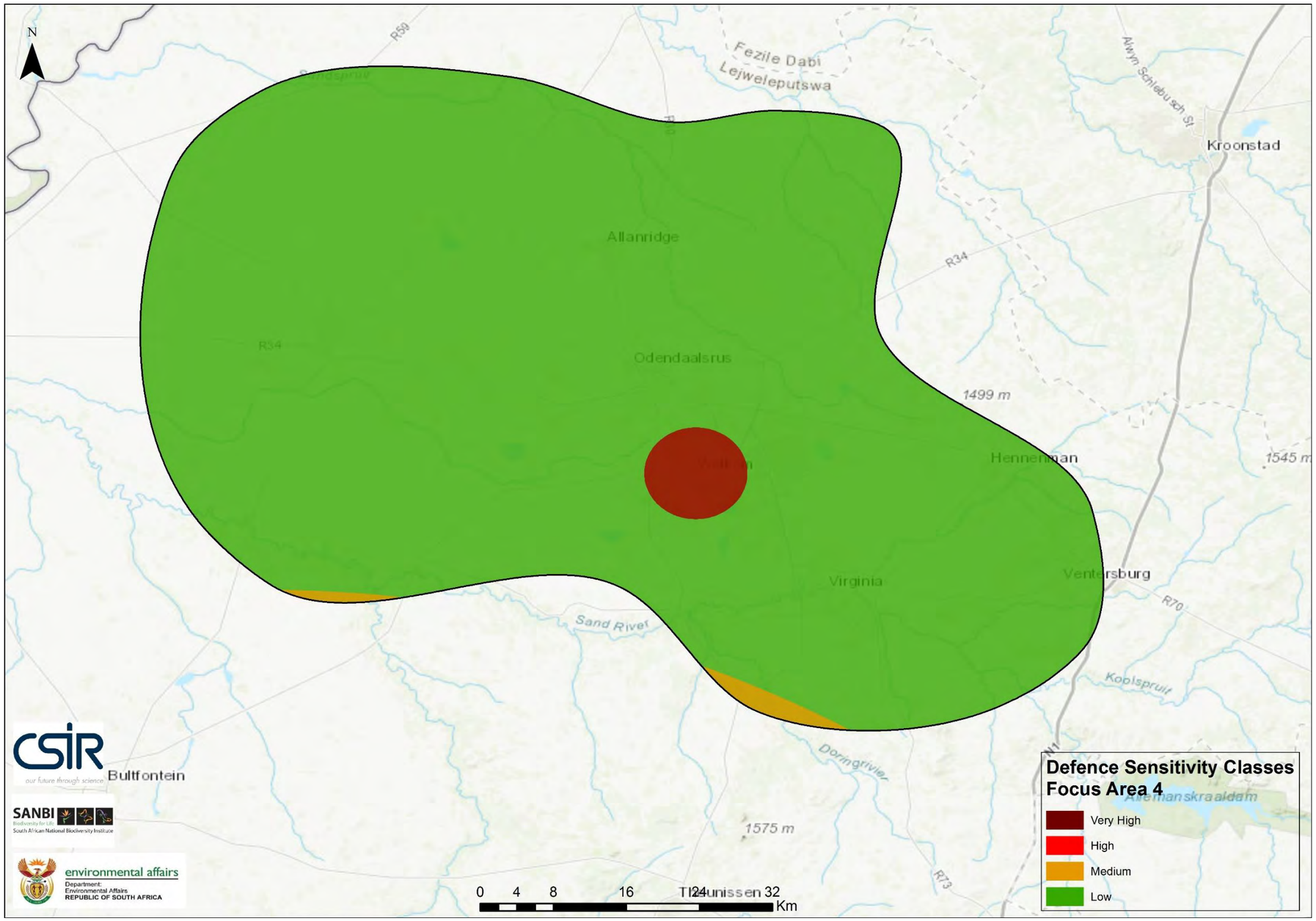

Figure 5: Military sensitivity for wind and solar PV energy development in FA4

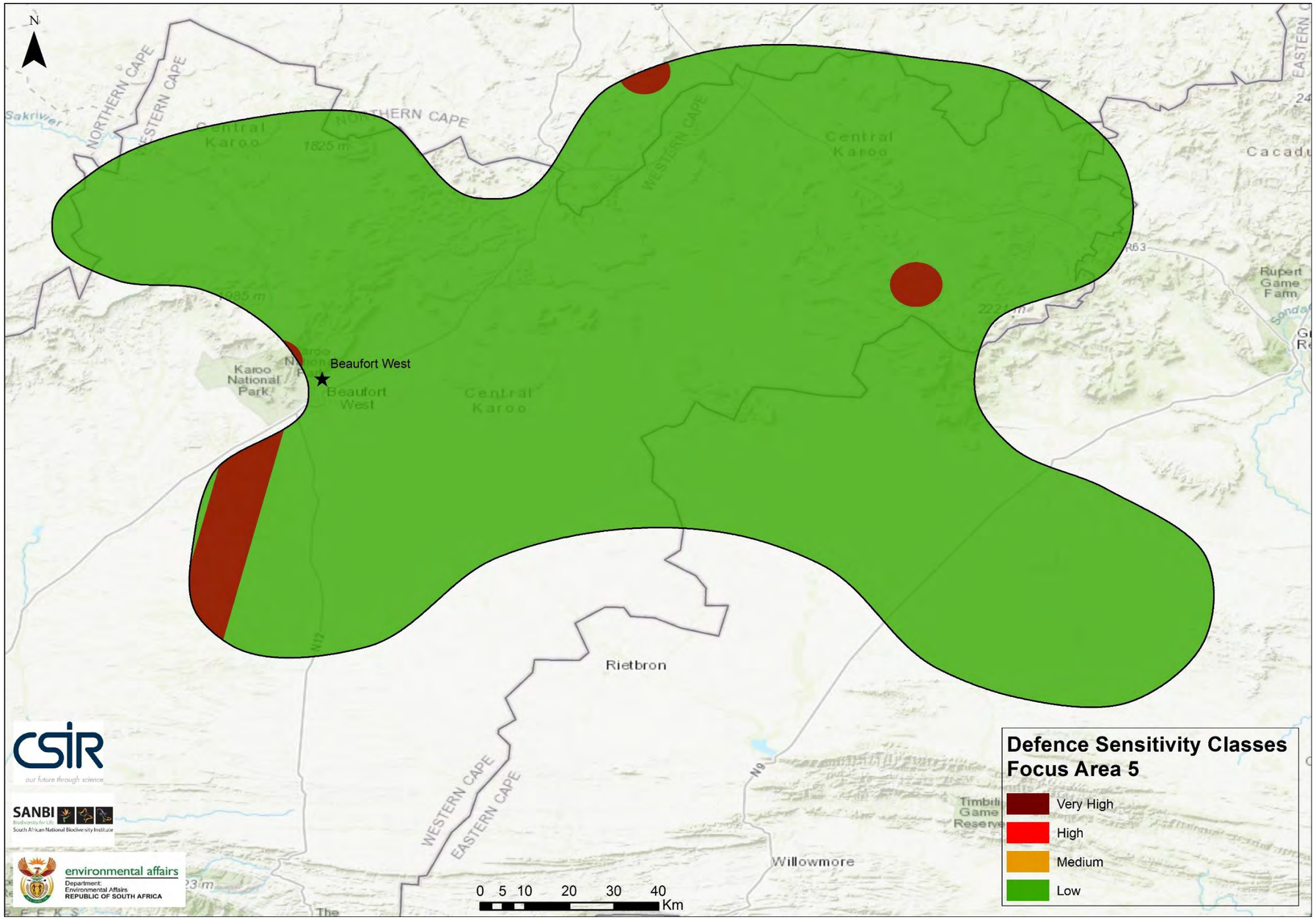

Figure 6: Military sensitivity for wind and solar PV energy development in FA5

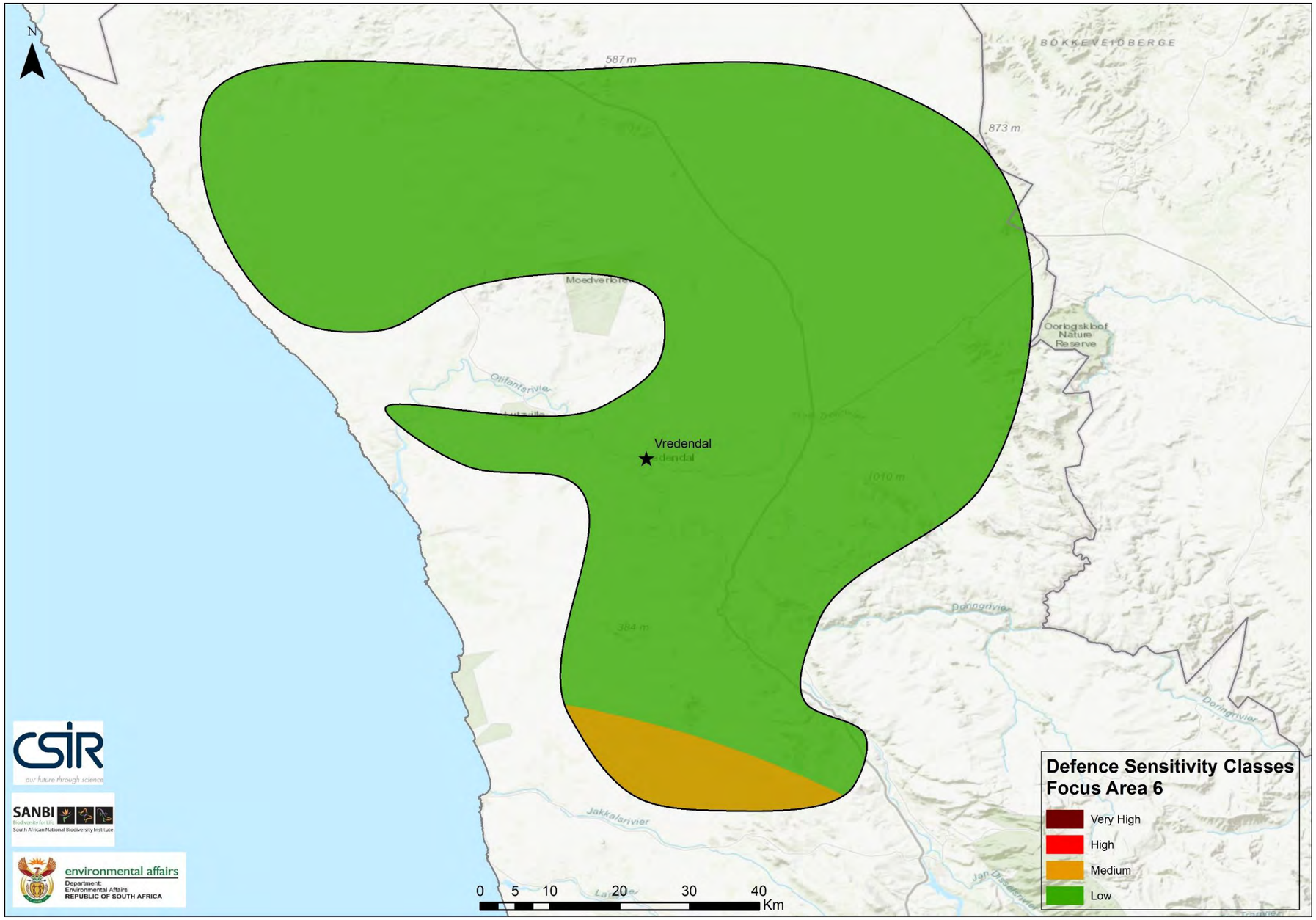

Figure 7: Military sensitivity for wind and solar PV energy development in FA6

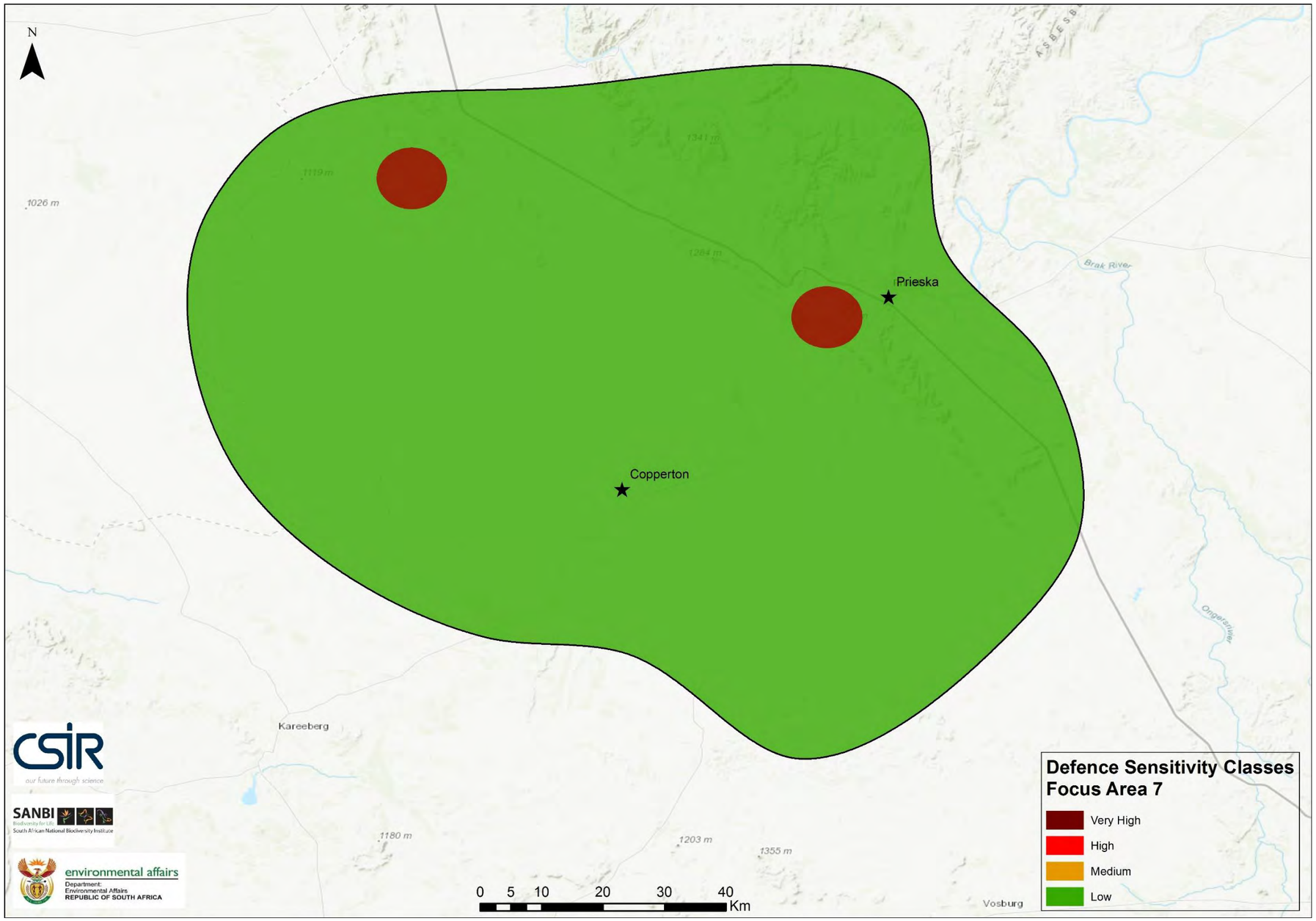

Figure 8: Military sensitivity for wind and solar PV energy development in FA7

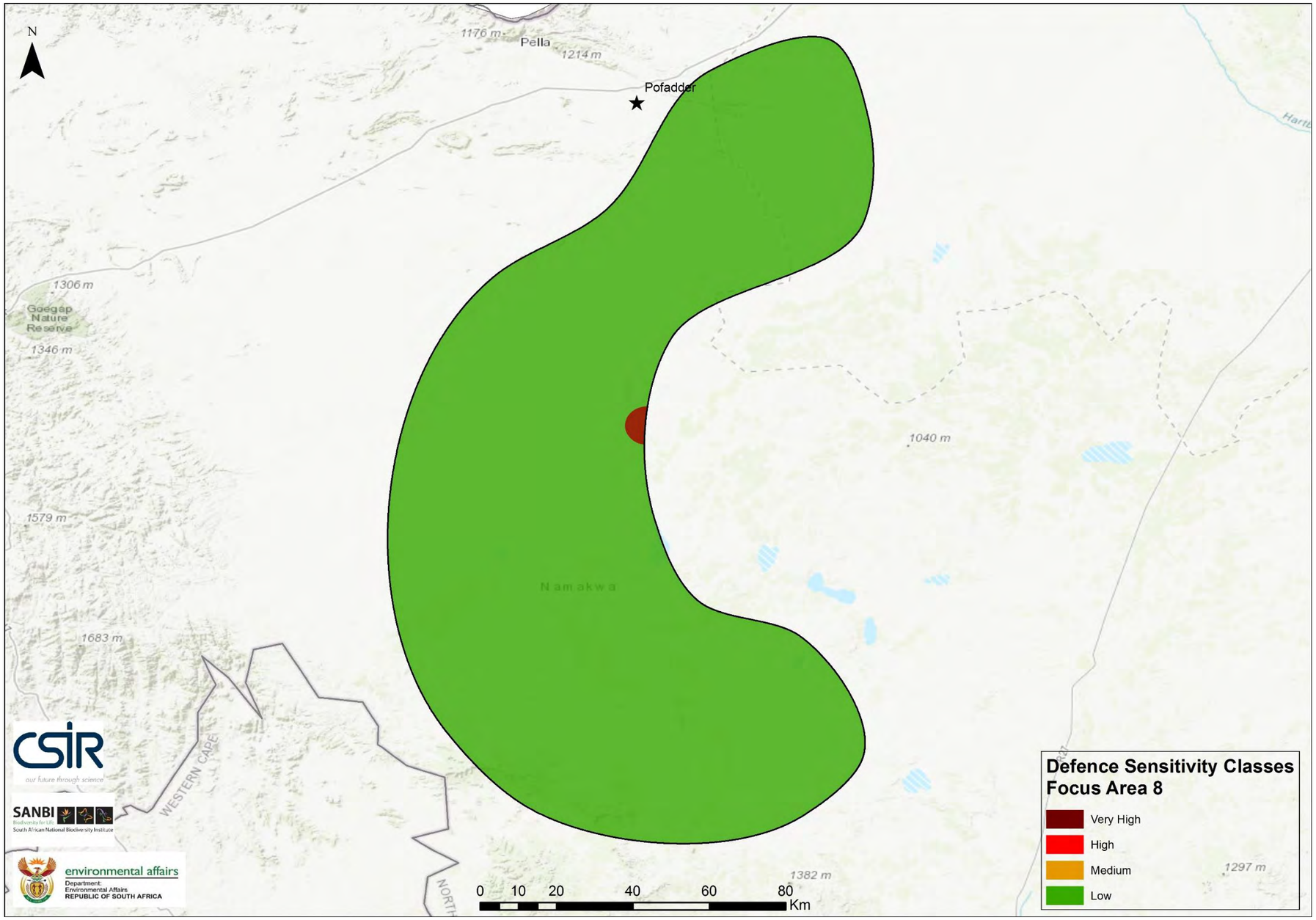

Figure 9: Military sensitivity for wind and solar PV energy development in FA8

3.6.3 Development Protocols

Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool. This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts of Defence installations by wind developments and solar PV developments. The Obstacle Evaluation Committee (OEC), under the chairmanship of the Senior Staff Officer Air Traffic Management of the Air Force, is responsible for streamlining and coordinating the approvals for the construction of potential aviation obstacles in the vicinity of military areas of interest. The OEC consists of members from both the Air Force and the South African Civil Aviation Authority (SACAA), and is mandated to make final recommendations to the Deputy Chief of the Air Force regarding the approval of obstacles that might impact on Air Force activities. Due to the complexity of impacts potentially posed by obstacles on aviation, surveillance, communication, and other military activities, all proposed wind and solar PV facilities must be evaluated by this committee. Even in instances where the distance from the nearest area of military interest may seem far enough for it not be able to have an impact, there is still potential for interference with communication, surveillance, or other military services.

DEFENCE

5(a) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON DEFENCE INSTALLATIONS ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on defence installations for activities associated with the development of onshore wind energy generation facilities which require environmental authorisation. This applies within and outside of the Renewable Energy Development Zones (REDZs) as published under Government Notice No. 114, Gazette No. 41445 on 16 February 2018. Requirements for the assessment and reporting of impacts on defence installations are set out in the Table 1 below, which shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON DEFENCE INSTALLATIONS FOR ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

VERY HIGH SENSITIVITY RATING - high likelihood for negative impacts on the defence installation. In-depth assessment of the potential impacts and mitigation measures are likely to be required before development can be considered in these areas.	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol proposed on a site identified by the national web based environmental screening tool as being of "very high", "high", "medium" or "low" sensitivity for defence must submit a **Defence Compliance Statement.** **2. Defence Compliance Statement** The **Defence Compliance Statement** must be prepared by an Environmental Assessment Practitioner on the site being submitted as the preferred development site and must indicate whether or not the proposed development will have an unacceptable negative impact on defence installations. 3. The **Defence Compliance Statement** must contain, as a minimum, the following information: 3.1 A comment, in writing, from the Department of Defence confirming no unacceptable impact on military areas of interest. If no inputs are provided by the Department of Defence within the prescribed timeframes, then the EAP must provide evidence of engagement with the relevant officials at the Department of DefenceO and timeous requests for inputs as part of the compliance statement. 3.2 Should the comment from the The Department of Defence require further assessment, a copy of the assessment report and mitigation measures is to be attached with the Compliance Statement as part of the Basic Assessment Report or Environmental Impact Assessment Report. The assessment must be in accordance with the requirements stipulated by the The Department of Defence. 4. A signed copy of the full Defence Compliance Statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
HIGH SENSITIVITY RATING - potential for negative impacts on the defence installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
MEDIUM SENSITIVITY RATING - low potential for negative impacts on the defence installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	
LOW SENSITIVITY RATING - No negative impacts on the defence installation are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	

PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
FOR WIND AND SOLAR PHOTOVOLTAIC
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PART 3.7

FLICKER EFFECTS






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3.7 FLICKER EFFECTS

3.7.1 Renewable Energy and Flicker Effects

Shadow flicker occurs when the moving blades of a wind turbine rotor cast moving shadows turbine between the sun and the observer. This flickering effect may impact on receptors living in close proximity to turbines. Sunlight may also be reflected from gloss-surfaced turbine blades and cause a "flashing" effect. Shadow flicker and blade glint is more of a problem in in northern Europe with its high latitudes and low angle of the sun exacerbating the effect [1]. The significance of this impact also depends on the frequency at which it is experienced by a specific observer, and the duration of the effect which is dependent on the location of the observer relative to the turbine and the time of day and year.

To calculate shadow flicker impacts, the following information is typically needed:

- The position of wind turbine generator units and operational times;
- Hub heights and rotor diameters;
- The position of the shadow receptor object and its orientation;
- The geographic position of the project with time zone and daylight savings time information, if applicable; and
- Information about the earth's orbit and rotation relative to the sun.

International regulations for shadow flicker vary widely. The most comprehensive regulations are those implemented in Germany[2]. The limits are:

- A maximum of 30 hours per year and 30 minutes per day of astronomical maximum shadow (worst-case);
- A maximum of 8 hours per year for real shadow impact.

The limit is based on the following:

- The angle of the sun over the horizon must be at least 3 degrees; and
- The blade of the wind turbine must cover at least 20% of the sun.

3.7.2 Sensitivity Mapping

In Denmark, a minimum separation distance of 6 to 8 rotor diameters between the turbine and closest neighbour is recommended[3].

In the absence of South African shadow flicker guidelines, the accepted European standards were used in the SEA. It is widely accepted that flicker impacts are unlikely to occur beyond 10 rotor blade diameters[4, 5 & 6] (i.e. approximately 1 km) from the turbine. Based on this, very high sensitivity is depicted as anything within a 1km buffer from a potential receptor. Sensitivity maps were generated by applying these buffers to every roof (derived from the 2009 SPOT Building Count dataset) in each FA (see Figure 1 to Figure 4).

Table 1: Flicker effect sensitivity criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application for Wind
Potential temporarily or permanently inhabited residence	2009 SPOT Building Count	**- Very High Sensitivity** within 1000 m of temporarily or permanently inhabited residence **- Low Sensitivity** greater than 1000 m from temporarily or permanently inhabited residence

[1] Manwell, McGowan, & Rogers, 2009
[2] Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen, Länderausschuss für Immissionsschutz, (2002)
[3] Manwell, McGowan, & Rogers, 2009
[4] Update of UK Shadow Flicker Evidence Base. Prepared by Parsons Brinkerhoff for the Department of Energy and Climate Change. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf
[5] Burton, T., Sharpe, D., Jenkins, N. and Bossanyi, E. (2001). Wind Energy Handbook. West Sussex, England: John Wiley & Sons
[6] Scottish Planning Policy: Onshore Wind Turbines (2013).

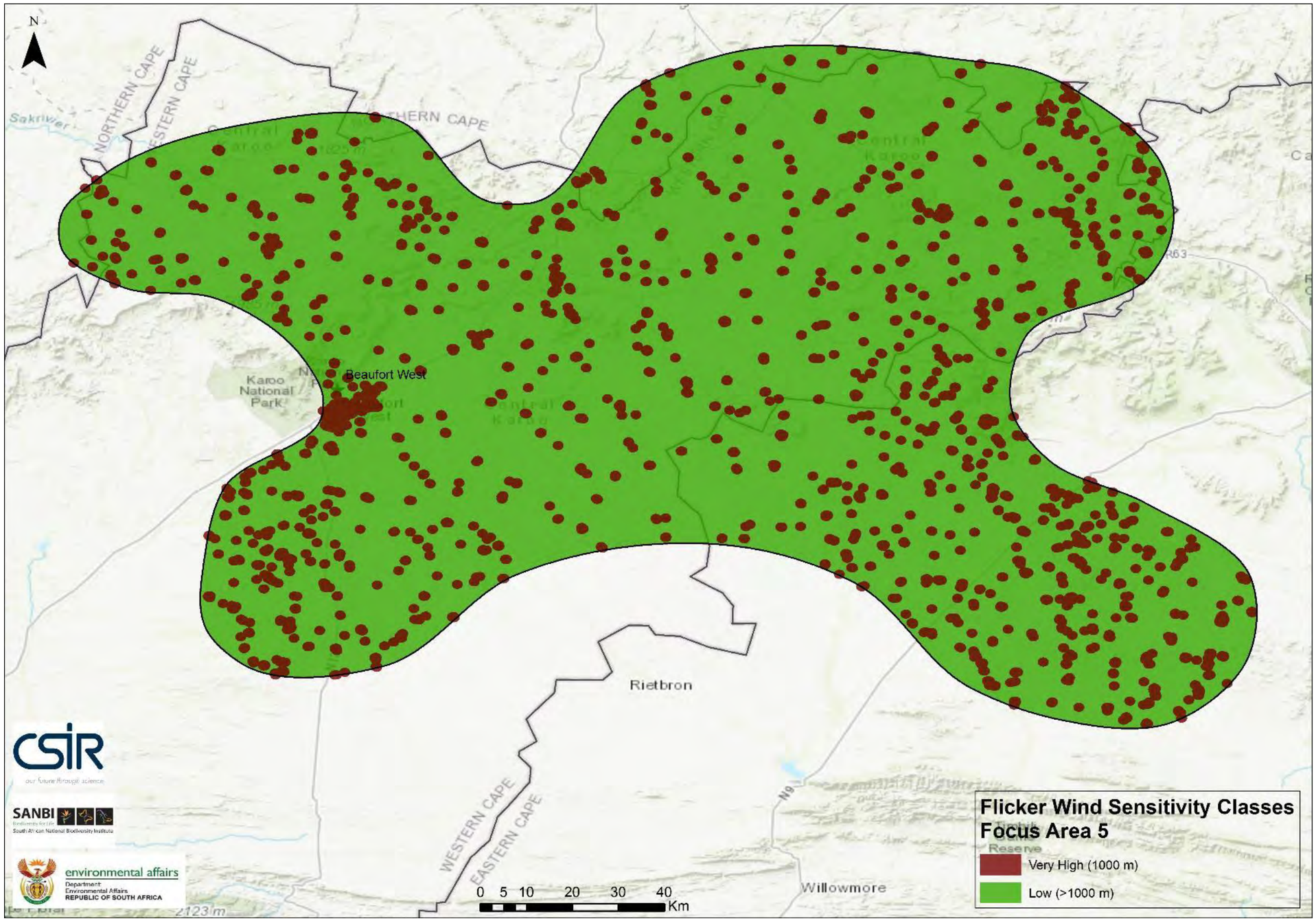

Figure 1: Flicker sensitivity for wind energy development in FA 5

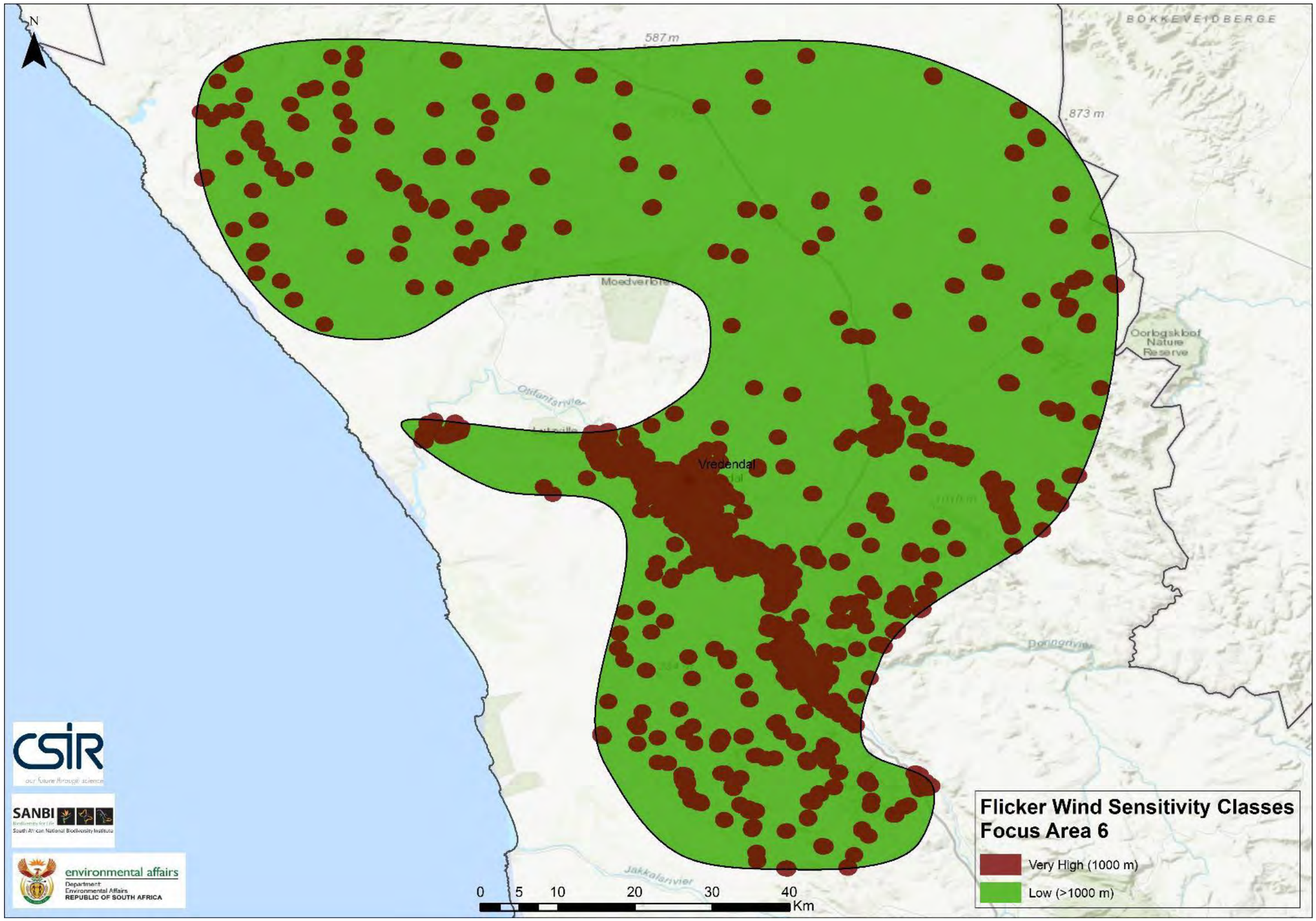

Figure 2: Flicker sensitivity for wind energy development in FA6

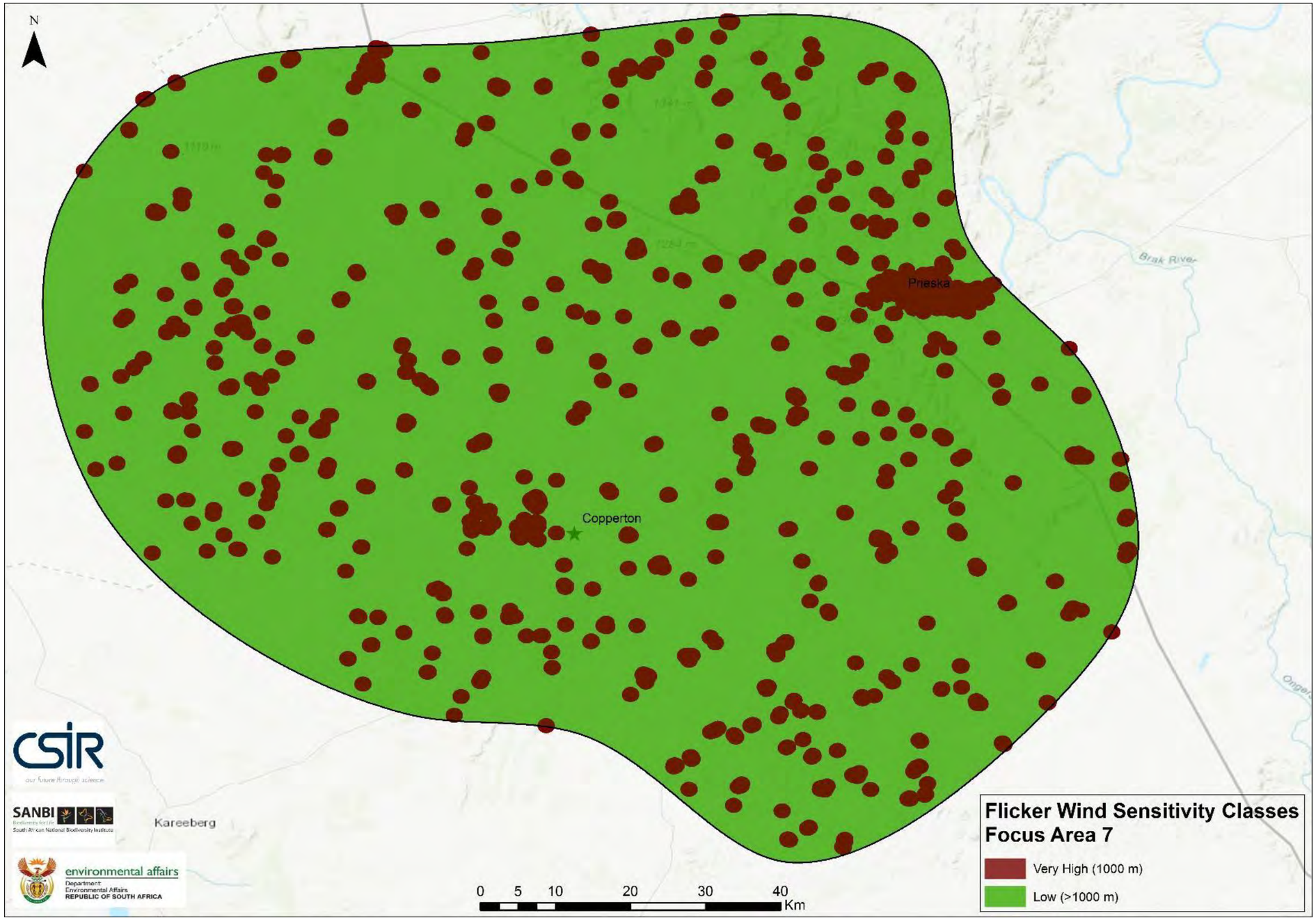

Figure 3: Flicker sensitivity for wind energy development in FA7

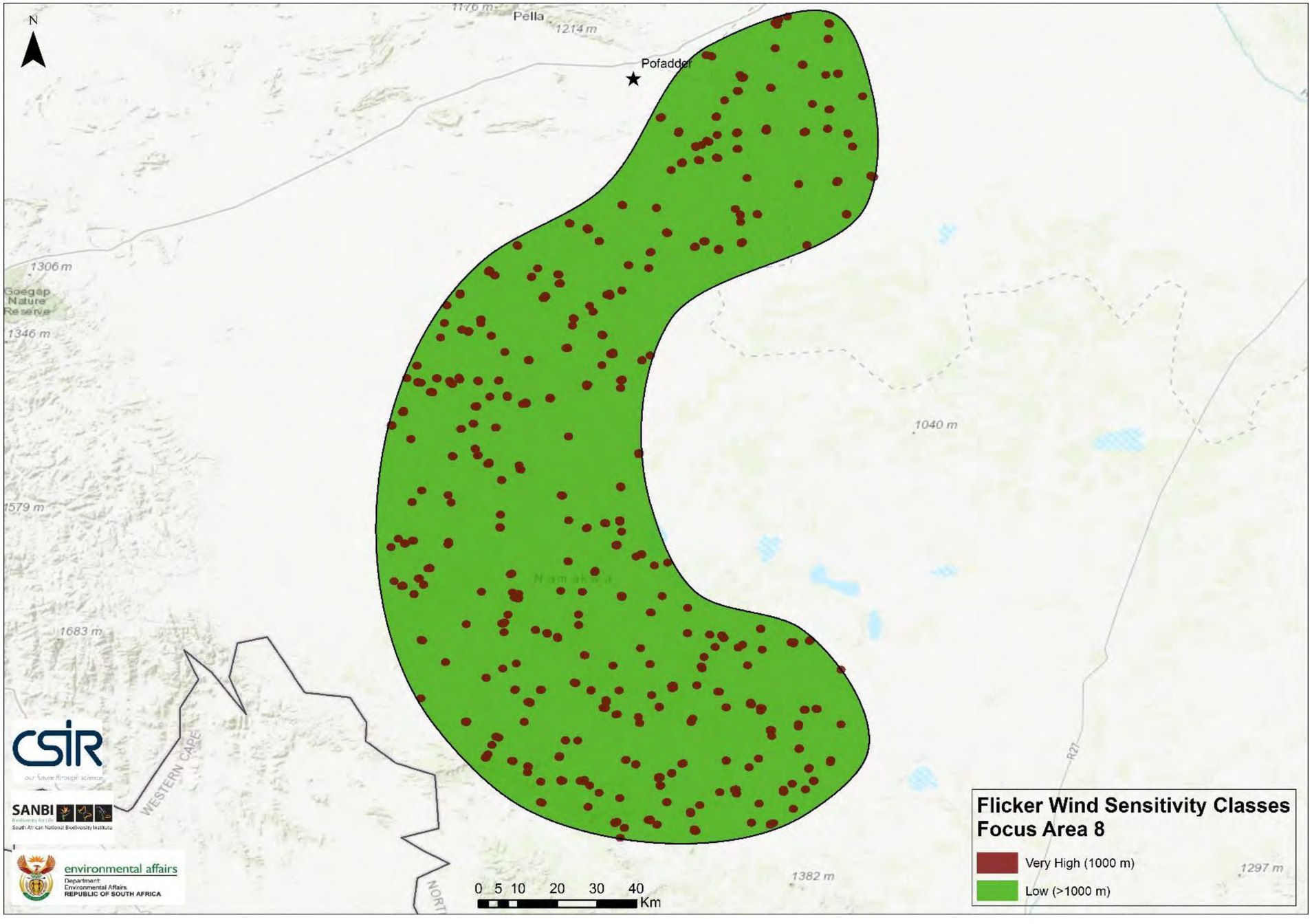

Figure 4: Flicker sensitivity for wind energy development in FA8

3.7.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts of Shadow Flicker by wind developments. Since solar PV does not result in any flicker impacts, such developments do not require any assessment or authorisation in this regard. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

SHADOW FLICKER
PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON SKA BY ONSHORE WIND AND SOLAR PV ENERGY GENERATION FACILITIES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts of Shadow Flicker for activities associated with the development of onshore wind energy generation facilities which require environmental authorisation. This applies within and outside of the Renewable Energy Development Zones (REDZs). Requirements for the assessment and reporting of impacts of Shadow Flicker are set out below, which shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

1. REQUIREMENTS FOR THE INITIAL SITE SENSITIVITY VERIFICATION

Requirements for the assessment and reporting of flicker impacts are set out in the Table 1 below and correlate with the sensitivity ratings contained in the national web based environmental screening tool. Prior to the assessment, the current use of the land and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.1 The Initial Site Sensitivity Verification must be undertaken by an environmental assessment practitioner or a specialist, with a specialist being defined in this Protocol as someone with relevant academic qualifications and with expertise in the domain of flicker assessments and management.

2.2 The Initial Site Sensitivity Verification must be undertaken through the use of:

(a) a desk top analysis, using satellite imagery and/or other available and relevant information; and

(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

2.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-

(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;

(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and

(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

2. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF SHADOW FLICKER IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING – Likelihood of a negative shadow flicker impact at the receptor (Note that the web based environmental screening tool generates two sensitivity results for wind energy facilities, i.e. either Very High Sensitivity or Low Sensitivity.)	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol for a site identified by the national web based environmental screening tool as being of "very high" sensitivity for shadow flicker must submit a **Shadow Flicker Assessment**. 1.2 Where the information gathered from the Initial Site Sensitivity Verification contemplated in section 2.1 of this Protocol or the specialist assessment differs from the designation of "very high" sensitivity from the national web based environmental screening tool and it is found to be of a "low" sensitivity a Shadow Flicker Assessment is not required. 1.3 Should 1.2 apply, a **Shadow Flicker Compliance Statement** is to be provided. An Environmental Assessment Practitioner or a specialist, must append to the **Shadow Flicker Compliance Statement** a motivation and evidence (e.g. photographs of no buildings near the proposed development footprint) of the different shadow flicker sensitivity. **2. The Shadow Flicker Assessment** 2.1 The assessment must be undertaken by a specialist on the site being submitted as the preferred development site. 2.2 The assessment must be undertaken based on a site inspection 2.3 A baseline description must be provided of the potential receptors. The receptors could include places of residence or tranquillity that have amenity value low activity levels. As a minimum, this description must include the following: a. The position of wind turbine generator units and operational times; b. Hub heights and rotor diameters; c. The position of the shadow receptor object and its orientation; d. The geographic position of the project with time zone and daylight savings time information, if applicable; and e. Information about the earth's orbit and rotation relative to the sun. 3 The findings of the **Shadow Flicker Assessment** must be written up in a **Report.** 3.1 This report must contain, as a minimum, the following information: 3.1.1 Details and relevant qualifications and experience of the specialist preparing the assessment including a curriculum vitae; 3.1.2 A signed statement of independence by the specialist; 3.1.3 The duration and date of the site inspection and the relevance of the season and weather conditions to the outcome of the assessment; 3.1.4 A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant, together with results of the noise assessment; 3.1.5 A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope; 3.1.6 Confirmation or not from the specialist that all reasonable measures have been considered in the micro-siting of the development to minimise disturbance of receptors;

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF SHADOW FLICKER IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3.1.7 Proposed developments anticipated to result in more than 20 hours of flicker duration per year on any permanent or temporarily inhabited residence will require mitigation. 3.1.8 A substantiated statement from the specialist on the acceptability of the development and a recommendation on the approval or not of the development; 3.1.9 Identification of any alternative development footprints within the preferred site and where any of these alternative development footprints are located in a "low" sensitivity as identified by the national web based environmental screening tool, and motivate as to why these potential development footprints were not considered appropriate; 3.1.10 Any conditions to which the statement is subjected; 3.1.11 Where identified, proposed impact management outcomes, mitigation measures for any monitoring requirements for inclusion in the EMPr; and 3.1.12 A description of the assumptions made and any uncertainties or gaps in knowledge or data. 4 The findings of the **Shadow Flicker Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified for inclusion in the EMPr. A signed copy of the full Shadow Flicker Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING - No significant noise impact expected at the receptor	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol proposed on a site identified by the national web based environmental screening tool as being of "low" sensitivity for Shadow Flicker must submit a **Shadow Flicker Compliance Statement**. 1.2 Where the information gathered from the Initial Site Sensitivity Verification contemplated in section 2.1 of this Protocol differs from that identified as having a "low" Shadow Flicker sensitivity by the national web based environmental screening tool and it is found to be of a "very high" sensitivity, then a Shadow Flicker Compliance Statement is not required. 1.3 Should paragraph 1.2 apply, a **Shadow Flicker Assessment** is to be undertaken and a report prepared in accordance with the requirements of a Noise Assessment. **2. Shadow Flicker Compliance Statement** 2.1 The **Shadow Flicker Compliance Statement** must be prepared by an Environmental Assessment Practitioner or a specialist, on the site being submitted as the preferred development site and the preferred development footprint and must indicate whether or not the proposed development will have an unacceptable negative impact on the receptors of the site or not. 2.2 Identify any alternative development footprints within the proposed development site which would be of "low" sensitivity as identified by the national web based environmental screening tool and motivate as to why these potential development footprints were not considered appropriate.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF SHADOW FLICKER IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3. The **Shadow Flicker Compliance Statement** must contain, as a minimum, the following information: 3.1 Details and relevant qualifications and expertise of the Environmental Assessment Practitioner or specialist preparing the statement including a curriculum vitae; 3.2 A signed statement of independence by the Environmental Assessment Practitioner or specialist; 3.3 A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the sensitivity map generated by the national web based environmental screening tool; 3.4 Confirmation from the Environmental Assessment Practitioner or specialist that all reasonable measures have been taken through micro-siting to minimize disturbance to receptors; 3.5 A substantiated statement from the Environmental Assessment Practitioner or specialist on the acceptability of the development and a recommendation on the approval or not of the development; 3.6 Any conditions to which the statement is subjected; 3.7 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and 3.8 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations. 4. A signed copy of the **Shadow Flicker Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

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

PART 3.8

HERITAGE

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

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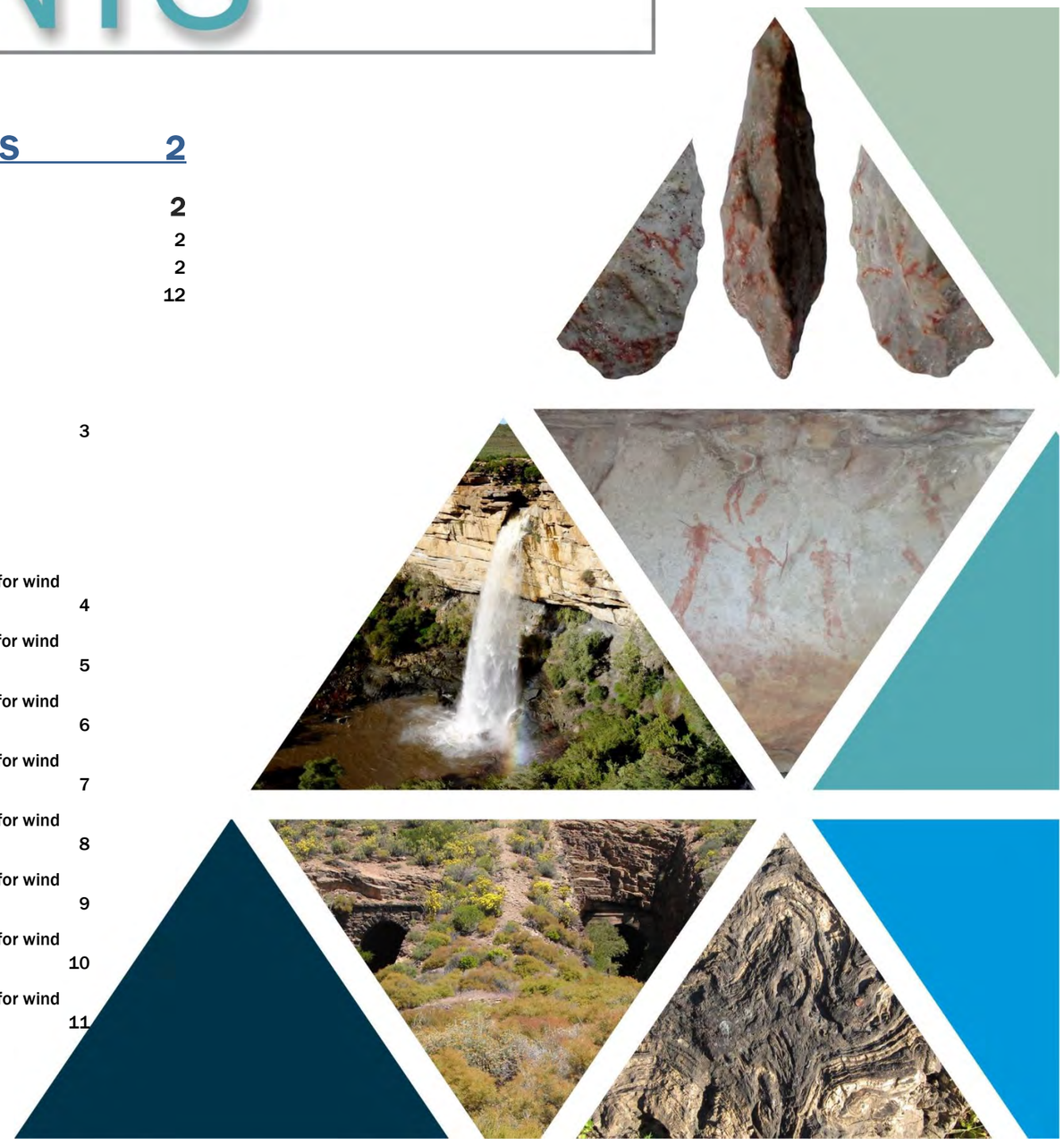


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.8 HERITAGE

South Africa has a long and complex pre-colonial human 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 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 following section is informed by the scoping level specialist heritage pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A3.

3.8.1 Renewable Energy and Heritage

Wind and solar photovoltaic (PV) developments have the potential to impact on heritage resources either through physical disturbance or by changing the wider landscape context. Impacts that may occur would be during the pre-construction, construction and operation 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. It is therefore important to ensure that wind and solar PV facilities are sited and constructed in a manner that minimises the impact on heritage resources, while the impacts on the wider landscape have been dealt with in the landscape section (Part 3: Section 12) of this report. The additional sensitivity mapping discussed in this section predominantly focuses on the potential physical impacts of wind and solar PV development on heritage resources.

[1] As described in NHRA Regulation 694 of 30 May 2003

3.8.2 Sensitivity Mapping

In terms of physical disturbance, this section investigates heritage resources in two categories namely: 1) palaeontology, and 2) archaeology and all other heritage resources. In addition to known fossil sites, the palaeontological component of the investigation is predominantly focused on inferring indicative palaeontological sensitivities based on where fossiliferous rock units are likely to occur according to geological maps. All archaeological and other heritage resources were identified from literature and existing heritage databases.

Heritage resources together constitute the National Estate, and each resource enjoys recognition and protection under the NHRA. 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 heritage;
c) historical settlements and townscapes;
d) landscapes and natural features of cultural significance;
e) geological sites of scientific or cultural importance [these are excluded from the present study as there is as yet no comprehensive national or provincial database of significant geological sites available];
f) archaeological and palaeontological sites;
g) 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
  vi. other human remains which are not covered in terms of the Human Tissue Act (No. 65 of 1983);
h) sites of significance relating to the history of slavery in South Africa;
i) movable objects [excluded from this study because by their nature they are not tied to any particular place on the landscape]

Utilising the National Heritage Grading System[1], areas around relevant heritage resources were assigned a sensitivity rating based on their significance (i.e. local, provincial and national), scale, rarity, current condition, and buffers were assigned based on input from SAHRA. Palaeontological resource sensitivity was largely inferred through the use of geological maps depicting formations likely to contain fossils (SAHRIS map used). Features taken into consideration to create the four-tier sensitivity map are:

- Palaeontological sites with buffers as indicated below; and
- SAHRIS palaeo-sensitvity map consisting of a range of six sensitivity levels and related recommendations.

The occurrence of Non-Palaeontological resources is much less predictable and cannot be determined through desktop assessment alone, unless the area has already undergone a detailed HIA in the lat five years. Features taken into consideration to create the four-tier sensitivity map are based on the heritage sites (excluding palaeontological sites) as provided by SAHRA (February 2019). Considering these criteria, palaeontological heritage resources were assigned sensitivity ratings for physical disturbance as described in Table 1.

Table 1: Spatial data used to identify archaeology and other heritage resources

Sensitivity Feature	Data Source and Date of Publications	Data Preparation and Processing	Sensitivity
World Heritage Sites and UNESCO Tentative sites	UNESCO website / SAHRA	Union between World Heritage Sites as part of SAHRA, 2018 layer and South African Protected Areas Database (SAPAD) - Q4, 2017 Buffer and core areas used as in data set	Very High – 5 km buffer
Grade I sites	Mapped Heritage Features, SAHRA, 2018	As extracted from the SAHRA, 2018 layer	Very High – 5 km buffer
Grade II sites	Mapped Heritage Features, SAHRA, 2018		Very High – 2 km buffer
Grade IIIa sites	Mapped Heritage Features, SAHRA, 2018		High – 150 m buffer
Grade IIIb sites	Mapped Heritage Features, SAHRA, 2018		High – 100 m buffer
Grade IIIc sites	Mapped Heritage Features, SAHRA, 2018		High – 50 m buffer
Ungraded sites	Mapped Heritage Features, SAHRA, 2018		Very High – 100m buffer
Battlefields (Grade IIIb)	Mapped Heritage Features, SAHRA, 2018		Very high – 5 km buffer
SAHRIS PalaeoSensitivity map - Formations of very high sensitivity (red)	SAHRIS PalaeoSensitivity Map	These features will be included in the sensitivity map as soon as it is made available to the SEA Project team. Currently only available online (SAHRIS website)	Very High
SAHRIS PalaeoSensitivity map - Formations of high sensitivity (orange/yellow)			High
SAHRIS PalaeoSensitivity map - Formations of moderate and unknown sensitivity (green/white)			Medium
SAHRIS PalaeoSensitivity map - Formations of low and insignificant sensitivity (blue)			Low
Palaeontological Substrate and Heritage Resources: High Sensitivity Areas: • ADELAIDE • ASBESTOS HILLS • BOEGOEBERG DAM • BOTHAVILLE • BRULSAND • CAMPBELL RAND • CLARENS • DRAKENSBERG • DWYKA • ECCA • KOEGAS • KUIBIS • MATSAP • MOLTENO • PRINCE ALBERT • RIETGAT • ELLIOT • ENON • GHAAP • SCHMIDTSDRIF • SCHWARZRAND • STALHOEK • SULTANAOORD • TARKASTAD • VRYBURG • WHITEHILL • WITTEBERG • KAMEELDOORNS	Geology – Known to potentially have Palaeontological resources from previous assessments Council for Geosciences, 2014	As extracted from geology layer	High
Palaeontological Substrate and Heritage Resources: Medium Sensitivity Areas: • ACHAB • ALLANRIDGE • BIDOUW • BREDASDORP • CERES • CONCORDIA GRANITE • DWYKA • FORT BROWN • GESELSKAPBANK • GLADKOP • GRAHAMSTOWN • HARTEBEEST PAN • GRANITE • KOOKFONTEIN • KORRIDOR • MESKLIP GNEISS • MODDERFONTEIN • GRANITE/GNEISS • NAAB • NABABEEP GNEISS • HOOGOOR • KALAHARI • KAMIESKROON GNEISS • KAROO DOLERITE • KHURISBERG • KONKYP GNEISS • NAKANAS • NARDOUW • NUWEFONTEIN • GRANITE • RIETBERG GRANITE • SKOORSTEENBERG • STINKFONTEIN • STYGER KRAAL • SYENITE • TABLE MOUNTAIN • TIERBERG • VOLKSRUST • WATERFORD	Geology – Known to potentially have Palaeontological resources from previous assessments Council for Geosciences, 2014	As extracted from geology layer	Medium

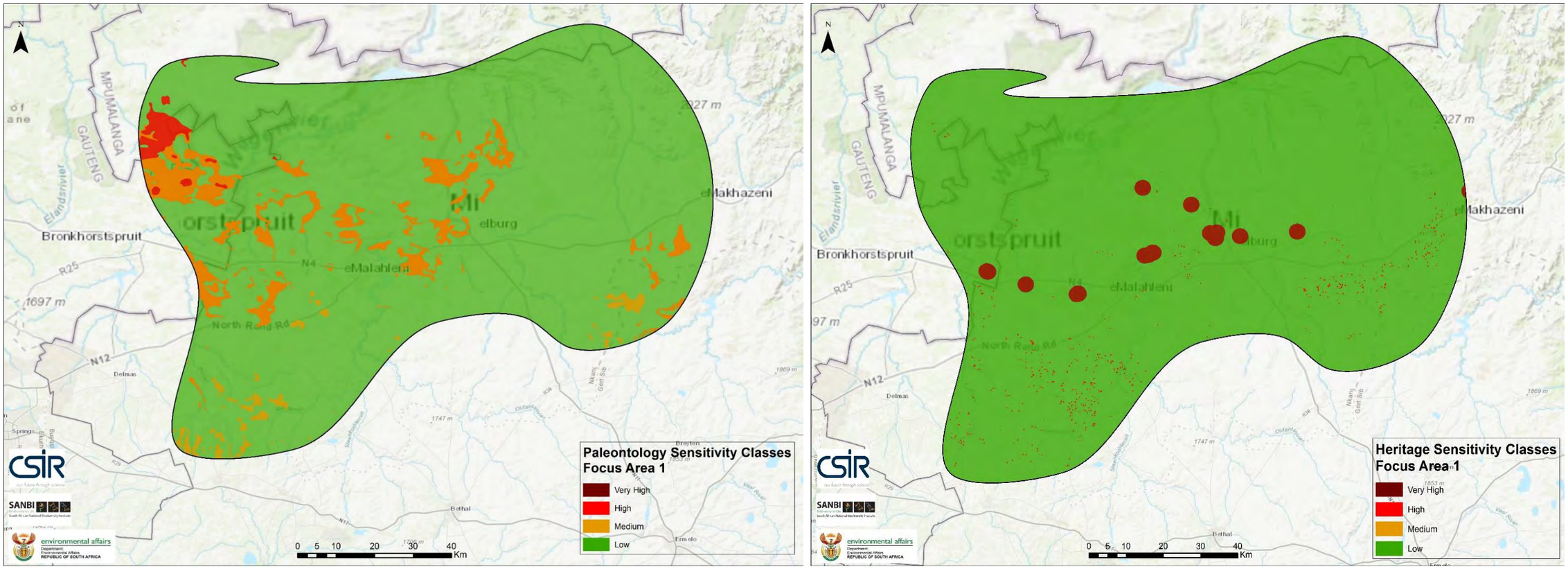


Figure 1: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA1

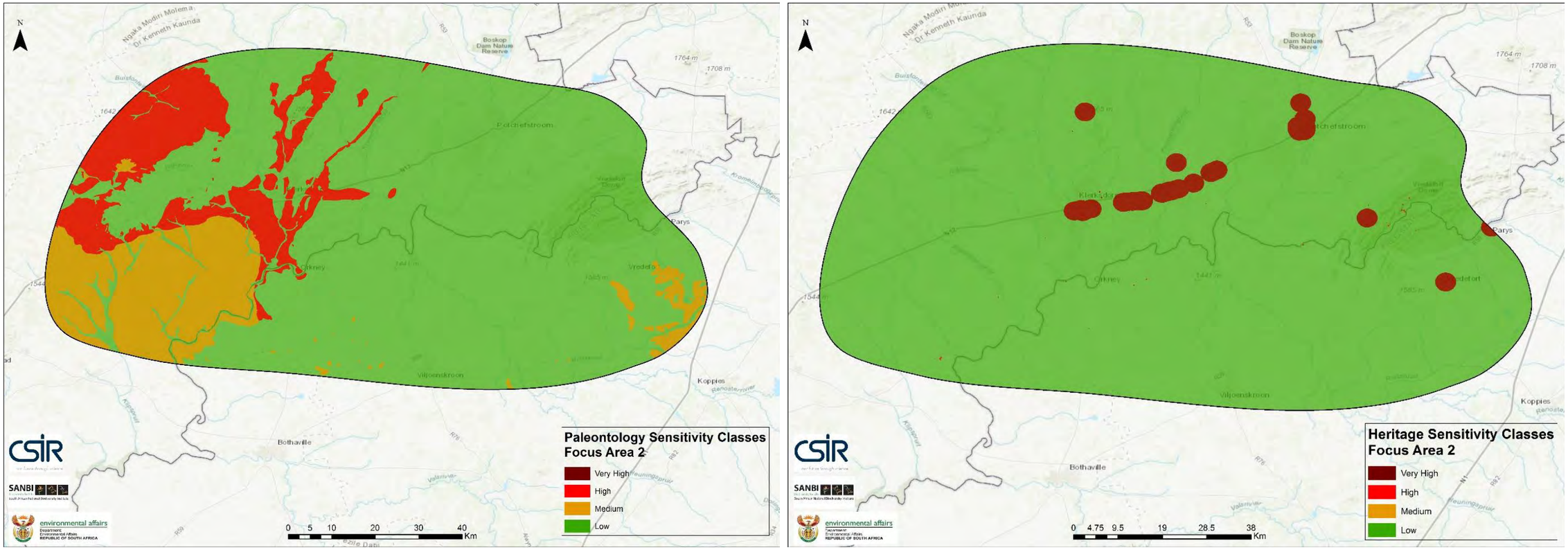


Figure 2: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA2

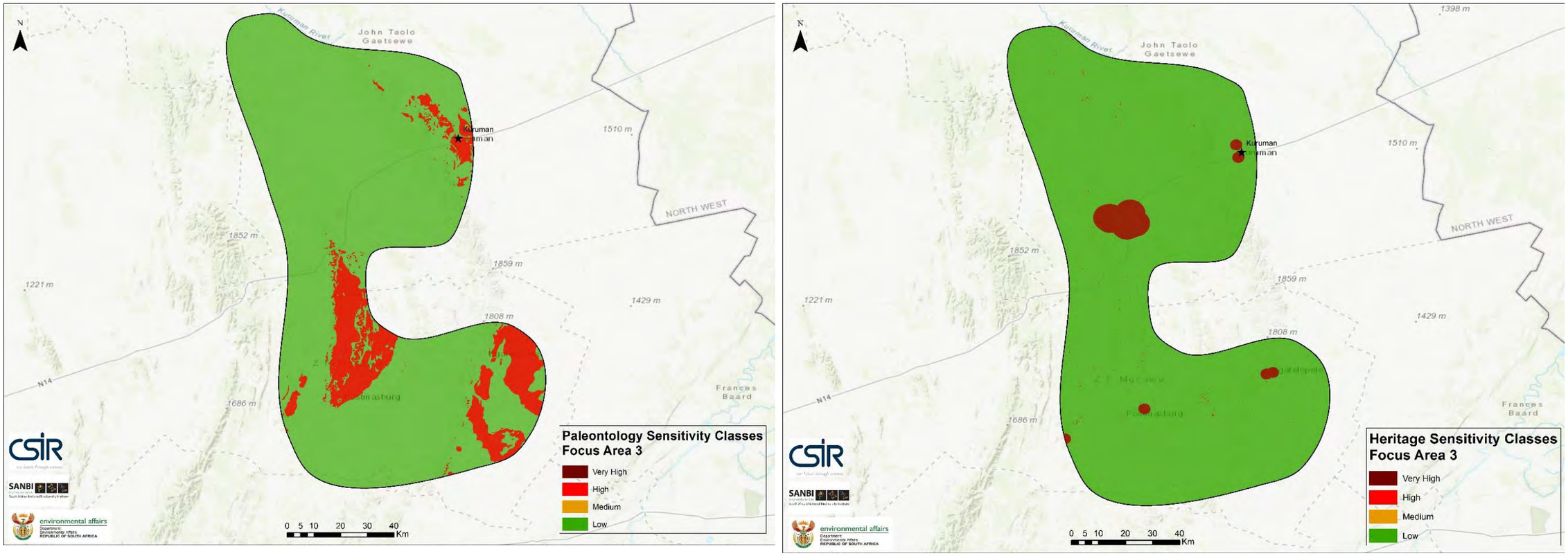


Figure 3: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA3

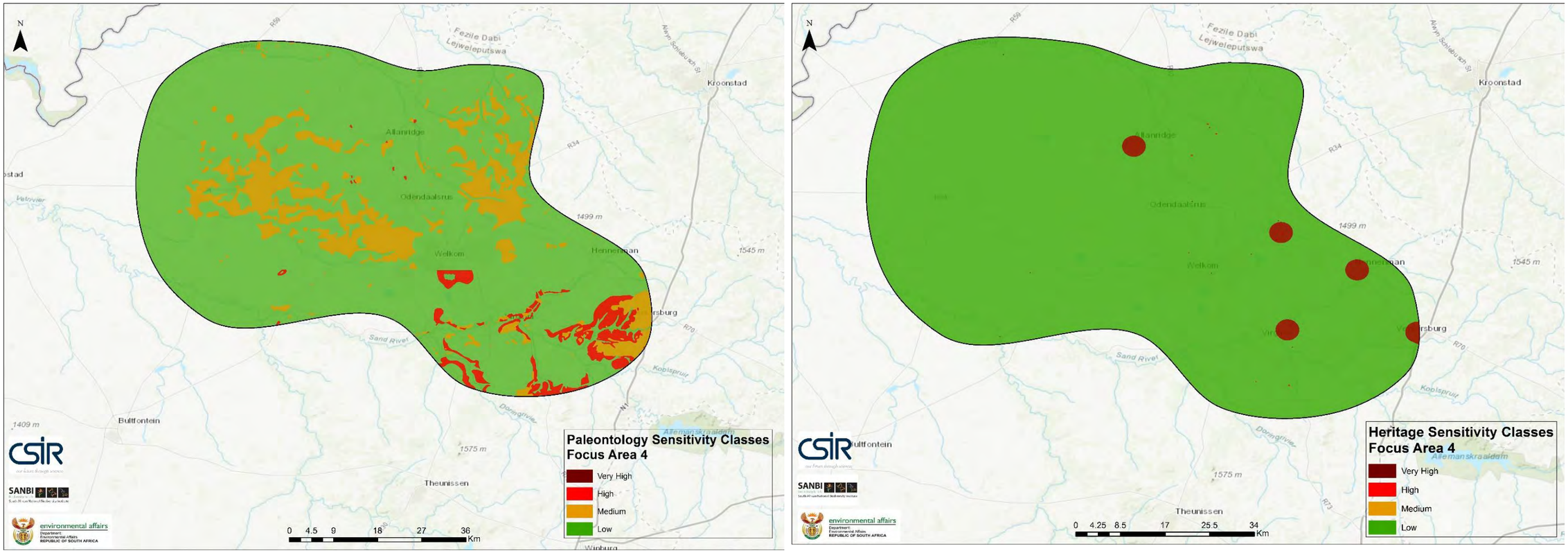


Figure 4: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA4

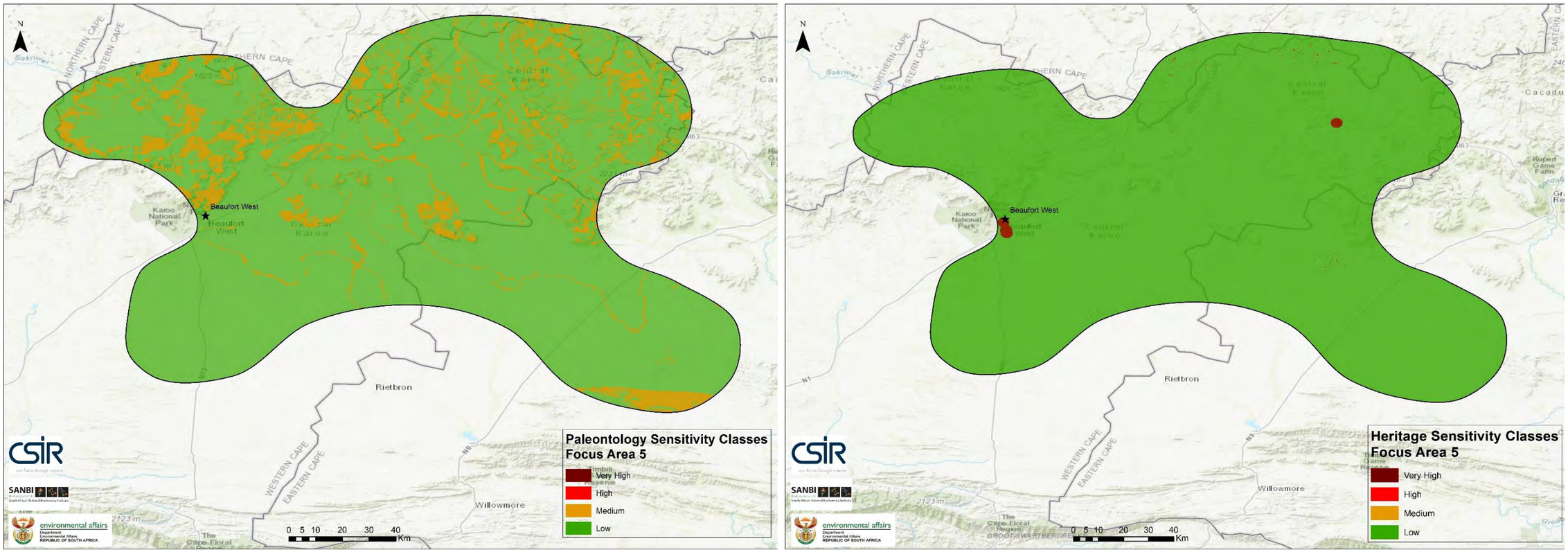


Figure 5: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA4

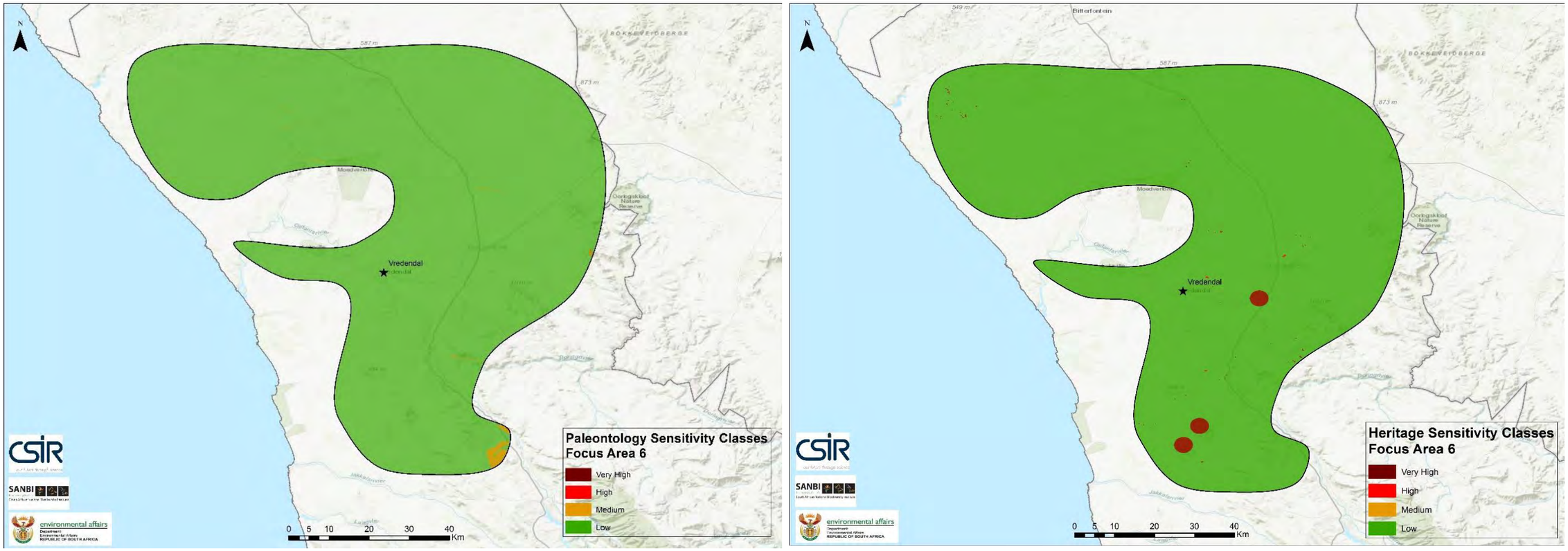


Figure 6: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA6

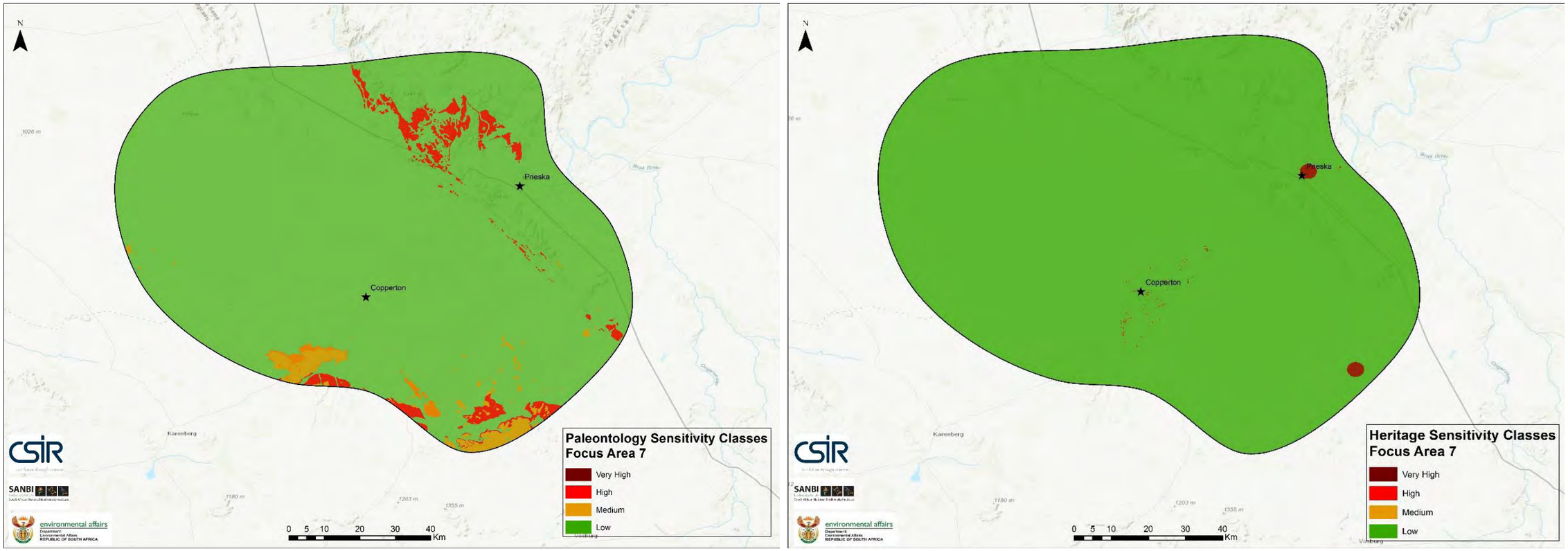


Figure 7: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA7

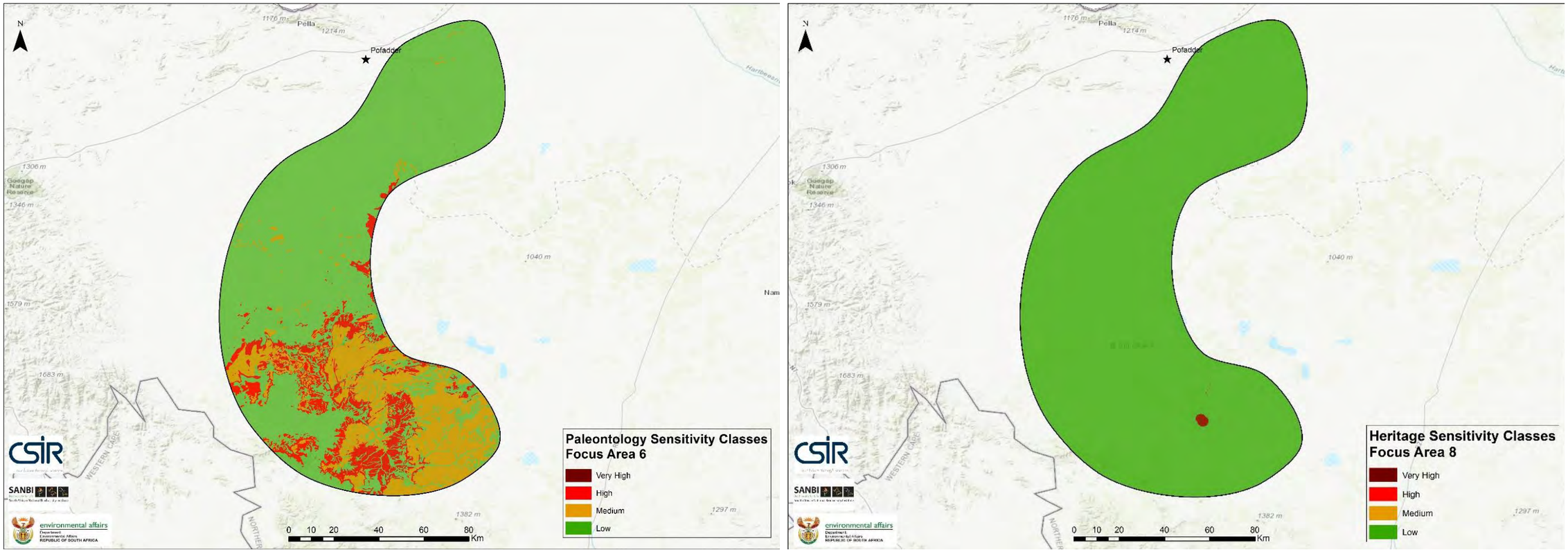


Figure 8: Heritage sensitivity map (right) derived from archaeology and other heritage and palaeontology sensitivities (left) for wind and solar PV development in FA8

3.8.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the sensitivity levels of heritage impacts by wind and solar PV developments. It must be noted that this protocol is still in development and will change based on inputs from heritage community and heritage authorities Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorisation (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones, and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool. Data for heritage sensitivities in the screening tool are two-tiered namely; 'very high' and 'low'. Very high sensitivity is defined as a combination of all heritage features (those represented as Very High and High in this SEA) and low is everything that does not contain a recorded heritage feature. The heritage protocol is currently under development and the protocol presented in this report is in draft format and is subject to change based on updates by the DEFF.

HERITAGE RESOURCES
7(A) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON HERITAGE (NON-PALAEONTOLOGICAL) RESOURCES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on heritage (non-palaeontological) resources for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web based environmental screening tool for heritage resources (non-paleontological) which is based on the data as provided by the South African Heritage Resources Agency (SAHRA)[2]. Table 1 below shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool. No damage, destruction or alteration may occur to heritage resources without a permit issued by a relevant heritage authority as required in terms of the National Heritage Resources Act (NHRA), No 25 of 1999.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS

Requirements for the assessment and reporting of impacts of development on heritage resources are set out in Table 1 below, and correlate to the sensitivity ratings contained in the national web based environmental screening tool. Prior to beginning the assessment, the current land use and the potential heritage sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.1 The Initial Site Sensitivity Verification must be undertaken by an environmental assessment practitioneror a heritage specialist if in a very high sensitivity area and the feature is graded, and in low sensitivity areas. For Protected maritime and underwater cultural heritage, the EAP must contact the competent authorities.

2.2 The Initial Site Sensitivity Verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery and/or other available and relevant information;
(b) correspondance with the South African Heritage Resources Agency and, where relevant, the Provincial Heritage Resources Authority and/or the Local Authority[3]; and
(c) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and/or heritage status quo versus the heritage sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, cultural heritage, etc.

2.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(a) Identify resources and field rating to confirm whether a HIA is required. Grading confirmed by heritage authorities
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different heritge sensitivity;
(c) includes all correspondance with the relevant authorities[4]; and
(d) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.
(e) Create a SAHRIS case (https://sahris.sahra.org.za/) and upload the Background Information Document or a Project announcement letter, and a location map (kml format).

3. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON HERITAGE (ARCHAEOLOGICAL, MARITIME AND UNDERWATER CULTURAL AND BUILT ENVIRONMENT) RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION

VERY HIGH SENSITIVITY RATING – For all non-palaeontological heritage resources, including: • Archaeological resources, • Protected maritime and underwater cultural heritage, and, • Built environment.	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified as being of "very high sensitivity" for heritage resources (including archaeology, maritime and built environment) on the national web based environmental screening tool must undertake a **Heritage Impact Assessment** (HIA) in compliance with section 38(3) of the NHRA. 1.1.1 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol differs from the designation of "very high" heritage resources sensitivity from the national web based environmental screening tool, and it is found to be of a "low" sensitivity, a heritage impact assessment may not required. 1.1.2 Should paragraph 1.1.1 apply, a **Heritage Compliance Statement** is to be provided. A heritage specialist must append to the **Heritage Compliance Statement** a motivation and evidence (e.g. photographs) of the changed heritage resources sensitivity to motivate that a HIA is not required. **2 The Heritage Impact Assessment** 2.1 A HIA can include, but is not limited to, the following separate heritage component studies: an Archaeological Impact Assessment, a Palaeontological Impact Assessment[5], a Maritime and Underwater Cultural Heritage Impact Assessment and a Built Environment Impact Assessment. 2.2 These assessments must be undertaken by a heritage specialist, within the preferred development site and on the preferred development footprint. 2.3 The SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports and SAHRA 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports in terms of section 38 of the NHRA (No.

[2] xxxx.
[3] In the Western Cape, a Notice of Intent to Develop (NID) needs to be submitted to the provincial heritage resources authority.
[4] Including the NID for development in the Western Cape.
[5] For the Palaeontological Impact Assessment, refer to Seciton 7(B) - Protocol for the assessment and reporting of impacts on palaeontological resources

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON HERITAGE (ARCHAEOLOGICAL, MARITIME AND UNDERWATER CULTURAL AND BUILT ENVIRONMENT) RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
	25 of 1999)[6] stipulate the process to be followed during the assessment of Heritage Impacts within a proposed development. 3 The findings of the **Heritage Impact Assessment** (i.e. separate heritage component studies) must be written up in a single Heritage Impact Assessment Report. The SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports and SAHRA 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports) stipulate the information required by SAHRA to be included in the HIA report. This report must contain as a minimum the following information: 3.1 Contact details and curriculum vitae of the heritage specialist including qualifications and expertise; 3.2 A signed statement of independence by the specialist; 3.3 A project description and legislative framework; 3.4 The methodology used to undertake the impact assessment and site inspection, including equipment used, where relevant; 3.5 A description of the assumptions made, limitations and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; 3.6 Description of the socio-economic and the physical environment; 3.7 Literature/background on the region, including a description of all identified resources within a 500m radius of the proposed development boundaries (including a map and significance); 3.8 Results of the heritage field survey and assigned significance field rating including a map of identified sites and site boundaries (if applicable) in relation to the proposed development footprint; 3.9 Results of the heritage-specific consultation and impact assessment; 3.10 Additional heritage impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts; 3.11 Areas not suitable for development, to be avoided during construction and operation (where relevant); 3.12 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr; and 3.13 A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected. 4 The findings of the **Heritage Impact Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING – For heritage (archaeology, martime and built environment) resources features Low sensitivity represents areas where heritage resources have not been identified or areas not likely to	**1 General Information** 1.1 An applicant, intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "low sensitivity" for heritage resources on the national web based environmental screening tool must submit an **Heritage (archaeology, marine and built environment) Resources Compliance Statement** to the competent authority, unless the information gathered from the Initial Site Sensitivity Verification differs from that identified

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON HERITAGE (ARCHAEOLOGICAL, MARITIME AND UNDERWATER CULTURAL AND BUILT ENVIRONMENT) RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
be sensitive to development in terms of heritage resources because previous assessment has revealed the area to contain no resources or resources of low significance • Archaeological resources, which includes all heritage resources that are over 100 years old in age and stuctures not in use as set out in Section 9 of the NHRA, • Protected maritime and underwater cultural heritage, and, • Built environment, which includes built structures, townscapes, cities and cultural landscapes older than 60 years as well as Graded resources (I, II and III) .	as having a "low" heritage resources sensitivity by the national web based environmental screening tool and it is found to be of a "very high" sensitivity. 1.2 Should paragraph 1.1 apply, an **Heritage Impact Assessment** is to be undertaken and a report prepared in accordance with the requirements of an Heritage Impact Assessment. **2 Heritage (archaeology, maritime and built environment) Resources Compliance Statement** 2.1 The Heritage Resources Compliance Statement, must be prepared by a suitably qualified specialist in the field of Heritage resources (Archaeology, marine and built environment) and must verify: 2.1.1 That the site is of "low" sensitivity for non-paleontological heritage resources; and 2.1.2 Whether or not the proposed development will have an impact on the heritage (non-palaeontological) features. 3 The **Heritage (non-palaeontological) Resources Compliance Statement**, must contain, as a minimum, the following information: 3.1 Contact details and curriculum vitae of the EAP or specialist including and expertise; 3.2 A signed statement of independence by the EAP or specialist; 3.3 Baseline profile description of heritage resources in the study area, including the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; 3.4 Methodology used to verify the sensitivities of the heritage (archaeology, marine and built environment) resources features on the national web based environmental screening tool; 3.5 Methodology used to undertake the Initial Site Sensitivity Verification and preparation of the Compliance Statement, including equipment and modelling used, where relevant; 3.6 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; 3.7 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; and 3.8 Any conditions to which the statement is subjected. 4 A **signed copy of the full Heritage Resources Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

7(B) - PROTOCOL FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on palaeontological resources for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web based environmental screening tool for paleontological resources which is based on the SAHRIS palaeontological sensitivity map[7]. Table 1 below shows how these requirements correlate with the sensitivity ratings as contained in the national web based

[7] https://sahris.sahra.org.za/map/palaeo

environmental screening tool. Palaeontological heritage resources indicated in grey on the SAHRIS palaeontological sensitivity do not require any assessment or further action. No damage, destruction or alteration may occur to heritage resources without a permit issued by a relevant heritage authority as required in terms of the National Heritage Resources Act (NHRA), No 25 of 1999.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS

Requirements for the assessment and reporting of impacts of development on heritage resources are set out in Table 1 below, and correlate to the sensitivity ratings contained in the national web based environmental screening tool. Prior to beginning the assessment, the current land use and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.4 The Initial Site Sensitivity Verification must be undertaken by a heritage specialist, with a heritage specialist being defined in this Protocol as someone with relevant academic qualifications and with expertise in the domain of palaeontological heritage assessments covered in this Protocol.

2.5 The Initial Site Sensitivity Verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery and/or other available and relevant information;
(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and/or environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, etc.; and
(c) correspondence with the South African Heritage Resources Agency via SAHRIS and, where relevant, the Provincial Heritage Resources Authority and/or the Local Authority. Where required, submit a Notice of Intent to Develop[8] (NID) to the relevant Provincial Authorities.

2.6 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(f) confirms or disputes the environmental sensitivity as identified by the national web based environmental screening tool;
(g) contains a motivation and evidence (e.g. photographs, geological map) of either the verified or different environmental sensitivity;
(h) includes all correspondance with the relevant authorities; and
(i) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

3. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING –	

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION

For palaeontological heritage resources indicated in red on the SAHRIS palaeontological sensitivity map	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified as being of "very high sensitivity" for palaeontological heritage resources on the national web based environmental screening tool must undertake a **Phase 1 Palaeontological Impact Assessment (PIA)** in compliance with section 38(3) of the NHRA. 1.1.1 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol differs from the designation of "very high" palaeontological resources sensitivity from the national web based environmental screening tool, and it is found to be of a "low" sensitivity, a palaeontological impact assessment may not be required depending on the response by the heritage authority. 1.1.2 Should paragraph 1.1.1 apply, a **Palaeontological Compliance Statement** is to be provided. A suitably qualified specialist, must append to the **Palaeontological Compliance Statement** a motivation and evidence (e.g. photographs, geological map) of the changed heritage resources sensitivity. **2 The Phase 1 Palaeontological Impact Assessment** 2.1 Create a SAHRIS case (https://sahris.sahra.org.za/) and, upload the Background Information Document or a Project announcement letter, and a location map (.kml format). 2.2 This assessment must be undertaken by a suitably qualified palaeontologist, within the preferred development site and on the preferred development footprint. 2.3 A Phase 1 PIA involves a background study and a field survey of the proposed development area. 2.4 The Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports in terms of section 38 of the NHRA (No. 25 of 1999)[9] stipulate the process to be followed during the assessment of Palaeontological Impacts within a proposed development. 3 The findings of the **Phase 1 Palaeontological Impact Assessment** must be written up according to the Minimum Standards : Palaeontological Component of Heritage Impact Assessment Reports developed by SAHRA. This report must contain as a minimum the following information: 3.1 Contact details and curriculum vitae of the specialist including field of expertise and their curriculum vitae; 3.2 A signed statement of independence by the specialist; 3.3 A project description and legislative framework; 3.4 Description of the affected environment and the geological setting including geological map; 3.5 Background to the palaeontology of the area; 3.6 The methodology used to undertake the impact assessment and field survey, including equipment used, where relevant; 3.7 A description of the assumptions made, limitations and any uncertainties or gaps in knowledge or data; 3.8 Results of the field survey (significance fossil occurrences) and assigned significance field rating; 3.9 Areas not suitable for development, to be avoided during construction and operation (where relevant); 3.10 Results of the impact assessment accompanied by a statement of significance in terms of heritage value; 3.11 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;

[8] This is required by the Western Cape Heritage Resources, the provincial heritage resources authority.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
	3.12 A protocol for palaeontological finds[10] uncovered during site preparation and construction; and 3.13 A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected (e.g. recommendations for a Phase 2 Palaeontological Mitigation Report or Phase 3 Palaeontological Site Conservation and Management Plan, if applicable). 4 The findings of the **Phase 1 Palaeontological Impact Assessment** must be incorporated into a single Heritage Impact Assessment Report, comprising all separate heritage component studies (including, but not limited to, an Archaeological Impact Assessment, a Palaeontological Impact Assessment, a Maritime Heritage Impact Assessment and a Built Environment Impact Assessment). 5 The full **Heritage Impact Assessment** must be incorporated in the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
HIGH SENSITIVITY RATING – For palaeontological heritage resources indicated in orange and yellow on the SAHRIS palaeontological sensitivity map	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified as being of "high sensitivity" for palaeontological heritage resources on the national web based environmental screening tool must undertake a **Desktop Palaeontological Impact Assessment** to investigate the potential presence of these resources and, where applicable, the potential impact to such resources in the context of the proposed development. 1.1.1 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol differs from the designation of "high or medium" palaeontological resources sensitivity from the national web based environmental screening tool, and it is found to be of a "low" or "very high" sensitivity, a palaeontological desktop study may not be required depending on the response by the heritage authority. 1.1.2 Should paragraph 1.1.1 apply and the sensitivity of the preferred development footprint was found to be "very high", a Phase **1 Palaeontological Impact Assessment** must be undertaken in accordance with the "Very high" sensitivity class requirements. 1.1.3 Should paragraph 1.1.1 apply and the sensitivity of the preferred development footprint was found to be "low", a Palaeontological **Compliance Statement** may be provided. A suitably qualified specialist, as appropriate, must append to the **Palaeontological Compliance Statement** a motivation and evidence (e.g. photographs, geological map) of the changed heritage resources sensitivity. **2 The Desktop Palaeontological Impact Assessment** 2.1 Create a SAHRIS case (https://sahris.sahra.org.za/) and, upload the Background Information Document or a Project announcement letter, and a location map (kml format). 2.2 This assessment must be undertaken by a suitably qualified palaeontologist, within the preferred development site and on the preferred development footprint.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
	2.3 The Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports in terms of section 38 of the NHRA (No. 25 of 1999)[11] stipulate the process to be followed during the assessment of Palaeontological Impacts within a proposed development. 2.4 The desktop Palaeontological Impact Assessment will conclude whether further field investigation is necessary or not. Should it be required, the field survey will form part of a Phase 1 PIA. The **Phase 1 Palaeontological Impact Assessment** must be undertaken in accordance with the "Very high" sensitivity class requirements. 3 The findings of the **Desktop Palaeontological Impact Assessment** must be written up according to the Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports developed by SAHRA. This report must contain <u>as a minimum</u> the following information: 3.1 Contact details and curriculum vitae of the specialist including field of expertise and their curriculum vitae; 3.2 A signed statement of independence by the specialist; 3.3 A project description and legislative framework; 3.4 Description of the affected environment and the geological setting including geological map; 3.5 Background to the palaeontology of the area; 3.6 Summary of palaeontological records/findings and potential impacts; 3.7 Impact management actions proposed by the specialist for inclusion in the EMPr; 3.8 A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected and 3.9 Recommendations. 4 The findings of the **Desktop Palaeontological Impact Assessment** must be incorporated into a single Heritage Impact Assessment Report, comprising all separate heritage component studies (including, but not limited to an Archaeological Impact Assessment, a Palaeontological Impact Assessment, a Maritime Heritage Impact Assessment and a Built Environment Impact Assessment). 5 The full **Heritage Impact Assessment** must be incorporated in the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
MEDIUM SENSITIVITY RATING – For palaeontological heritage resources indicated in green and white on the SAHRIS palaeontological sensitivity map	**1 General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol on a site identified as being of "medium sensitivity" for palaeontological heritage resources on the national web based environmental screening tool must undertake a **Desktop Palaeontological Impact Assessment** to investigate the potential presence of these resources and, where applicable, the potential impact to such resources in the context of the proposed development. 1.1.1 However, where the information gathered from the Initial Site Sensitivity Verification identified in section 2.1 of this Protocol differs from the designation of "high or medium" palaeontological resources sensitivity from the national web based environmental screening tool, and it is found to be of a "low" or "very high" sensitivity, a palaeontological desktop study is not required.

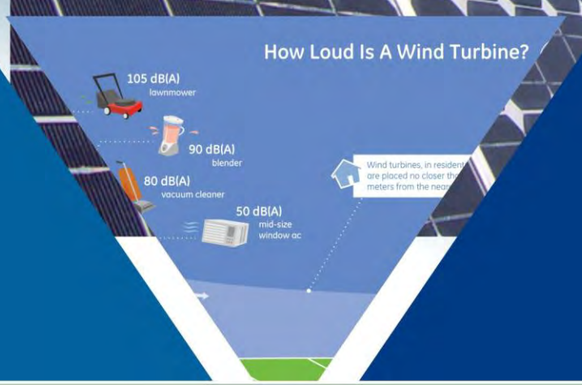
[10] Note that some Provincial authorities, such as Heritage Western Cape, have developed a generic *Chance finds* procedure to be followed.

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON PALAEONTOLOGICAL RESOURCES FOR ACTIVITIES REQUIRING ENVIRONMENTAL AUTHORISATION	
	1.1.2 Should paragraph 1.1.1 apply and the sensitivity of the preferred development footprint was found to be "very high", a Phase **1 Palaeontological Impact Assessment** must be undertaken in accordance with the "Very high" sensitivity class requirements. 1.1.3 Should paragraph 1.1.1 apply and the sensitivity of the preferred development footprint was found to be "low", a Palaeontological **Compliance Statement** is to be provided. A suitably qualified and specialist, as appropriate, must append to the **Palaeontological Compliance Statement** a motivation and evidence (e.g. photographs) of the changed heritage resources sensitivity. **2 The Desktop Palaeontological Impact Assessment** 2.1 Create a SAHRIS case (https://sahris.sahra.org.za/) and, upload the Background Information Document or a Project announcement letter, and a location map (.kml format). 2.2 This assessment must be undertaken by a suitably qualified palaeontologist, within the preferred development site and on the preferred development footprint. 2.3 The Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports in terms of section 38 of the NHRA (No. 25 of 1999)[12] stipulate the process to be followed during the assessment of Palaeontological Impacts within a proposed development. 3 The findings of the **Desktop Palaeontological Impact Assessment** must be written up according to the Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports developed by SAHRA. This report must contain <u>as a minimum</u> the following information: 3.1 Contact details and curriculum vitae of the specialist including field of expertise and their curriculum vitae; 3.2 A signed statement of independence by the specialist; 3.3 A project description and legislative framework; 3.4 Description of the affected environment and the geological setting; 3.5 Background to the palaeontology of the area; and 3.6 Summary of palaeontological records/findings and potential impacts; and 3.7 Recommendations. 4 The findings of the **Desktop Palaeontological Impact Assessment** must be incorporated into a single Heritage Impact Assessment Report, comprising all separate heritage component studies (including, but not limited to an Archaeological Impact Assessment, a Palaeontological Impact Assessment, a Maritime Heritage Impact Assessment and a Built Environment Impact Assessment). 5 The full **Heritage Impact Assessment** must be incorporated in the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING – For palaeontological heritage resources indicated in blue on the SAHRIS palaeontological sensitivity map.	**1 General Information** 1.1 An applicant, intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "low sensitivity" for paleontological heritage resources on the national web based environmental screening tool must submit a **Paleontological Resources Compliance Statement** (**Letter of Recommendation for Exemption of Palaeontological Studies**) to the competent authority, unless the information gathered from the Initial Site Sensitivity Verification differs from that identified as having a "low" heritage resources sensitivity by the national web based environmental screening tool and it is found to be of a different sensitivity. 1.2 Should paragraph 1.1 apply, a **Palaeontological Impact Assessment** or a **Desktop Palaeontological Impact Assessment** is to be undertaken, based on the identified sensitivity of the proposed development area and a report prepared in accordance with the requirements of such report. **2 Paleontological Resources Compliance Statement** 2.1 The Paleontological Resources Compliance Statement, must be prepared by a suitably qualified specialist in the field of Palaeontology and must verify: 2.1.1 That the site is of "low" sensitivity for Paleontological heritage resources; and 2.1.2 Whether or not the proposed development will have an impact on the palaeontological features. 3 The **Paleontological Resources Compliance Statement**, must contain, as a minimum, the following information: 3.1 Contact details and curriculum vitae of the specialist including field of expertise; 3.2 A signed statement of independence by the specialist; 3.3 Baseline profile description of heritage resources in the study area, including the duration and date of the site investigation; 3.4 Methodology used to verify the sensitivities of the paleontological resources features on the national web based environmental screening tool; 3.5 Methodology used to undertake the Initial Site Sensitivity Verification and preparation of the Compliance Statement, including equipment and modelling used, where relevant; 3.6 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr (i.e. Fossil Finds Procedure); 3.7 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; and 3.8 Any conditions to which the statement is subjected. 4 A **signed copy of the full Paleontological Resources Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report

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

PART 3.9

NOISE



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Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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TABLES

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.9 NOISE

3.9.1 Renewable Energy and Noise Emissions

Noise from the operation of wind turbines can be divided into two categories, namely (1) aerodynamic noise, and (2) mechanical noise.

Aerodynamic noise is generated by the flow of air around the rotor blades. This type of noise increases with blade tip speed or tip speed rotation and is broadband in nature. It is typically also the largest source of wind turbine noise. During turbulent wind conditions, blades may emit low-frequency noise as they are buffeted by changing winds.

Mechanical noise is generated from the mechanical components of wind turbines. Main mechanical noise sources include the gearbox, generator, yaw drives, cooling fans, and auxiliary equipment such as hydraulics. Noise emitted by these components tends to be discrete frequency noise. Mechanically generated noise can also be transmitted, amplified and radiated by the hum, rotor and tower[1].

Figure 1 illustrates the decrease in noise generated by a wind turbine and audible to the human ear in relation to distance from the wind turbine. While this illustration presents general noise levels, the values will vary depending on the characteristics of the turbine, wind speed and the environment in which the sound is heard. This chapter focuses on impact of wind turbine noise on anthropogenic sources i.e. human receptors.

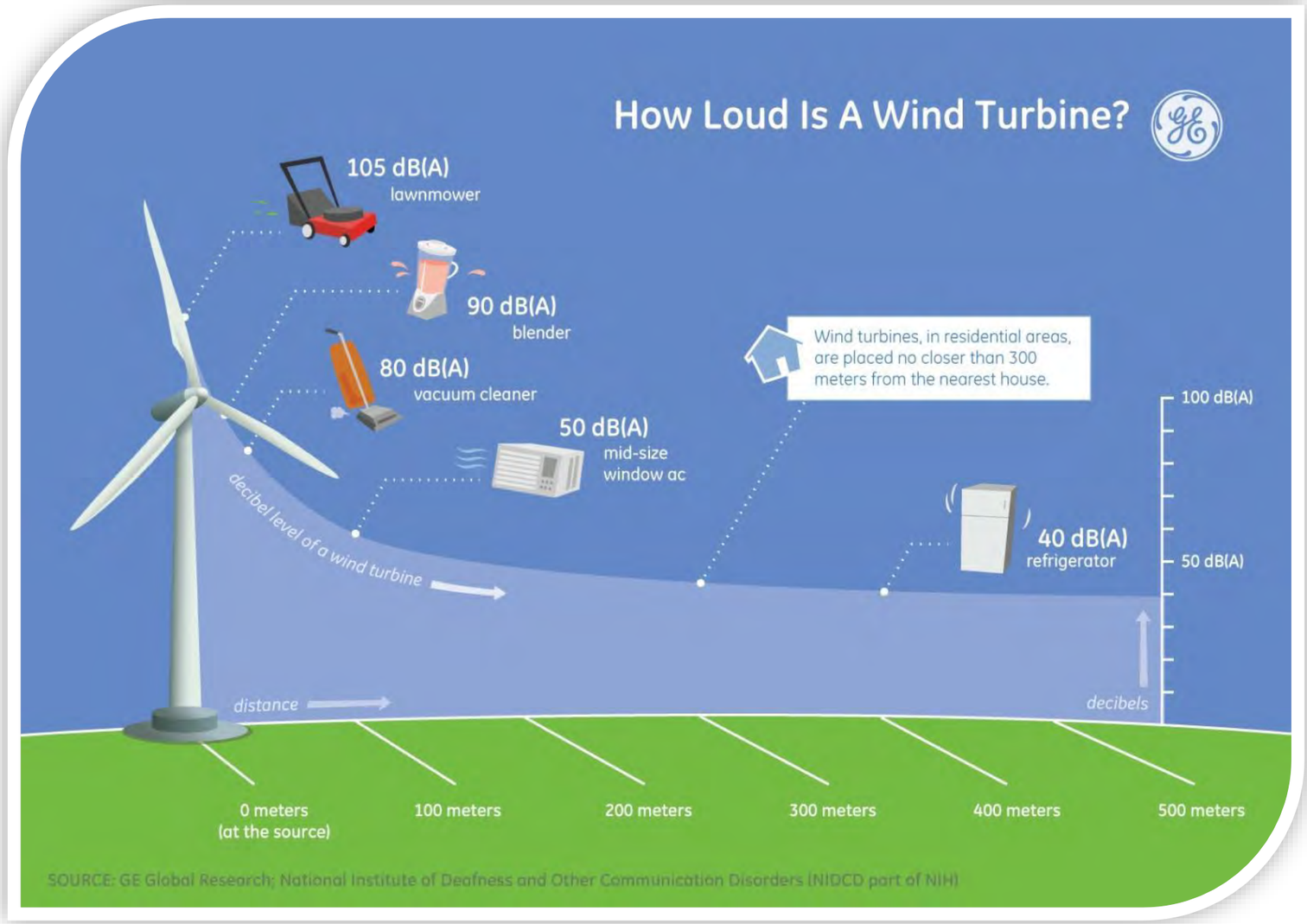


Figure 1: Decrease in audible noise generated from wind turbine with increasing distance from turbine.

Source: GE Global Research; National Institute of Deafness and Other Communication Disorders (NIDCD part of NIH)

[1] Manwell, J. F., McGowan, J. G., & Rogers, A. L. (2009). Wind Energy Explined | Theory, Design and Application (2nd ed.). Chichester: John Wiley & Sons Ltd.

3.9.2 Sensitivity Mapping

Table 1 presents the maximum noise levels for residential and non-residential areas as prescribed by the South African National Standards (SANS) 10103:2008 - *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. Most wind farm applications target rural residential areas where the ambient outdoor noise should not exceed 35 A-weighted decibels (dB(A)) at night and 45 dB(A) during the day, and industrial non-residential areas where the ambient noise should not exceed 60 dB(A) at night and 70 dB(A) during the day.

Table 1: Typical rating levels for noise in various types of districts.

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dBA)			Indoors, with open windows (dBA)		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Residential						
Rural Districts	**45**	**45**	**35**	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Non-Residential						
Urban districts with one or more of the following: Workshops, business premises. or main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	**70**	**70**	**60**	60	60	50

Source: Adapted from SANS 10103, The measurement and rating of environmental noise with respect to annoyance and to speech communication.

As stipulated in SANS 10328, the impact of noise generated by a wind farm on local receptors is assessed by determining whether the ambient noise level at a specific time (day time or night time) will exceed the typical rating levels of noise presented in Table 1. If the ambient noise level is expected to exceed the typical level at the receptor's location, it can be assumed that there will be an impact on that receptor. The intensity of a noise impact on a receptor is defined in SANS 10103 as per Table 2. Based on these impact ratings, and the expected noise levels illustrated in Figure 1, sensitivity buffers have been determined for implementation in the Renewable Energy Development Zones (REDZs) once adopted (see Table 3). Sensitivity maps were generated by applying these buffers to every roof (derived from the 2013 SPOT Building Count dataset) in each Focus Area (FA) (see Figure 2 to Figure 5).

Table 2: Impact ratings for various increases in ambient noise levels.

Impact rating	Increase in ambient noise levels
None	Predicted noise does not exceed the typical rating level of noise
Low	Predicted noise exceeds the typical rating level of noise by 0 to 5 dBA
Medium	Predicted noise exceeds the typical rating level of noise by 5 to 10 dBA
High	Predicted noise exceeds the typical rating level of noise by more than 10 dBA

Source: Adapted from SANS 10103, The measurement and rating of environmental noise with respect to annoyance and to speech communication.

Table 3: Noise sensitivity criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application for Wind
Potential temporarily or permanently inhabited residence	2013 SPOT Building Count	- **Very High Sensitivity** within 1 000 m of temporarily or permanently inhabited residence Considering the fact that most wind developments are likely to be situated in rural districts with some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of 45 dBA or more resulting from a wind turbine within 1 000 m from the turbine, more than 0 - 10 dBA increase in ambient noise level within 1 000 m is defined as a high impact in this SEA - **Low Sensitivity** greater than 1000 m from temporarily or permanently inhabited residence - No significant noise impact expected at the receptor Considering the fact that most wind developments are likely to be situated in rural districts with some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of less than 35 dBA resulting from a wind turbine at more than 1 000 m from the turbine, there are likely to be no noise impacts.

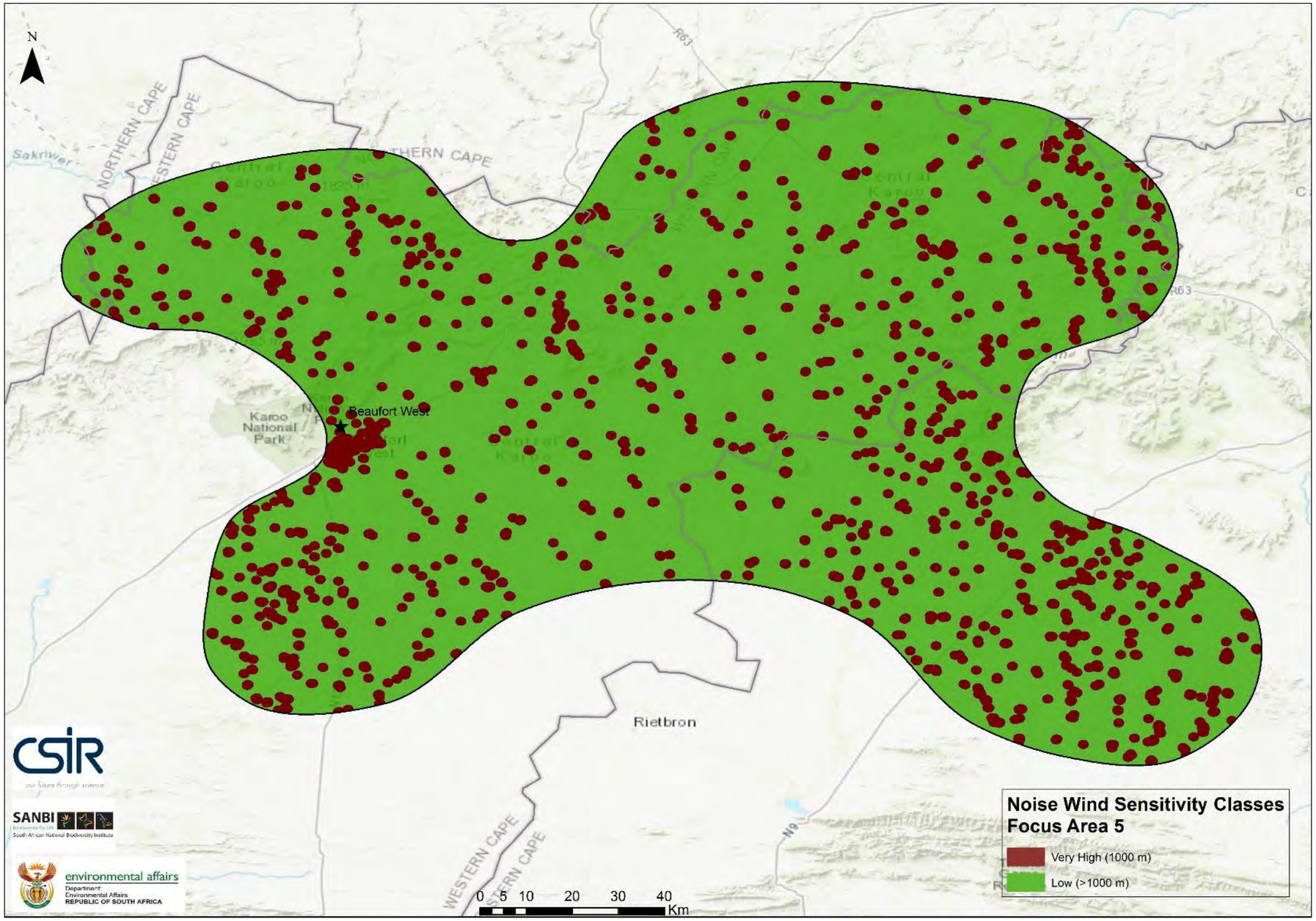


Figure 2: Noise sensitivity for wind energy development in FA5

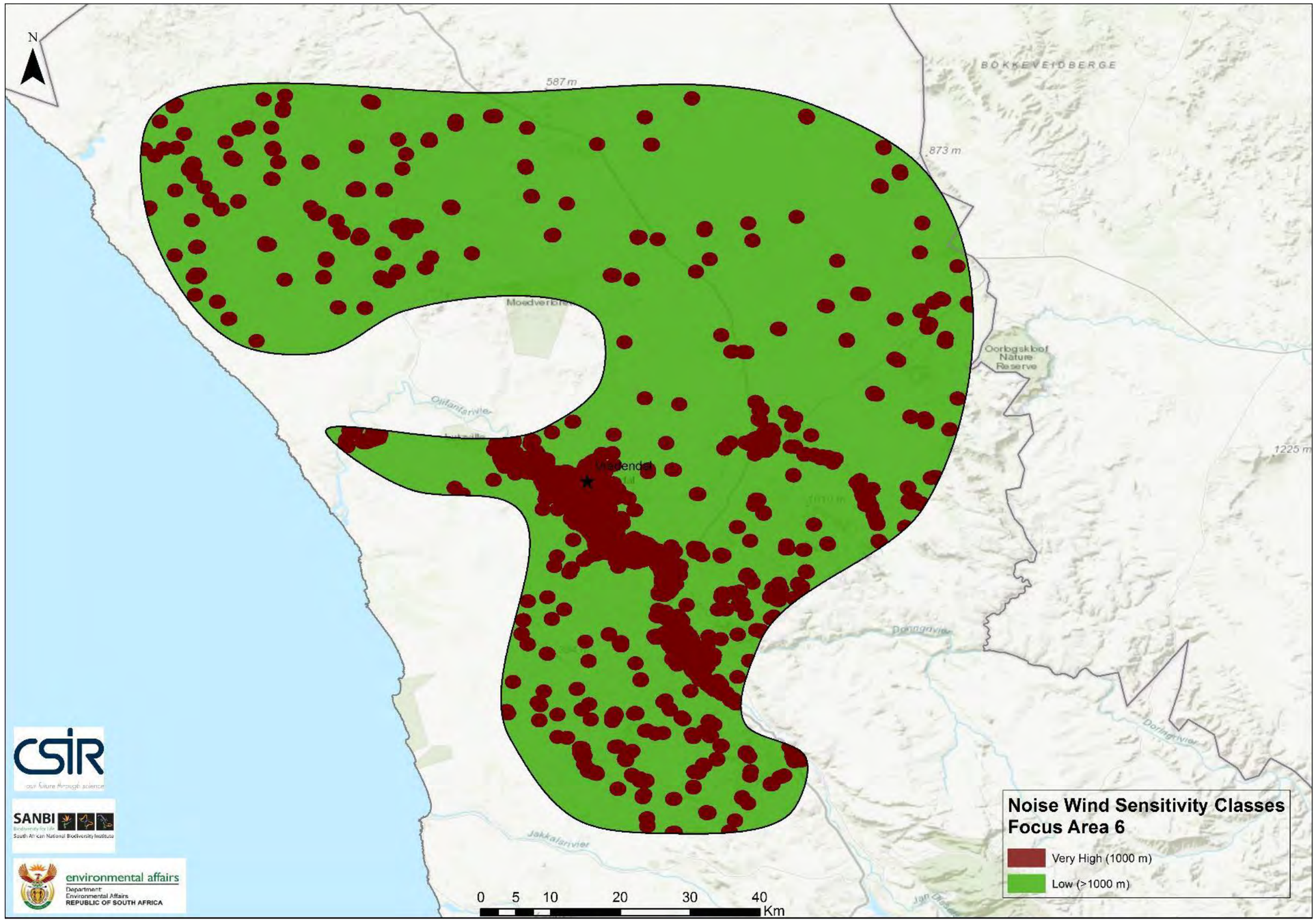


Figure 3: Noise sensitivity for wind energy development in FA6

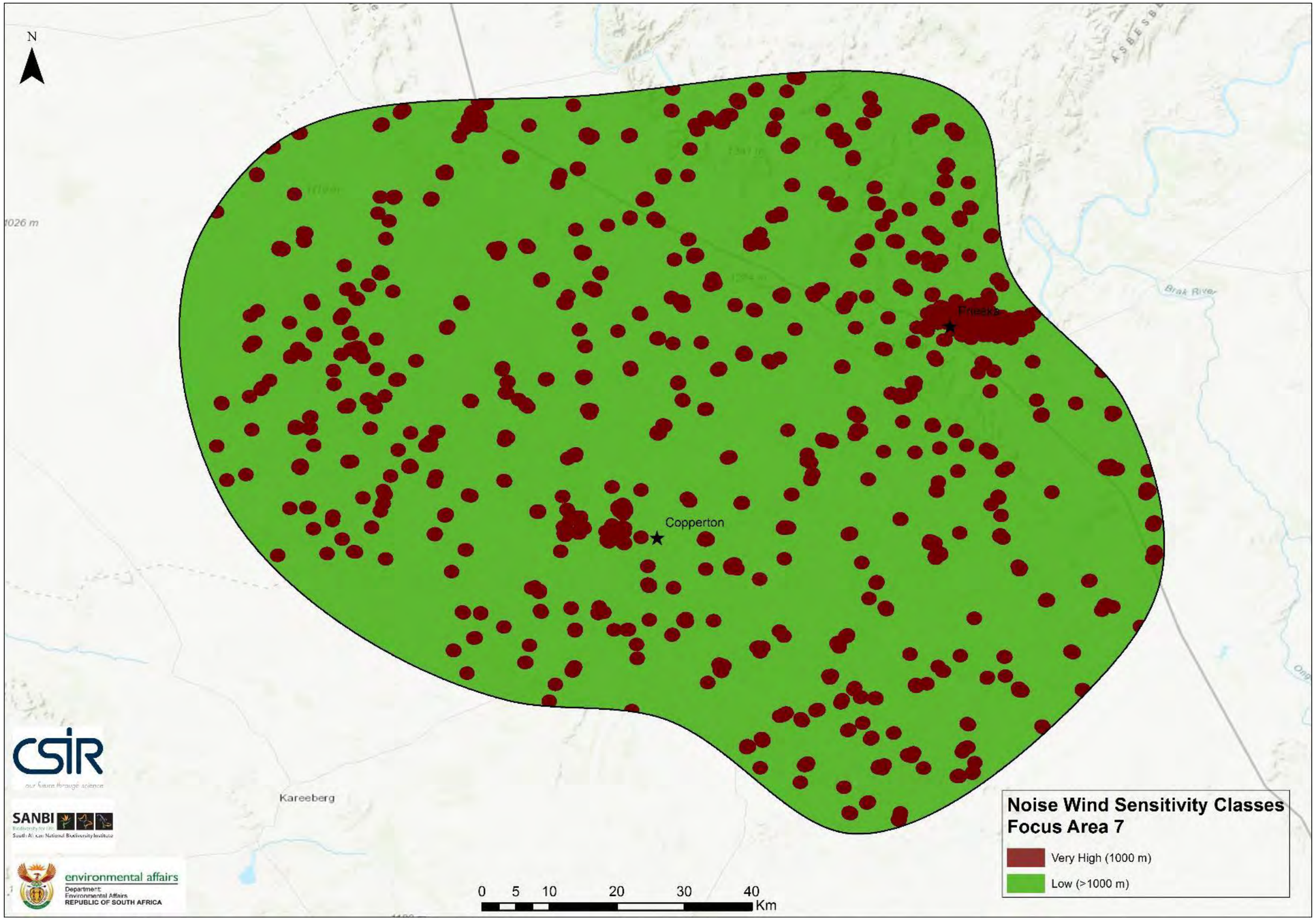


Figure 4: Noise sensitivity for wind energy development in FA7

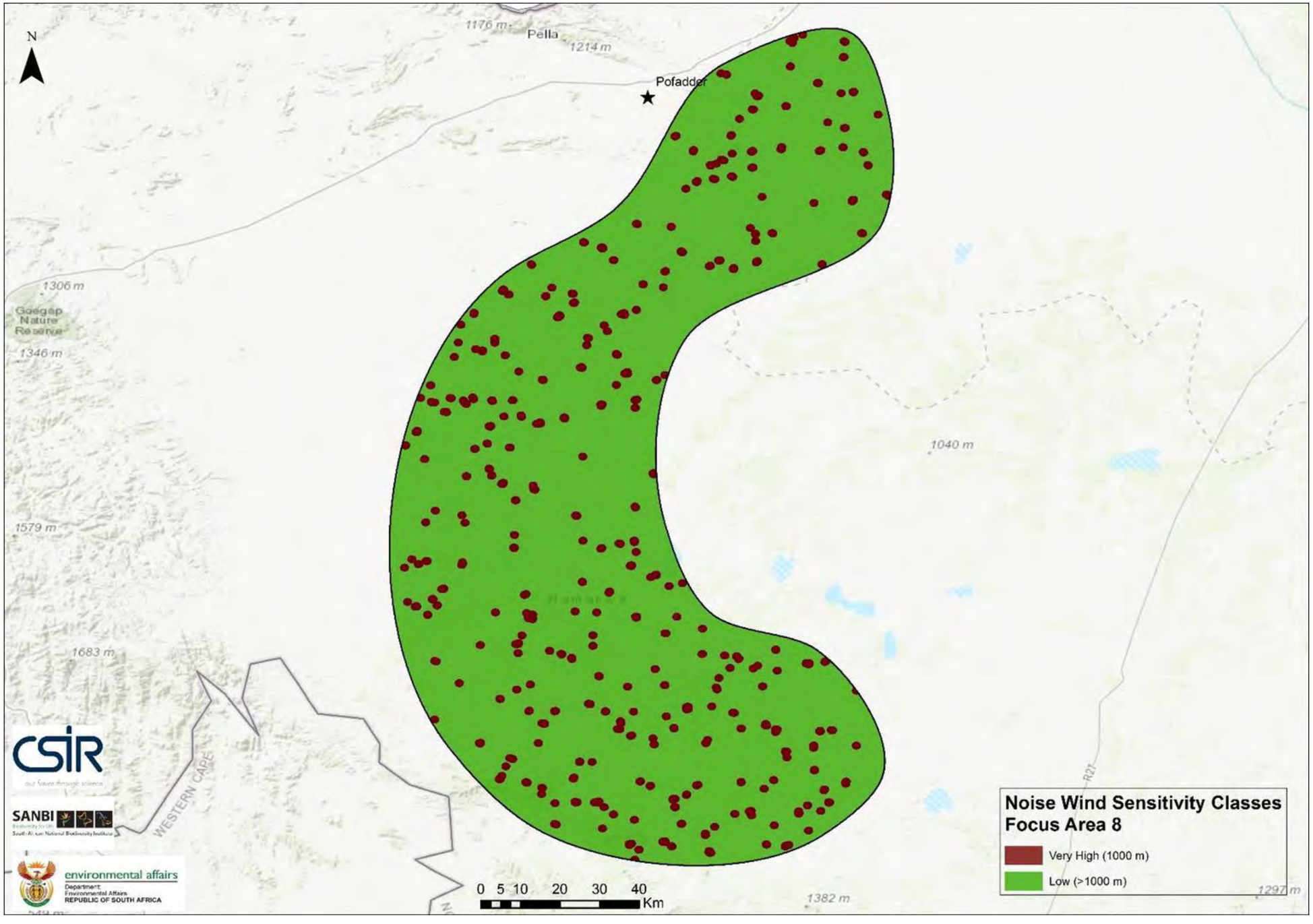


Figure 5: Noise sensitivity for wind energy development in FA8

3.9.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts of Noise on anthropogenic sources by wind developments. Since solar PV does not not have any moving components and does not generae noise, such developments do not require any assessment or authorisation in this regard. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

PROTOCOL FOR THE ASSESSMENT AND REPORTING OF NOISE IMPACTS ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of noise impacts for activities associated with the development of onshore wind energy facilities that require environmental authorisation. These requirements are set out in the Table 1 below, which shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool. If any part of the proposed development falls within an area of "very high" sensitivity, the requirements prescribed for such sensitivity apply.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool

2. REQUIREMENTS FOR THE INITIAL SITE SENSITIVITY VERIFICATION

Requirements for the assessment and reporting of noise impacts are set out in the Table 1 below and correlate with the sensitivity ratings contained in the national web based environmental screening tool. Prior to the assessment, the current use of the land and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification.

2.1 The Initial Site Sensitivity Verification must be undertaken by an environmental assessment practitioner or a noise specialist, with a noise specialist being defined in this Protocol as someone with relevant academic qualifications and with expertise in the domain of acoustic assessments and noise management.

2.2 The Initial Site Sensitivity Verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery and/or other available and relevant information; and
(b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

2.3 The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-
(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

3. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF NOISE IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING – Likelihood of a negative noise impact at the receptor (Note that the web based environmental screening tool generates two sensitivity results for wind energy facilities, i.e. either Very High Sensitivity or Low Sensitivity.)	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol for a site identified by the national web based environmental screening tool as being of "very high" sensitivity for noise must submit a **Noise Assessment**. 1.2 Where the information gathered from the Initial Site Sensitivity Verification contemplated in section 2.1 of this Protocol or the specialist assessment differs from the designation of "very high"sensitivity from the national web based environmental screening tool and it is found to be of a "low" sensitivity a Noise Assessment is not required. 1.3 Should 1.2 apply, a **Noise Compliance Statement** is to be provided. An Environmental Assessment Practitioner or a noise specialist, must append to the **Noise Compliance Statement** a motivation and evidence (e.g. photographs of no buildings near the proposed development footprint) of the different noise sensitivity. **2. The Noise Assessment** 2.1 The assessment must be undertaken by a noise specialist on the site being submitted as the preferred development site. 2.2 The assessment must be undertaken based on a site inspection as well as applying the noise standards and methodologies stipulated in SANS 10103:2008 and SANS 10328:2008 (or latest versions) for residential and non-residential areas as defined in these standards. 2.3 A baseline description must be provided of the potential receptors and existing ambient noise levels. The receptors could include places of residence or tranquility that have amenity value associated with low noise levels. As a minimum, this description must include the following: a. Current ambient sound levels recorded at relevant locations (e.g. receptors and proposed new noise sources) over a minimum of two nights and that provide a representative measurement of the ambient noise climate, with each sample being a minimum of ten minutes and taken at two different times of the night (such as early evening and late at night) on each night, in order to record typical ambient sound levels at these different times of night. b. Records of the approximate wind speed at the time of the measurement. c. Mapped distance of the receiver from the proposed development that is the noise source. d. Discussion on temporal aspects of baseline ambient conditions. 2.4 Assessment of impacts done in accordance to SANS 10103:2008 and SANS 10328:2008 including the following aspects which must be considered as a minimum in the predicted impact of the proposed development: a. Characterisation and determination of noise emissions from the noise source, where characterization could include types of noise, frequency, content, vibration and temporal aspects. b. Projected total noise levels and changes in noise levels as a result of the construction, commissioning and operation of the development for the nearest receptors using industry accepted models and forecasts. c. Desired noise levels for the area. 3 The findings of the **Noise Assessment** must be written up in a **Noise Report.** 3.1 This report must contain, as a minimum, the following information: 3.1.1 Details and relevant qualifications and experience of the noise specialist preparing the assessment including a curriculum vitae; 3.1.2 A signed statement of independence by the specialist; 3.1.3 The duration and date of the site inspection and the relevance of the season and weather conditions to the outcome of the assessment;

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF NOISE IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
	3.1.4 A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant, together with results of the noise assessment; 3.1.5 A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope; 3.1.6 Confirmation or not from the specialist that all reasonable measures have been considered in the micro-siting of the development to minimise disturbance of receptors; 3.1.7 A substantiated statement from the specialist on the acceptability of the development and a recommendation on the approval or not of the development; 3.1.8 Identification of any alternative development footprints within the preferred site and where any of these alternative development footprints are located in a "low" sensitivity as identified by the national web based environmental screening tool, and motivate as to why these potential development footprints were not considered appropriate; 3.1.9 Any conditions to which the statement is subjected; 3.1.10 Where identified, proposed impact management outcomes, mitigation measures for noise emissions during the construction and commissioning phases that may be of relative short duration, or any monitoring requirements for inclusion in the EMPr; and 3.1.11 A description of the assumptions made and any uncertainties or gaps in knowledge or data. 4 The findings of the **Noise Assessment** must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified for inclusion in the EMPr. A signed copy of the full Noise Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING - No significant noise impact expected at the receptor	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol proposed on a site identified by the national web based environmental screening tool as being of "low" sensitivity for Noise must submit a **Noise Compliance Statement**. 1.2 Where the information gathered from the Initial Site Sensitivity Verification contemplated in section 2.1 of this Protocol differs from that identified as having a "low" Noise sensitivity by the national web based environmental screening tool and it is found to be of a "very high", "high" or "medium" sensitivity, then a Noise Compliance Statement is not required. 1.3 Should paragraph 1.2 apply, a **Noise Assessment** is to be undertaken and a report prepared in accordance with the requirements of a Noise Assessment. **2. Noise Compliance Statement** 2.1 The **Noise Compliance Statement** must be prepared by an Environmental Assessment Practitioner or a noise specialist, on the site being submitted as the preferred development site and the preferred development footprint and must indicate whether or not the proposed development will have an unacceptable negative impact on the noise receptors of the site or not. 2.2 Identify any alternative development footprints within the proposed development site which would be of "low" sensitivity as identified by the national web based environmental screening tool and motivate as to why these potential development footprints were not considered appropriate. 3. The **Noise Compliance Statement** must contain, as a minimum, the following information: 3.1 Details and relevant qualifications and expertise of the Environmental Assessment Practitioner or noise specialist preparing the statement including a curriculum vitae;

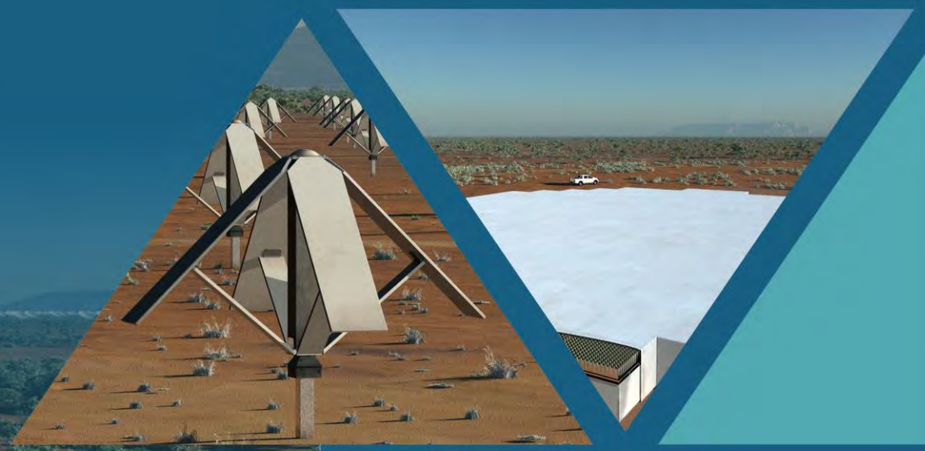
TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF NOISE IMPACTS FOR ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF ONSHORE WIND ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION

	3.2 A signed statement of independence by the Environmental Assessment Practitioner or noise specialist; 3.3 A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the sensitivity map generated by the national web based environmental screening tool; 3.4 Confirmation from the Environmental Assessment Practitioner or noise specialist that all reasonable measures have been taken through micro-siting to minimize disturbance to receptors; 3.5 A substantiated statement from the Environmental Assessment Practitioner or noise specialist on the acceptability of the development and a recommendation on the approval or not of the development; 3.6 Any conditions to which the statement is subjected; 3.7 Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and 3.8 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations. 4. A signed copy of the **Noise Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

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

PART 3.10

SQUARE KILOMETRE ARRAY



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Environmental Affairs
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3.10 SQUARE KILOMETRE ARRAY PROJECT

3.10.1 Renewable Energy and SKA

In 2012, South Africa and 8 partner countries (Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia) were selected as the preferred site for hosting the Square Kilometre Array (SKA), the world's largest and most sensitive radio telescope. In 2003, five countries responded to an invitation to submit proposals to host the SKA. The original bid proposal was submitted and endorsed by South African Cabinet in 2003 in line with the national research and development strategy, published in 2002 and the Government's Astronomy Geographic Advantage Programme.

The International SKA Organisation announced that the extensive SKA mid-frequency dish array would be developed in Africa, and the more compact low-frequency aperture array would be constructed in Australia. The majority of the mid-frequency dish array will be constructed in the core which is on the Northern Cape with dish – antennas in the spiral arms. The South African component of the SKA will consist of approximately 3 000 receptors comprising dish antennas, each with a diameter of 15 m, and radio receptors known as dense aperture-arrays. The outer stations in the spiral arms will extend beyond the borders of South Africa and at least 3 000 km from the core area. About 80% of the receptors, including a dense core and up to 5 spiral arms, will be located in the Karoo Central Astronomy Advantage Area (KCAAA).

SKA is being constructed in a phase approach with Phase 1 being the construction of Meerkat which is already operational. The second Phase of SKA is the construction of the spiral arms with further phases increasing the number of spiral arms containing dish antennas.

The KCAAA, which is located between Brandvlei, Van Wyksvlei, Carnarvon and Williston in the Northern Cape Province, was in early 2014 officially declared by the Minister of Science and Technology in terms of the Astronomy Geographic Advantage Act (Act No. 21 of 2007) for the purposes of protection from Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI). The declaration of the KCAAA ensures the long term viability of the area to be used for astronomical installations. The KCAAA has since also been identified for the construction of other astronomy projects such as PAPER (Precision Array for Probing the Epoch of Re-ionisation), C-BASS (C-Band All Sky Survey) and MeerKAT, with the latter being a pathfinder for SKA.

The Astronomy Geographic Advantage (Act 21 of 2007) aims is to provide for the preservation and protection of areas within the Republic that are uniquely suited for optical and radio astronomy; to provide for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas; and to provide for matters connected therewith.

Photovoltaic systems are known to have unintentional radiated emissions from electrical and electronic equipment that have the potential to interfere with the SKA Radio Telescope project in the Northern Cape. This can result in interference to celestial observations and/or data loss. Such interference is typically referred to as RFI. RFI is a part of the Electromagnetic Compatibility (EMC) discipline that includes Electromagnetic emissions and Electromagnetic immunity.

The main impacts of RE developments on the SKA is radio-frequency interference. Sensitivity of the SKA is such that any interference from human activities needs to be avoided. The main reason for this is that RFI from human activities is usually higher than the signals recorded from cosmic sources and this makes it difficult to detect the cosmic source from the RFI. This is made worse by the sensitivity of the dish- antennae which are designed to record RFI from far distances for astronomical observations.

3.10.2 Sensitivity Mapping

Based on the potential RFI and EMI impacts of wind and solar photovoltaic (PV) developments on SKA receptors, sensitivity buffers as presented in Table 1 were determined, including consultation with SKA. They were then applied to the preliminary SKA radio sites to produce national sensitivity maps for wind and solar PV (see Figure 1 and Figure 2) as well as individual sensitivity maps of those Focus Areas (FAs) which overlap with identified sensitivities (see Figure 3 to Figure 7).

Table 1: SKA sensitivity distance guidelines

Colour	Sensitivity	Distance from SKA facility	
		Wind	Other Solar PV
Dark red	Very High	Less than 18 km	Less than 8 km
Red	High	Between 18 and 26 km	Between 8 and 14 km
Orange	Medium	Between 26 and 48 km	Between 14 and 32 km
Green	Low	Greater than 48 km	Greater than 32 km

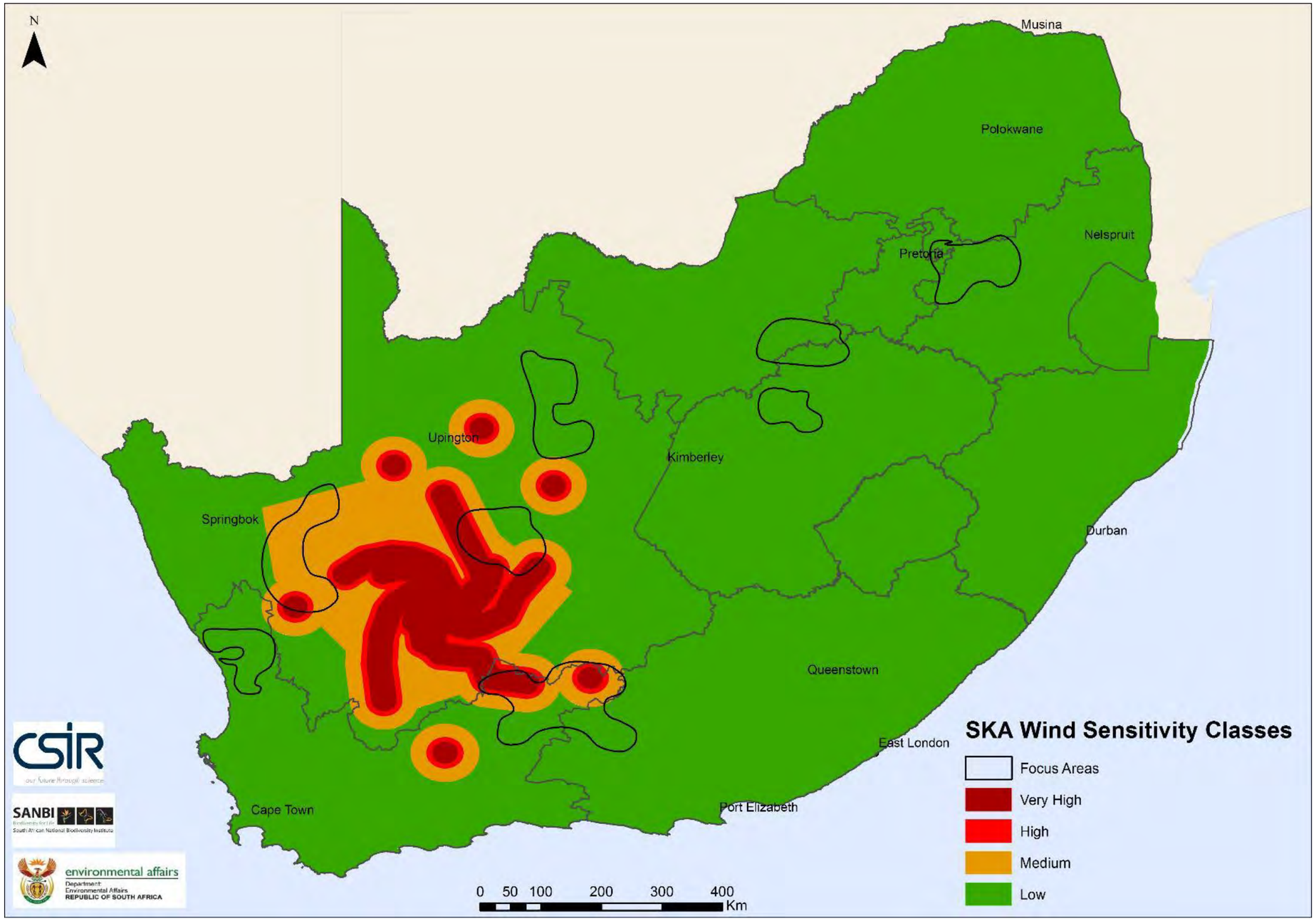


Figure 1: National SKA sensitivity for wind energy development

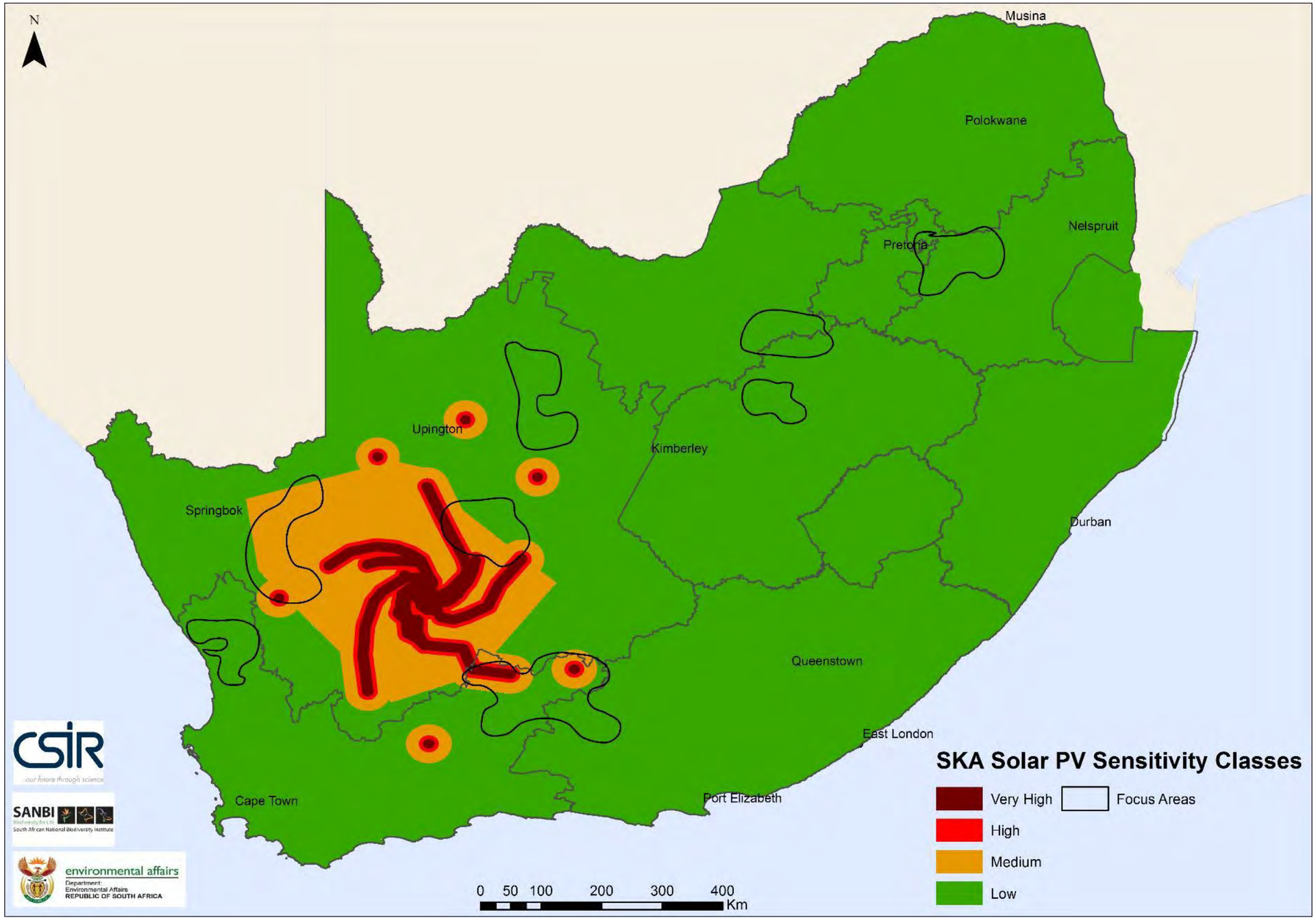


Figure 2: National SKA sensitivity for solar PV energy the development

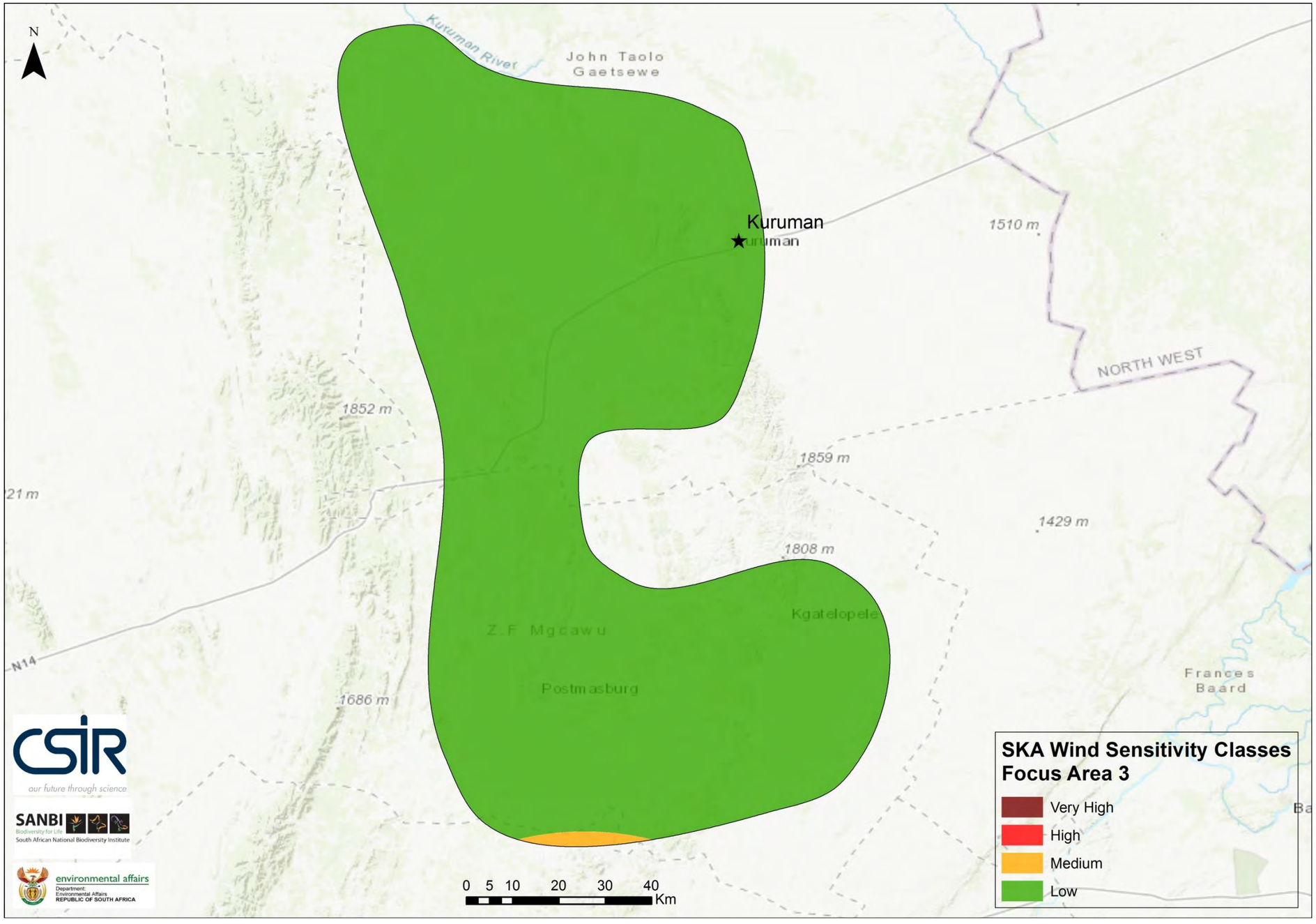


Figure 3: SKA sensitivity for the development of wind energy in FA3

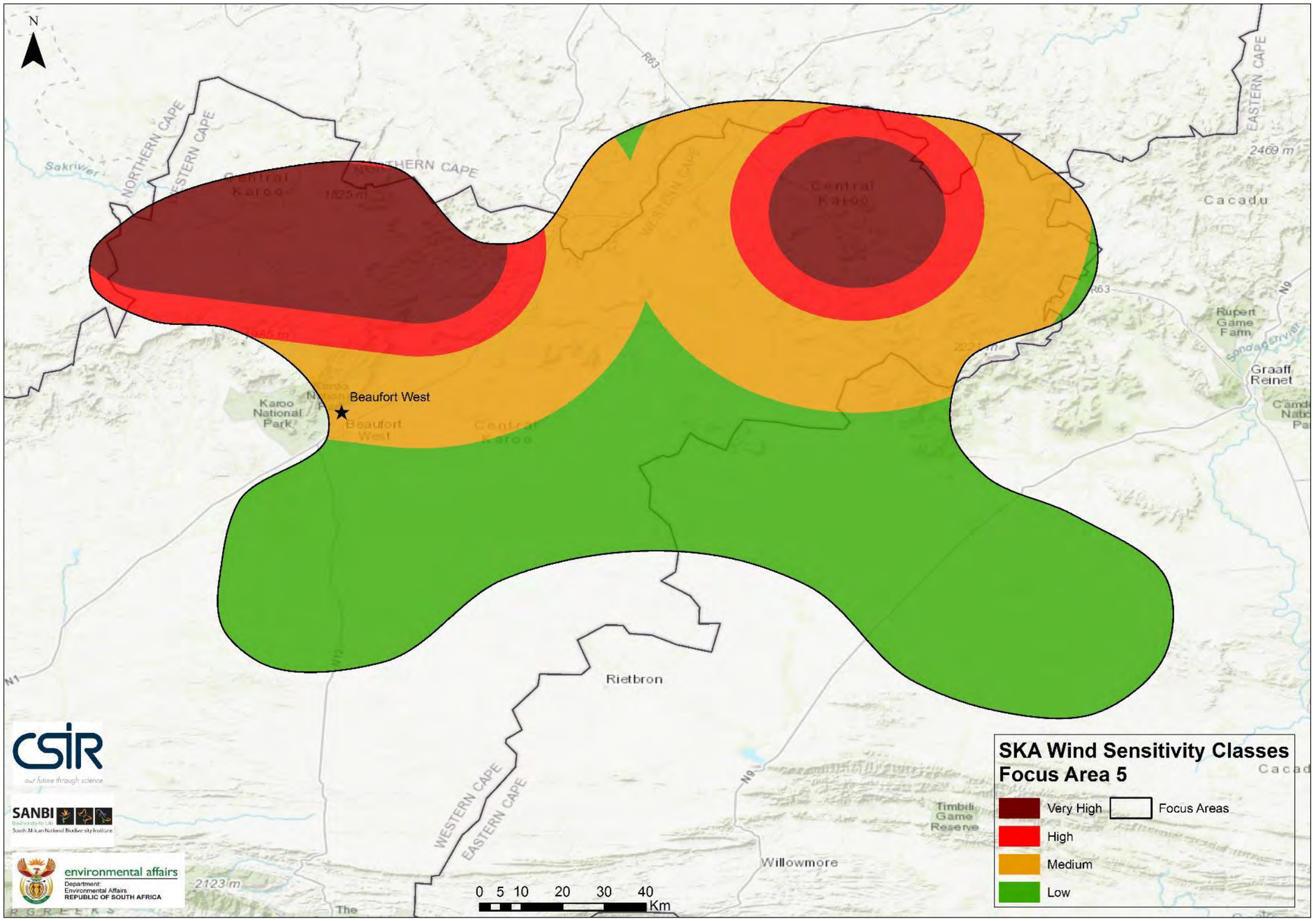


Figure 4: SKA sensitivity for the development of wind energy in FA5

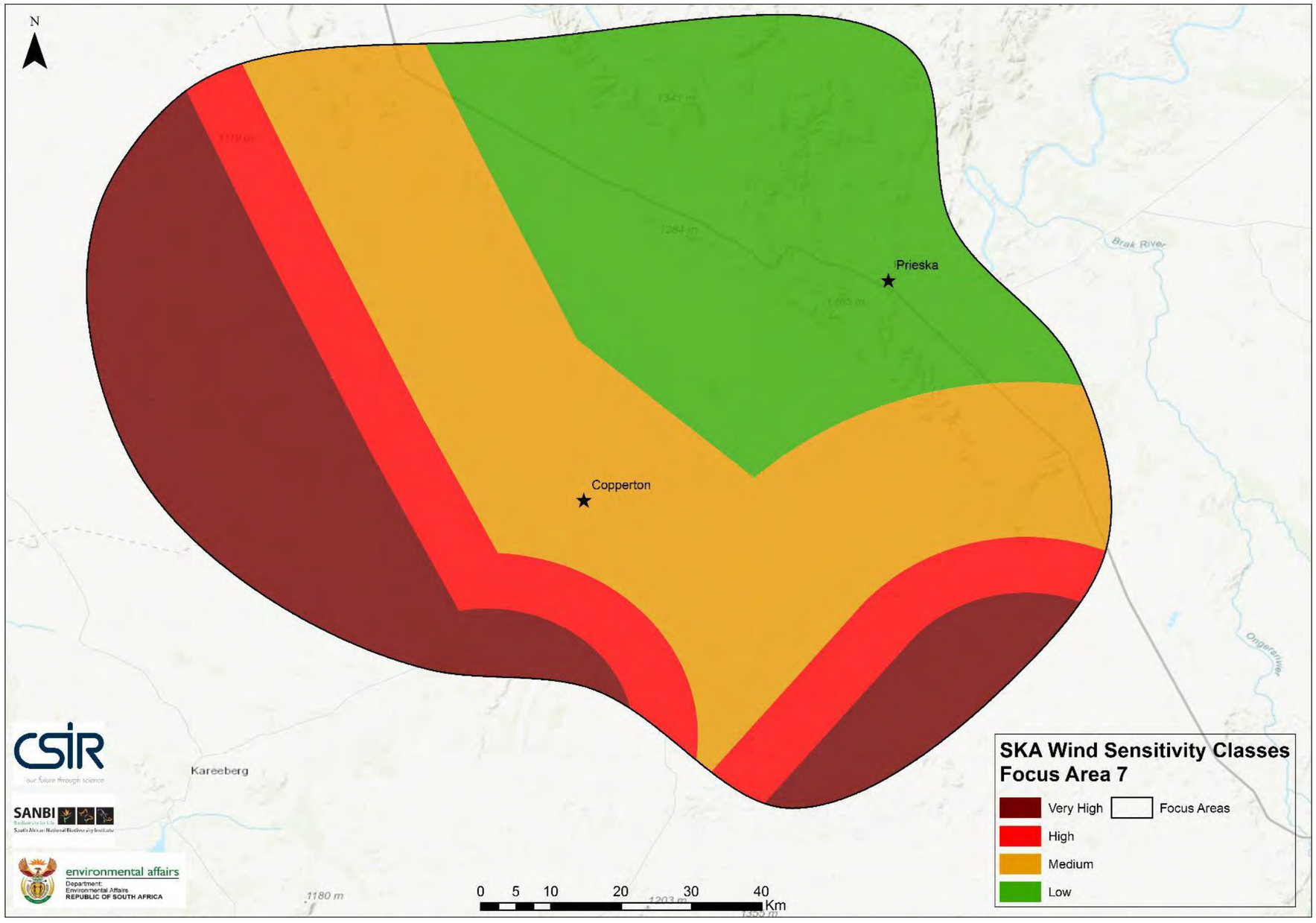


Figure 5: SKA sensitivity for the development of wind energy in FA7

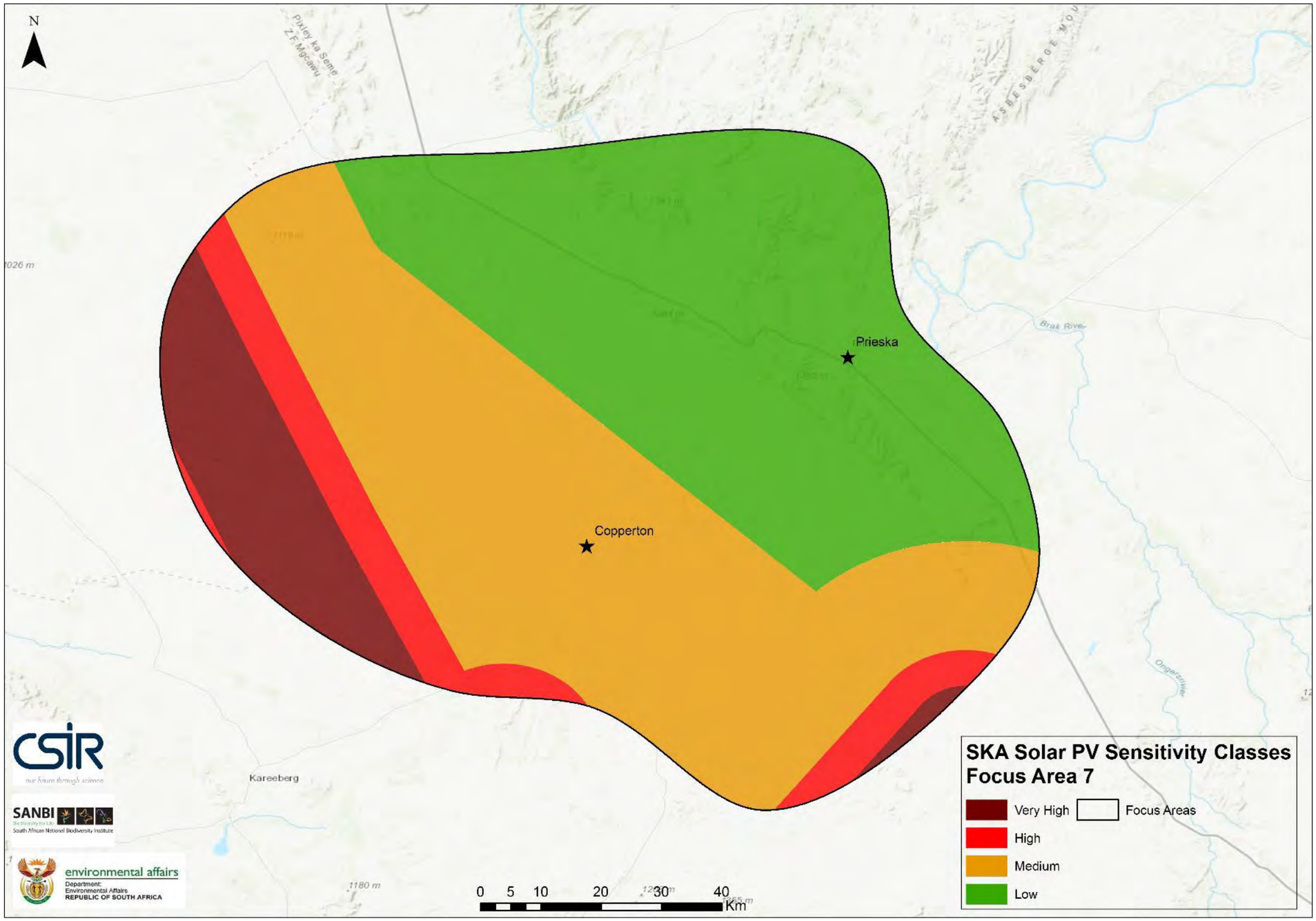


Figure 6: SKA sensitivity for the development of solar PV energy in FA7

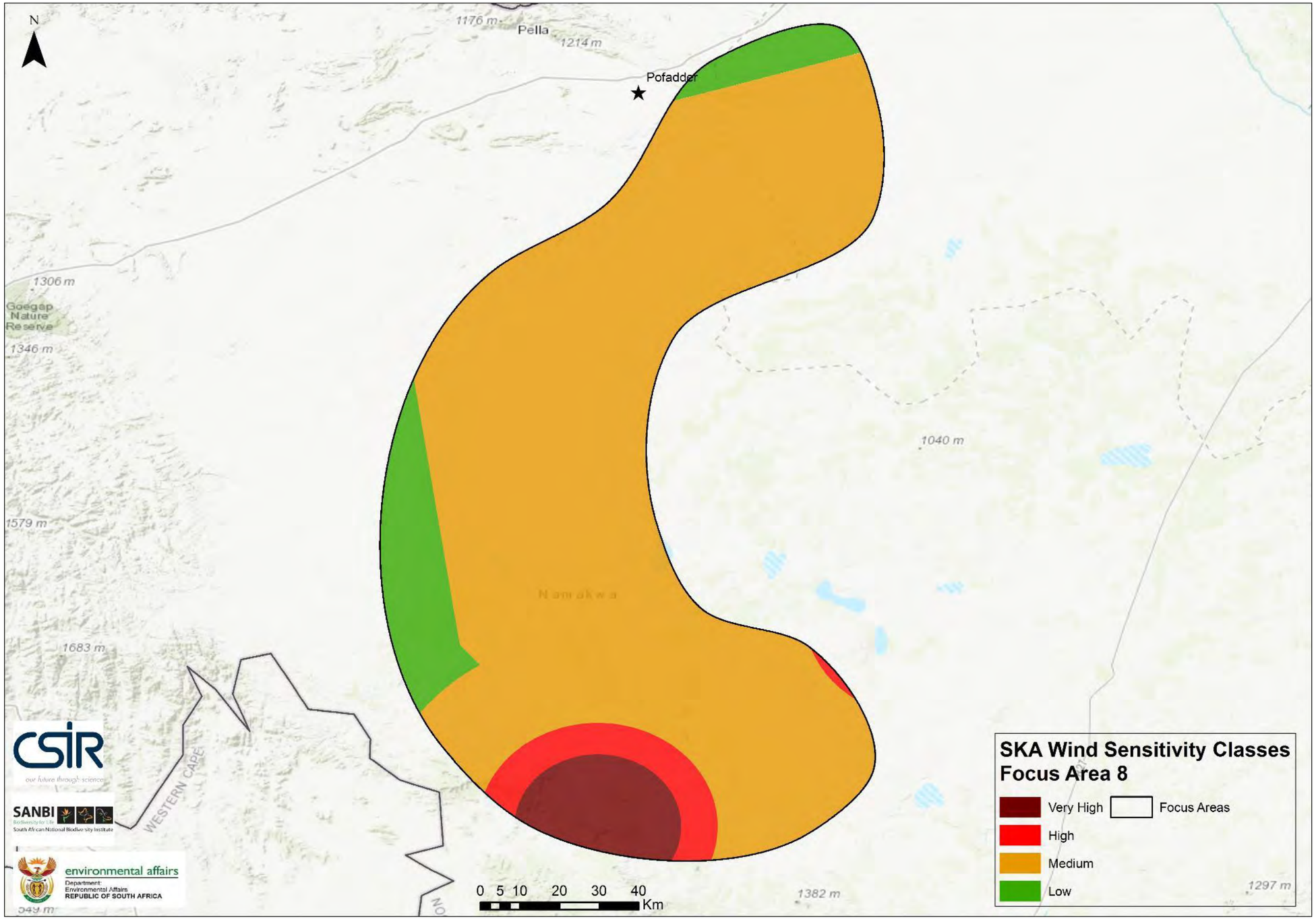


Figure 7: SKA sensitivity for the development of wind energy in FA8

3.10.3 Development Protocols

This section of the chapter details the levels of assessment assigned to the four tiered sensitivity levels on impacts on SKA by wind and solar PV developments. Protocols provide a minimum set of assessment and reporting criteria that must form the basis of specialist investigation in the Environmental Authorization (EA) process. These requirements are relevant to areas both inside and outside the Renewable Energy Development Zones and sensitivity mapping for onshore wind and solar PV facilities is available on the national web based environmental screening tool.

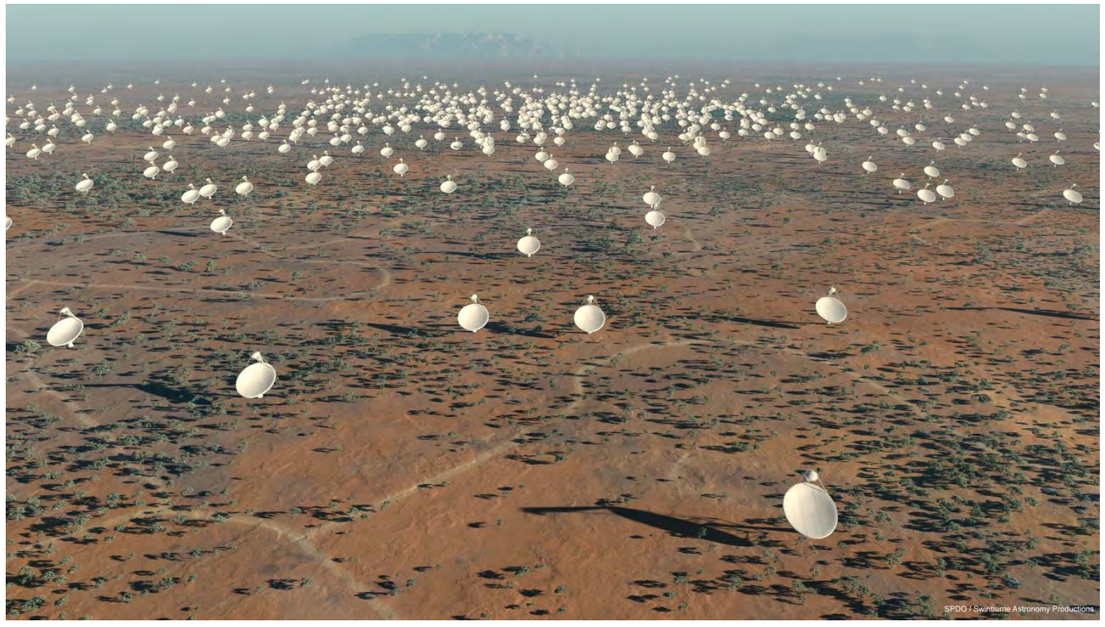
SKA

PROTOCOL FOR THE ASSESSMENT AND REPORTING OF ENVIRONMENTAL IMPACTS ON SKA BY ONSHORE WIND AND SOLAR PV ENERGY GENERATION FACILITIES

1. SCOPE

This protocol provides the criteria for the assessment and reporting of impacts on SKA for activities associated with the development of onshore wind and solar PV energy generation facilities which require environmental authorisation. This applies within and outside of the Renewable Energy Development Zones (REDZs) as published under Government Notice No. 114, Gazette No. 41445 on 16 February 2018. Requirements for the assessment and reporting of impacts on SKA are set out below, which shows how these requirements correlate with the sensitivity ratings as contained in the national web based environmental screening tool.

The national web based environmental screening tool can be accessed at:
https://screening.environment.gov.za/screeningtool



2. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

TABLE 1: REQUIREMENTS FOR THE ASSESSMENT AND REPORTING OF IMPACTS ON SKA FOR ONSHORE WIND AND SOLAR PV ENERGY GENERATION FACILITIES THAT REQUIRE ENVIRONMENTAL AUTHORISATION	
VERY HIGH SENSITIVITY RATING - high likelihood for significant negative impacts on the civil aviation installation that cannot be mitigated. In-depth assessment of the potential impacts are likely to be required before development can be considered in these areas. **HIGH SENSITIVITY RATING –** potential for negative impacts on the civil aviation installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures. **MEDIUM SENSITIVITY RATING -** low potential for negative impacts on the civil aviation installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required. **LOW SENSITIVITY RATING -** No significant impacts on the civil aviation installation are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	**1. General Information** 1.1 An applicant intending to undertake an activity identified in the Scope of this Protocol, proposed on a site identified by the national web based environmental screening tool as being of "very high", "high", "medium" or "low" sensitivity for the SKA must submit a **SKA Compliance Statement.** **2. SKA Compliance Statement** The **SKA Compliance Statement** must be prepared by an Environmental Assessment Practitioner for the site being submitted as the preferred development site and must indicate whether or not the proposed development will have an unacceptable negative impact on the SKA. 3. The **SKA Compliance Statement** must contain, as a minimum, the following information: 3.1 A comment, in writing, from SKA South Africa confirming no unacceptable impact on SKA. 3.2 Should comment from SKA South Africa require further assessment, a copy of the assessment report and mitigation measures is to be attached with the Compliance Statement as part of the Basic Assessment Report (BAR) or Environmental Impact Assessment Report (EIAR). The assessment must be in accordance with the requirements stipulated by the SKA South Africa. 4. A signed copy of the **SKA Compliance Statement** must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
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PART 3.11

TELECOMMUNICATIONS

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3.11 TELECOMMUNICATIONS

3.11.1 Renewable Energy and Telecommunication

The increase in renewable energy developments has also raised concerns regarding the potential impacts on telecommunication services. The impact of wind turbines on telecommunication systems is of particular concern. Telecommunication services such as television and radio broadcasts, mobile phone etc often utilise similar landscape that is also suitable for wind turbines. There is therefore the potential for wind turbines to cause interference with telecommunication signals.

Impacts can include television (TV) transmissions being reflected by the wind turbine blades. These interferences are attributed to many factors including the location of the TV receiver with respect to the wind energy facility and transmitter, proximity of the facility to the transmitter, the receiver technology, as well as the frequency used[1]. Although wind energy facilities are known to have the greatest impact when located in close proximity to high power transmitter stations, they could also affect distant transmitters located within the line of sight.

Amplitude Modulation (AM) transmission is regarded as highly susceptible to interference when wind energy facilities are located in close proximity to the transmitters. The preferred distance for wind energy facilities is at least 1 km from an AM antenna array. Frequency modulation (FM) radio is however regarded as less susceptible to interference from wind energy facilities[1].

3.11.2 Key potential impacts

Key potential impacts of wind energy facilities on broadcasting and telecommunication services are:

- Potential of degradation or loss of signal strength, and poor TV reception and/or “ghosting” effects.
- Reduction in the coverage of mobile phone, resulting in dropping of cellular phone calls and slow data transmission.
- Reduction in the coverage of radio transmission and wireless internet.

Although unlikely, solar photovoltaic (PV) plants might have an impact where elevation of the PV plant is relatively high in relation to the transmitter station, and where the PV plant is located in close proximity to the south of a transmitter (with PV panels generally facing north towards the equator). Broadcasting signals could be reflected from the solar panels and result in “Ghost Pictures” on analogue TV and multipath interference on digital TV. Telecommunication signals crossing a solar PV facility might be affected with multipath reflection and result in the degradation of the quality of the link.

3.11.3 Sensitivity Mapping

The sensitivity criteria below follow those determined for the 2015 Phase 1 SEA (DEA, 2015). Sentech data, as well as the data provided by the South African Civil Aviation Authority (SACAA), was used to map sensitivity around high powered broadcasting facilities and other communication masts. The sensitivity criteria presented in Table 1 was applied at a national scale and used to produce national wind and solar PV sensitivity maps (see Map 1 and Map 2). Sensitivities were also mapped for each focus area (FA) (see Maps 3 to 18).

Table 1: Telecommunication sensitivity criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Sentech High Power Terrestrial Broadcasting Facilities	- Sentech	- **Very High sensitivity** 5 km	- **Medium sensitivity** 5 km
Other Communication Facilities	- SACAA Obstacle Database	- **High sensitivity** 1 km	- **Medium sensitivity** 1 km

[1] https://www.broadcastwind.com/wind-farms-tv-and-radio-interference/

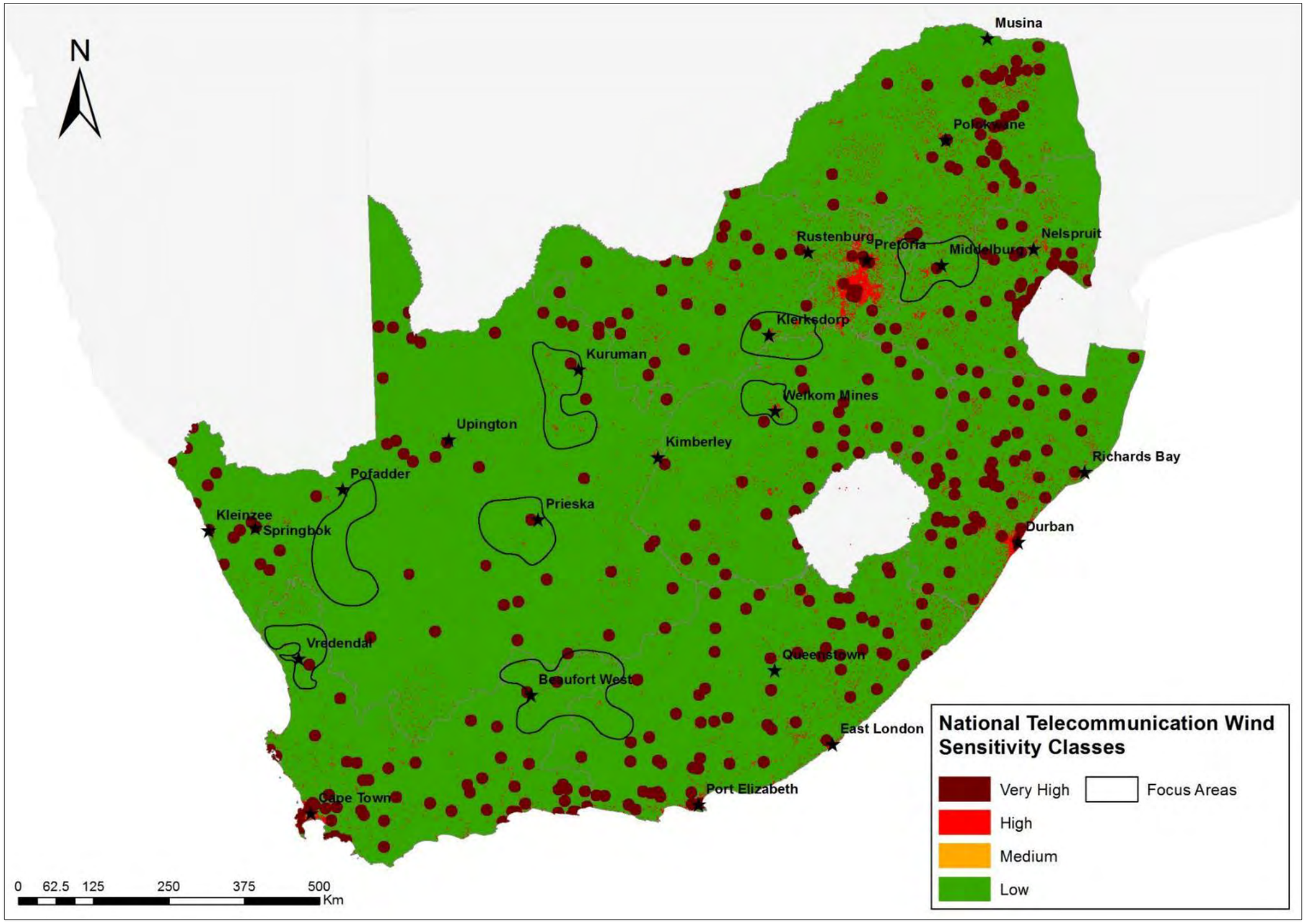

Figure 1: National telecommunication sensitivity map for wind development

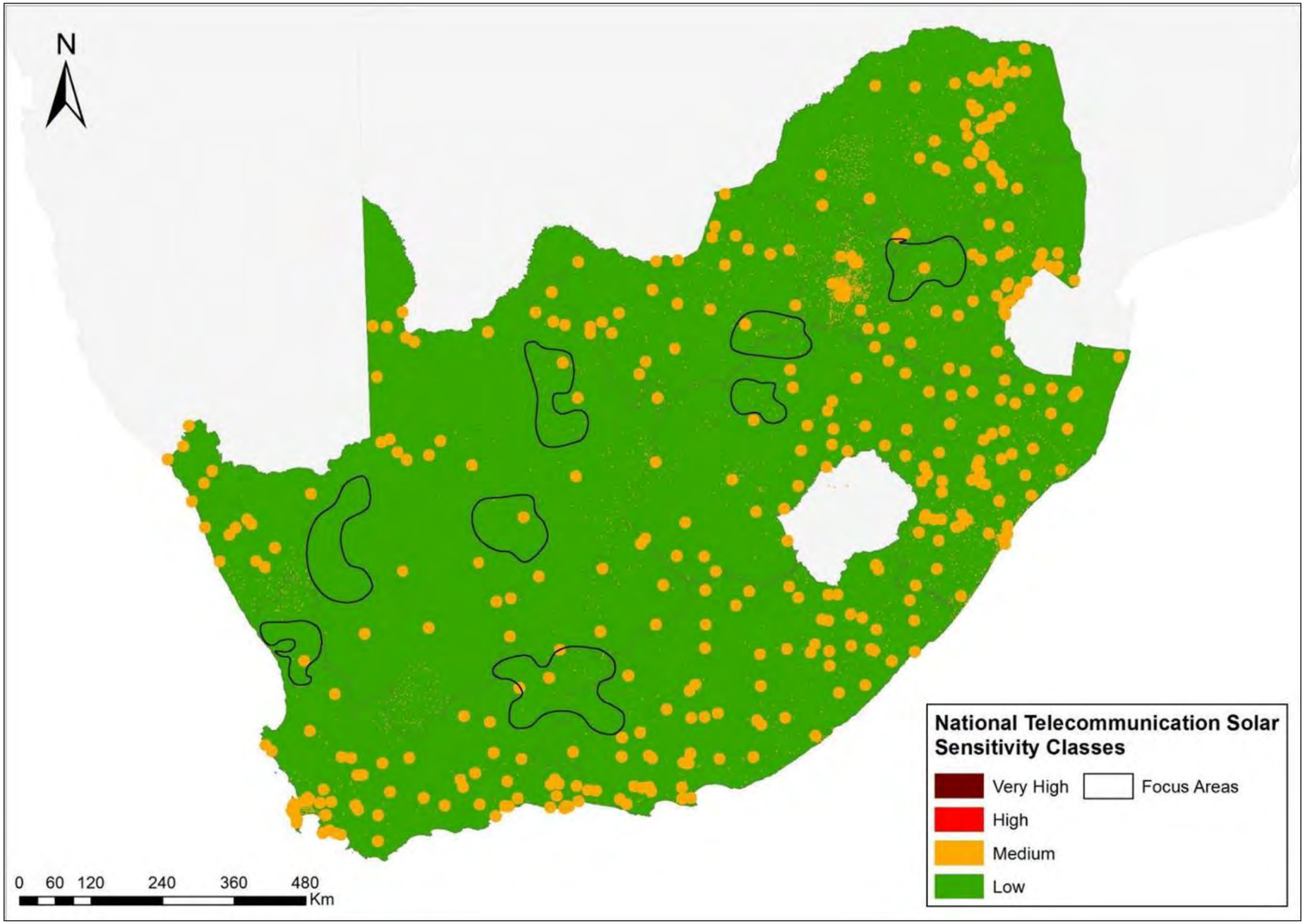

Figure 2: National telecommunication sensitivity map for solar PV development

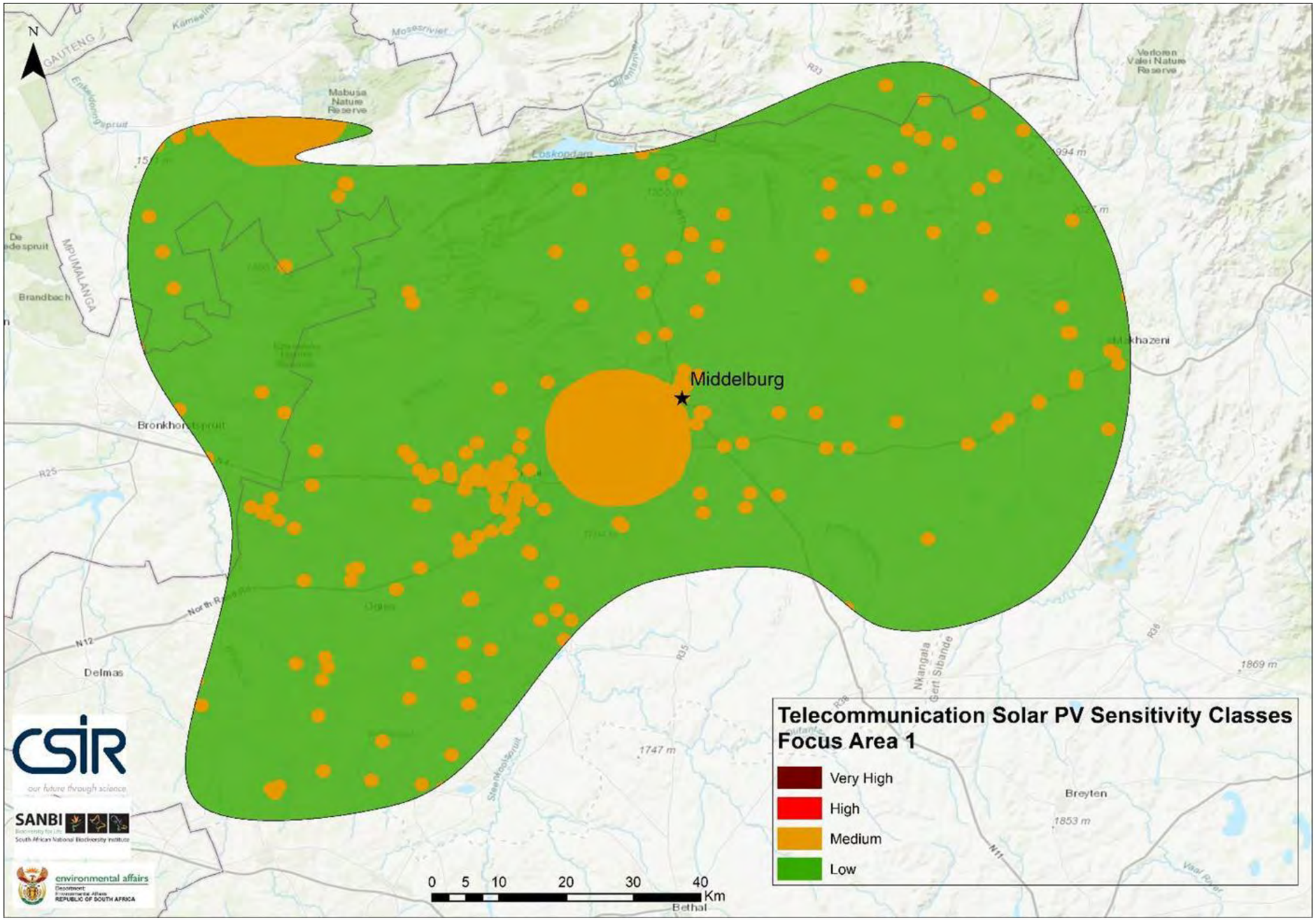

Figure 3: Telecommunication sensitivity for solar PV development in FA1

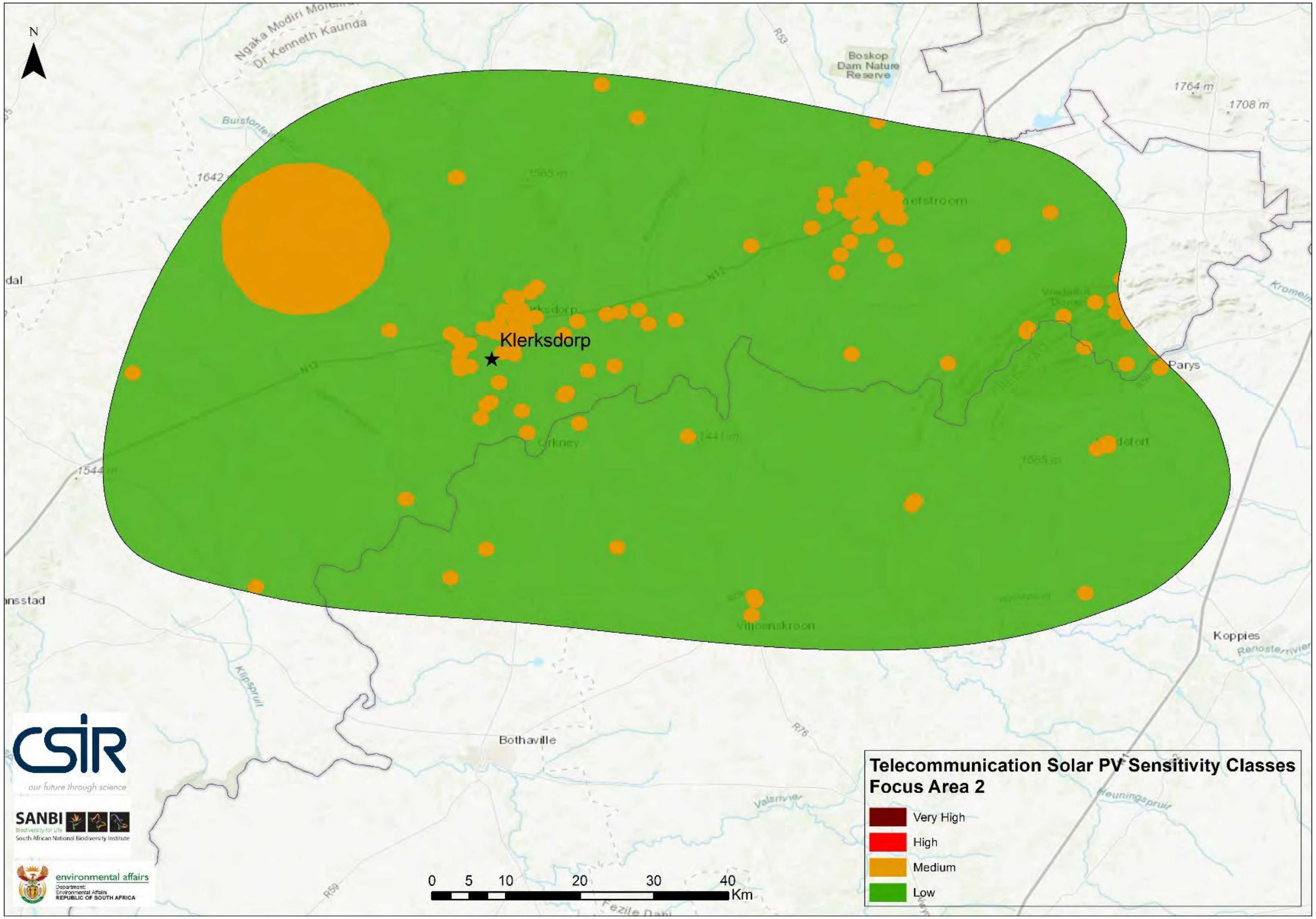

Figure 4: Telecommunication sensitivity for solar PV energy development in FA2

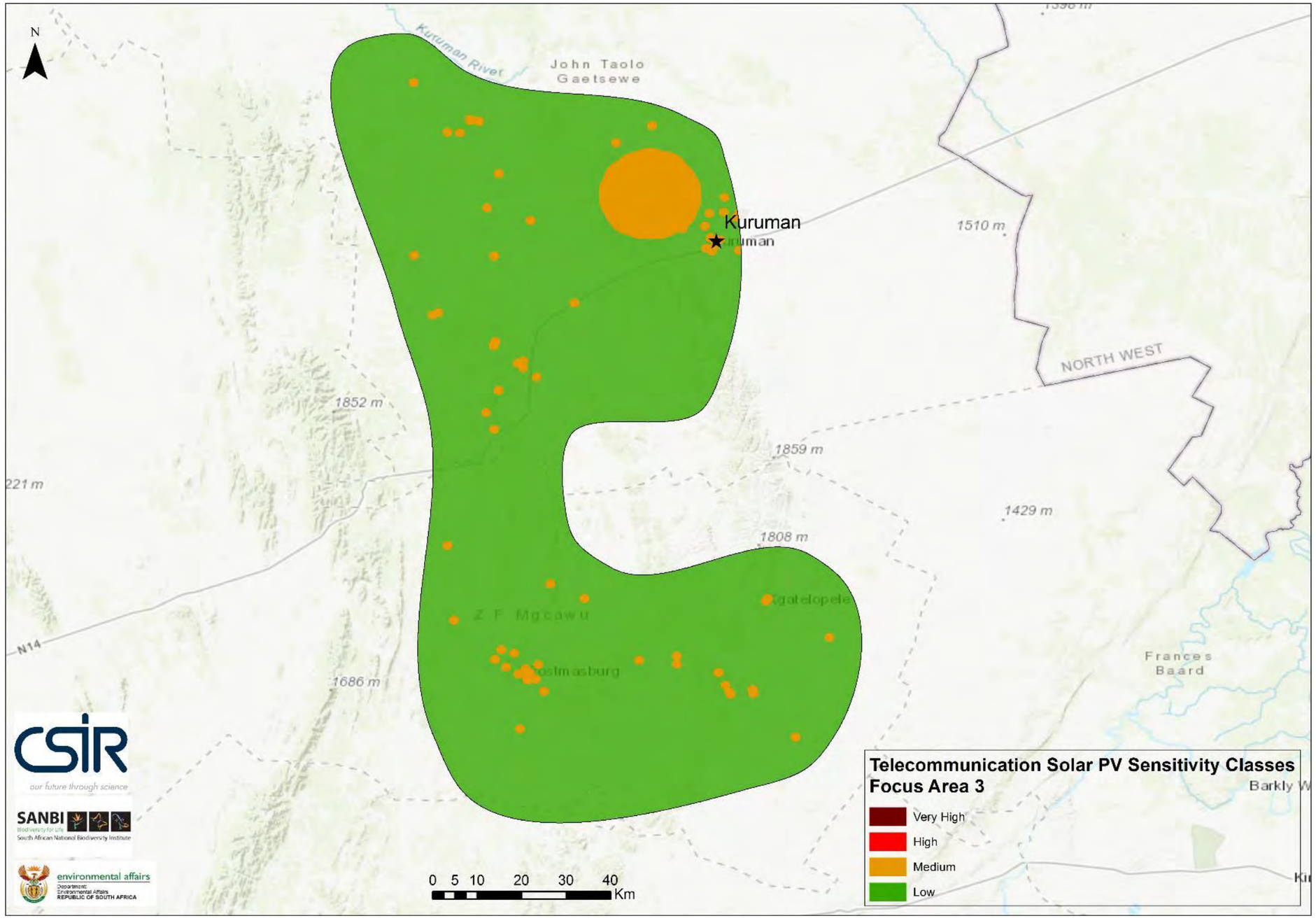

Figure 5: Telecommunication sensitivity for solar PV energy development in FA 3

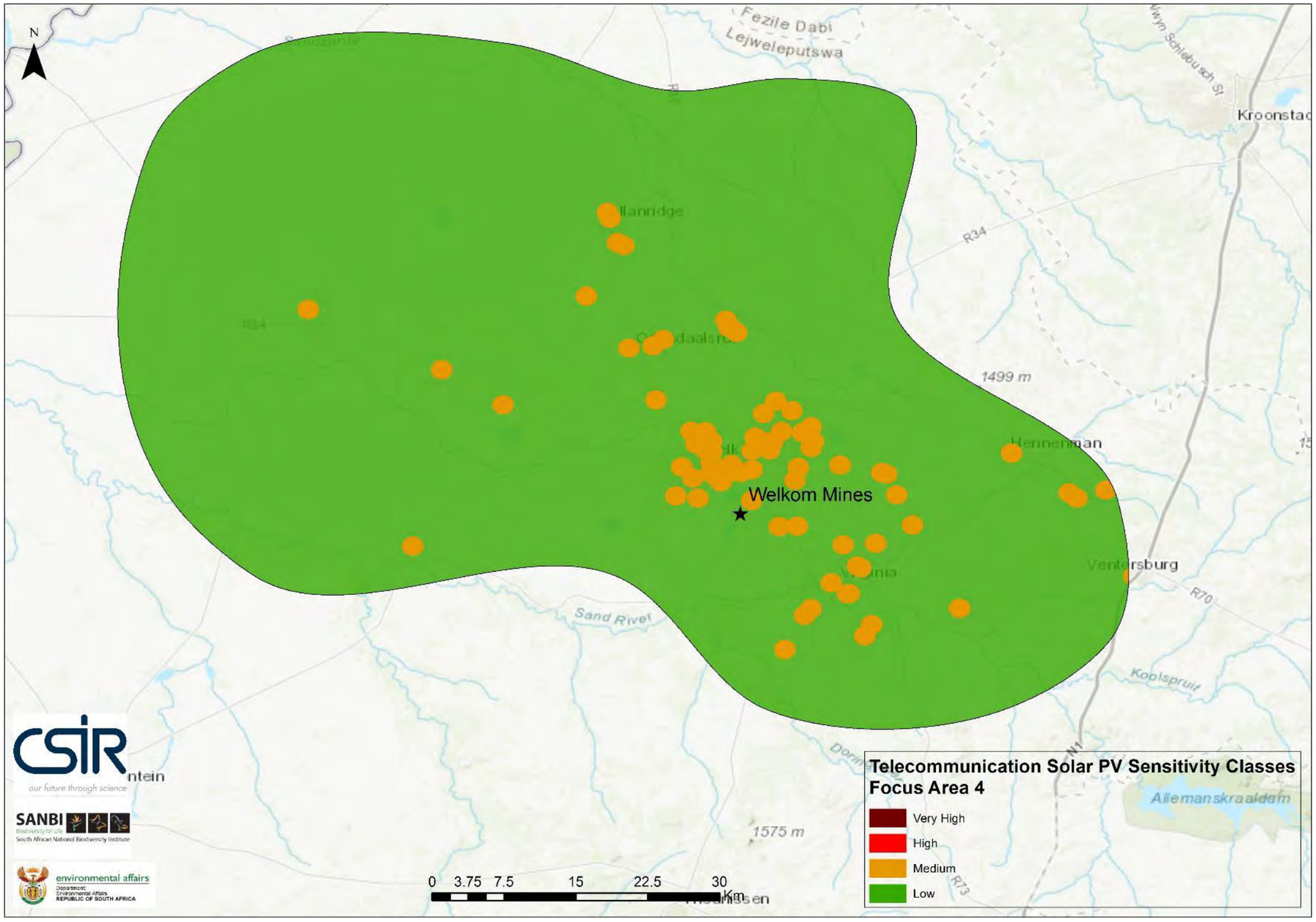

Figure 6: Telecommunication sensitivity for solar PV energy development in FA 4

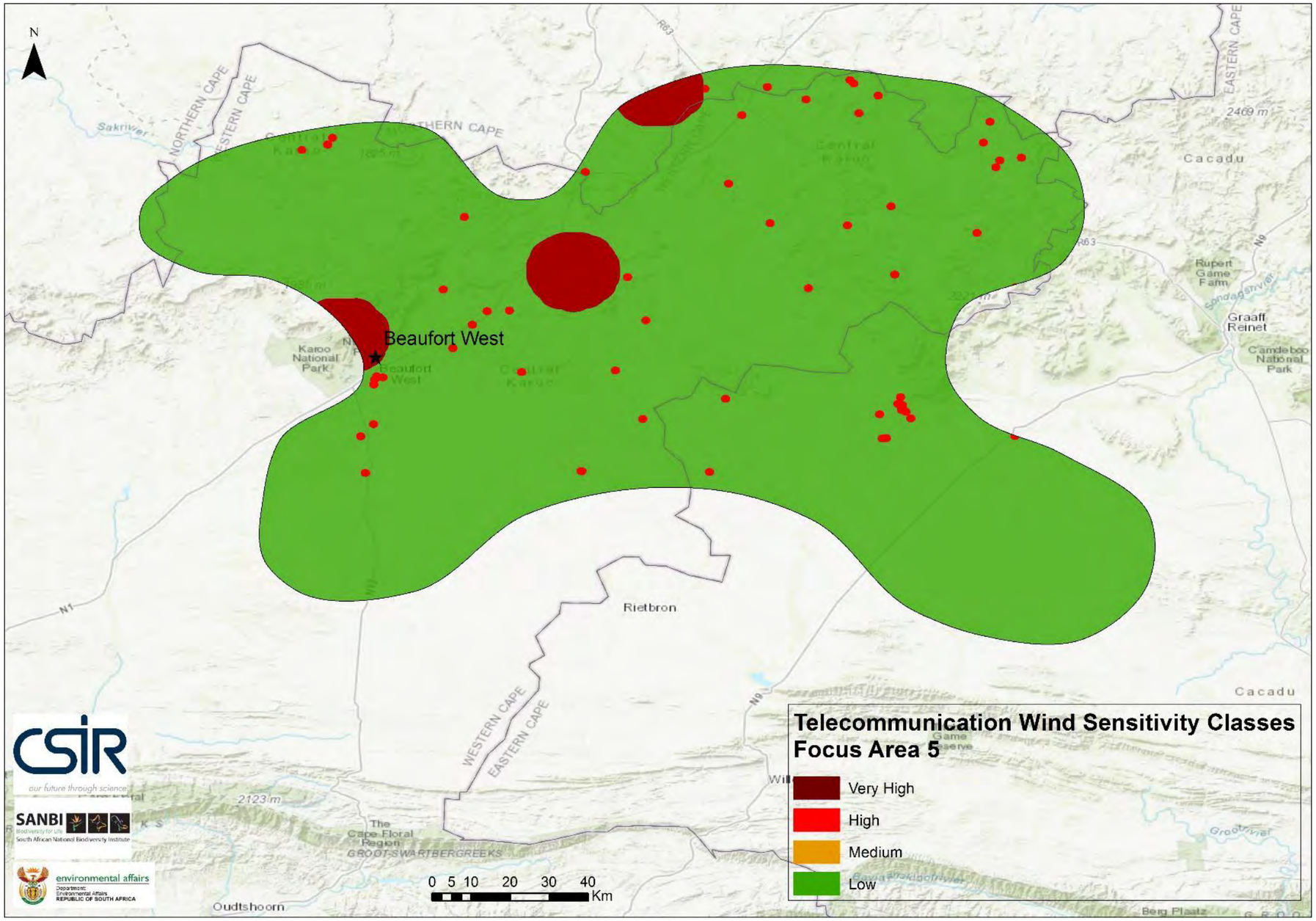

Figure 7: Telecommunication sensitivity for wind energy development in FA 5

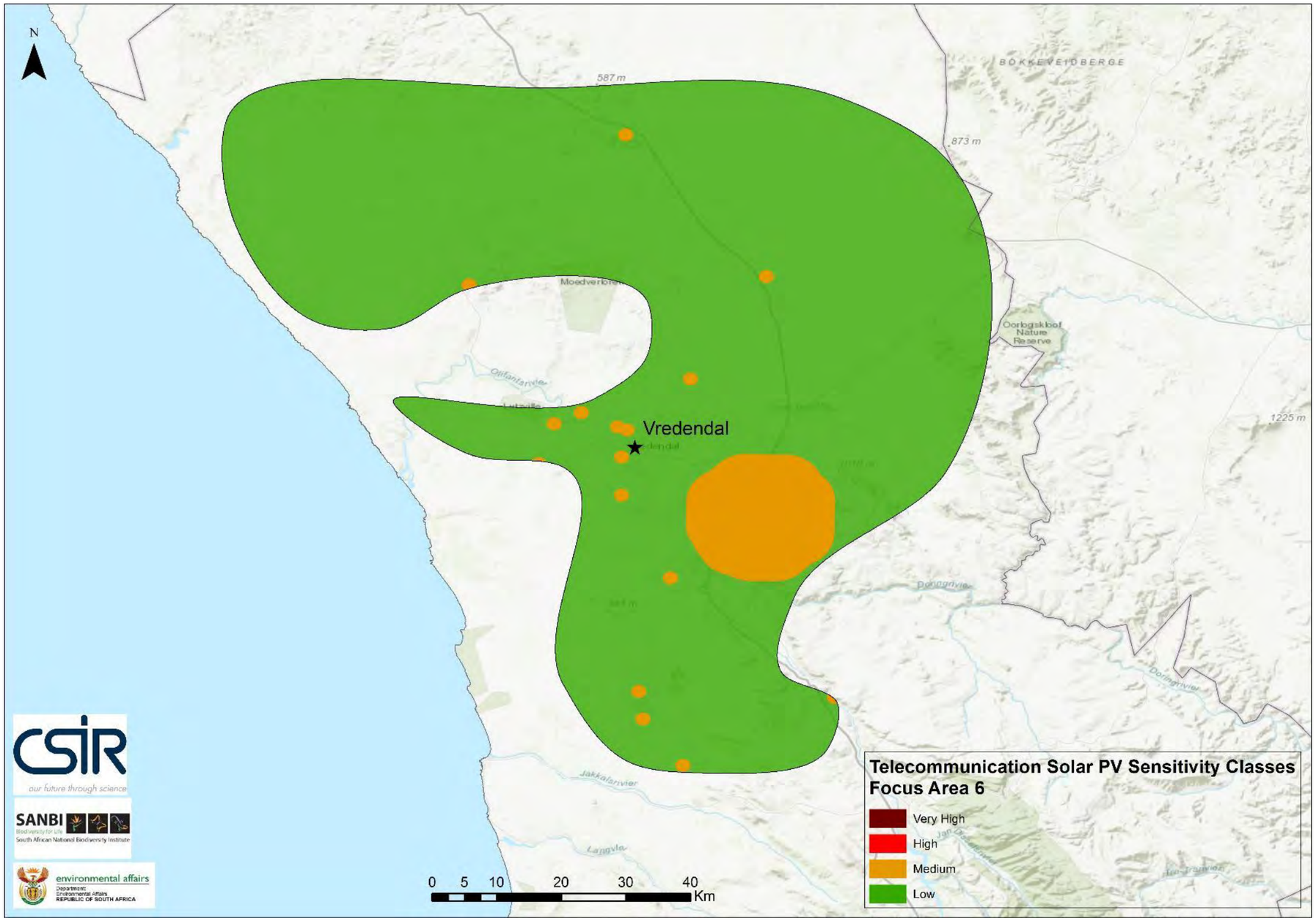

Figure 8: Telecommunication sensitivity for solar PV energy development in Focus Area 6

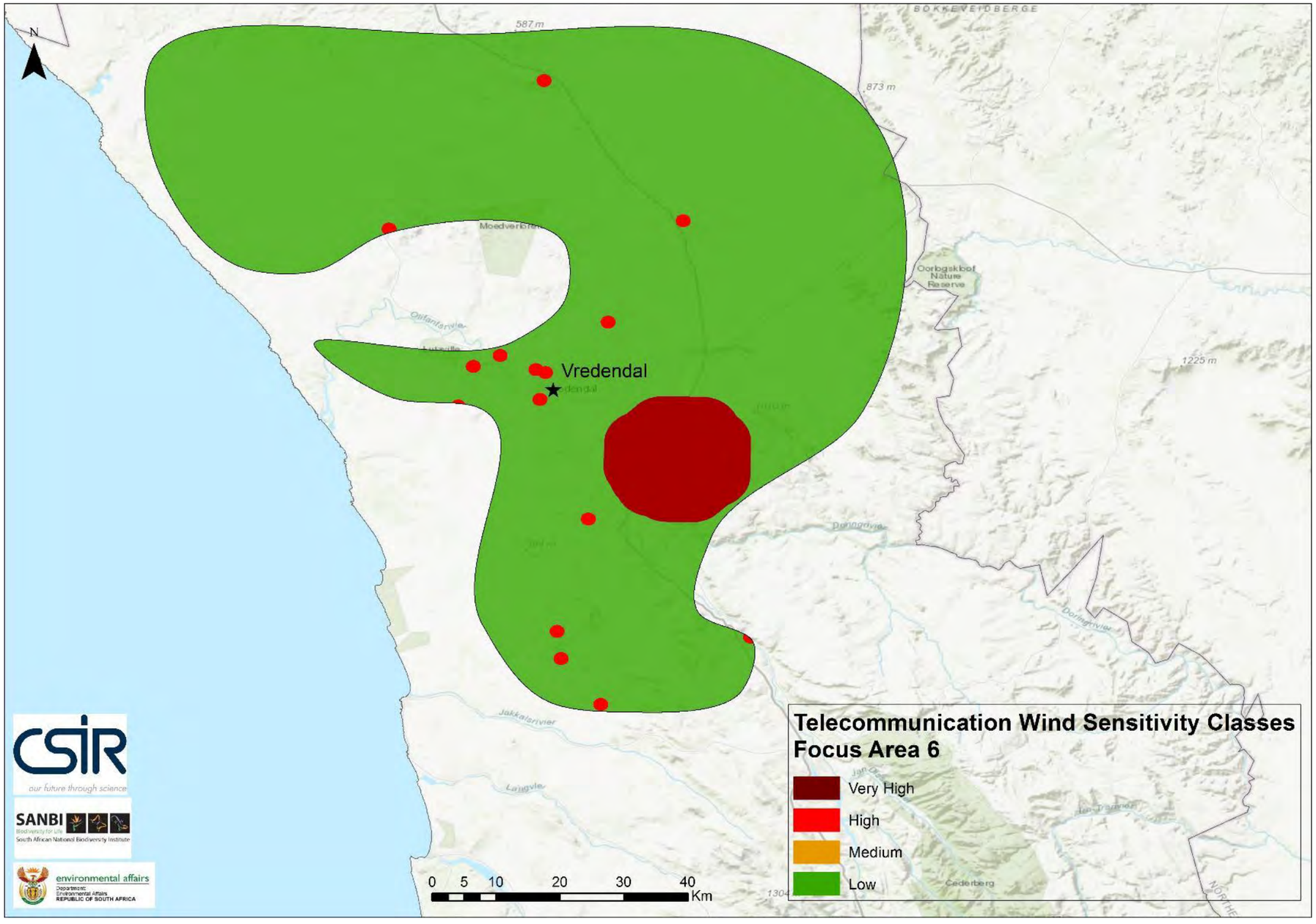

Figure 9: Telecommunication sensitivity for wind energy development in FA 6

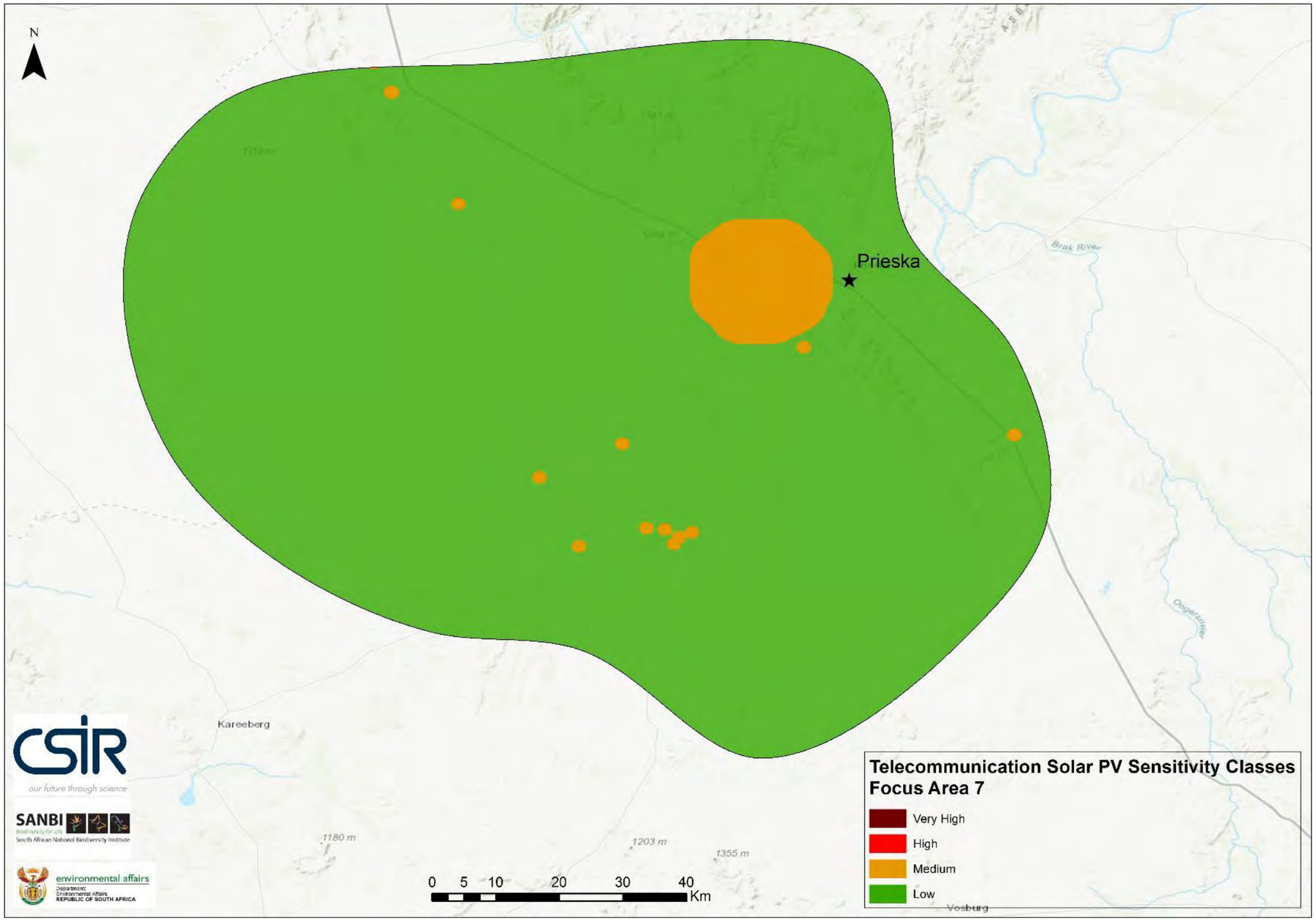

Figure 10: Telecommunication sensitivity for solar PV energy development in FA 7

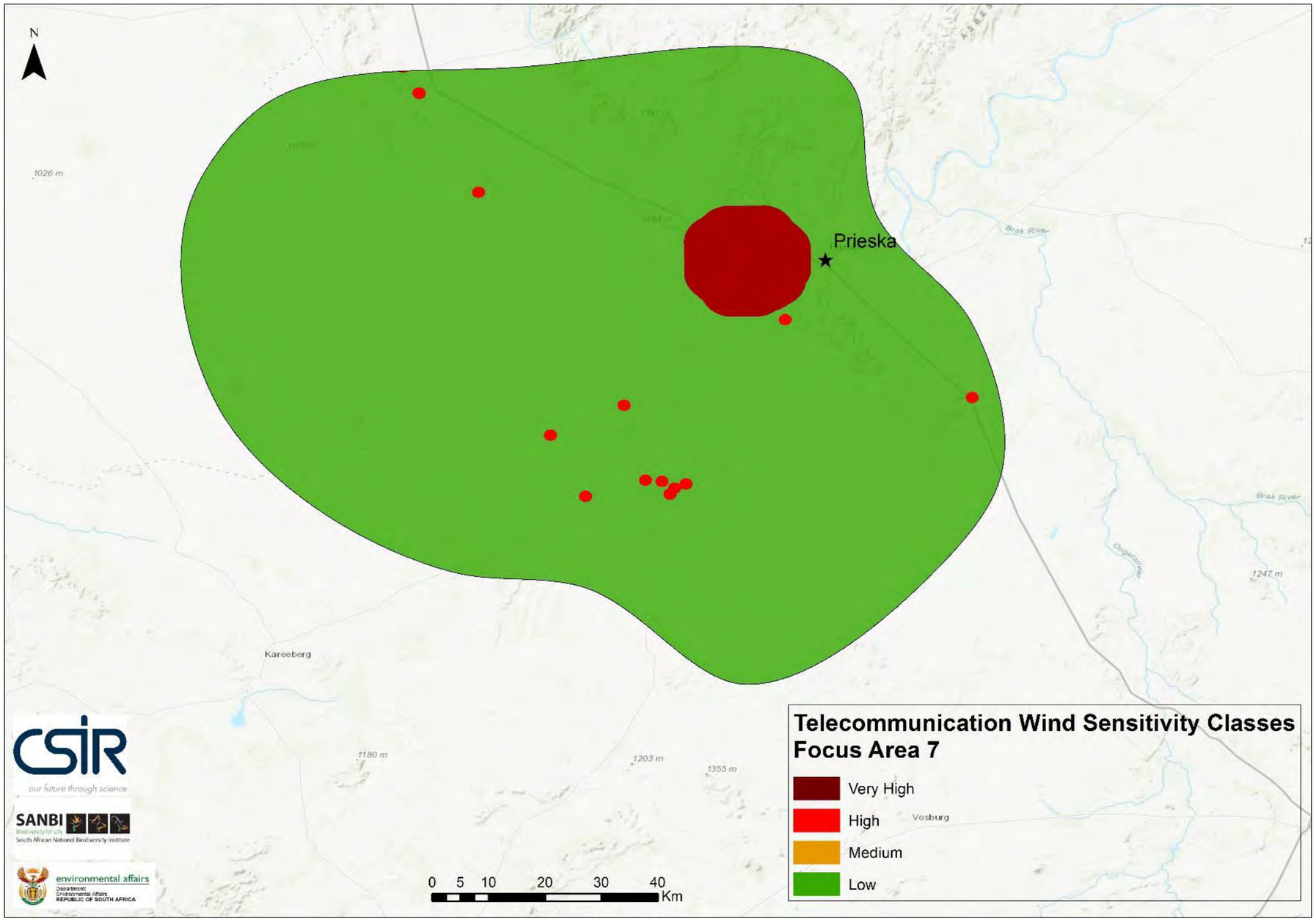

Figure 11: Telecommunication sensitivity for wind energy development in FA 7

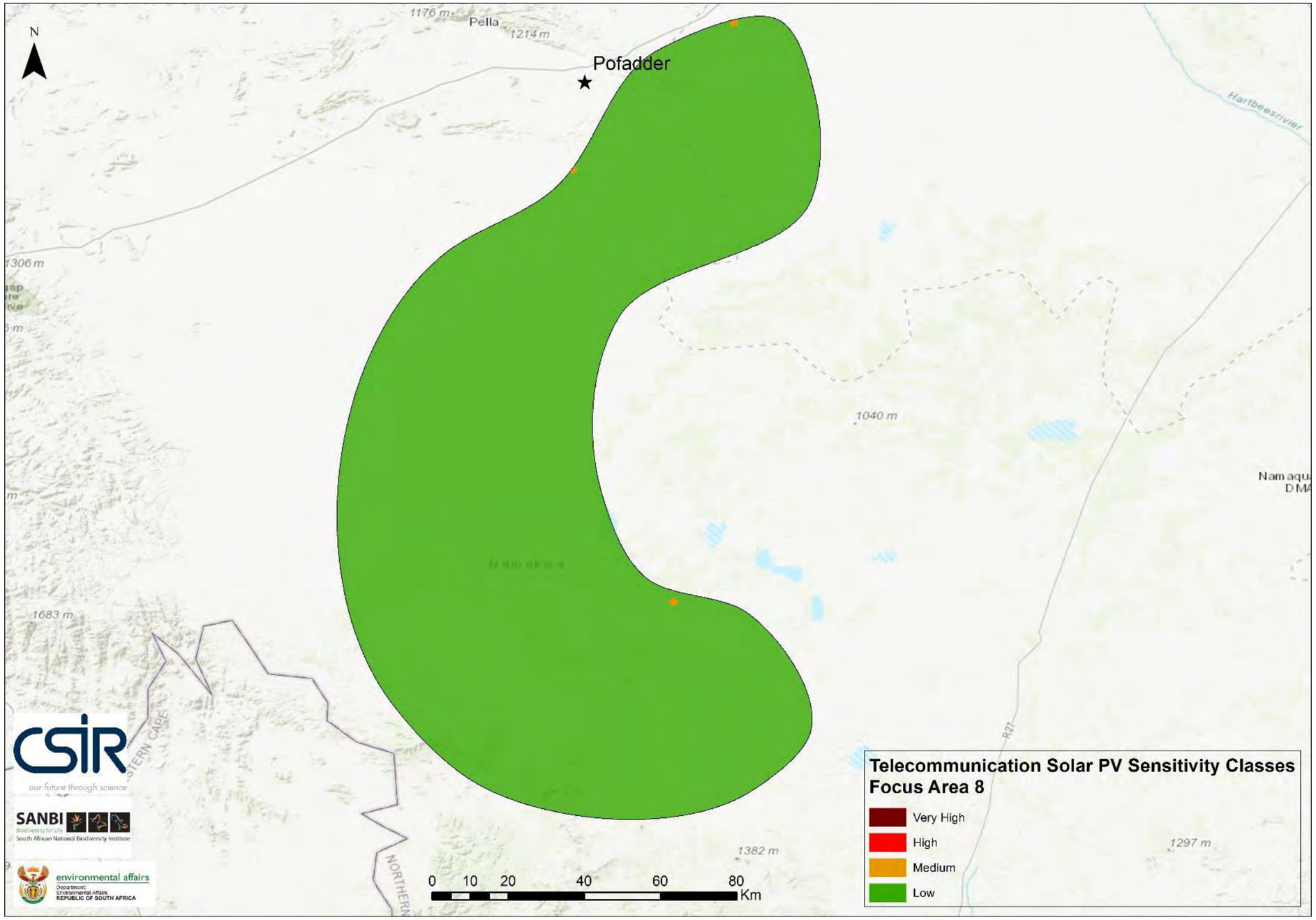

Figure 12: Telecommunication sensitivity for solar PV energy development in FA 8

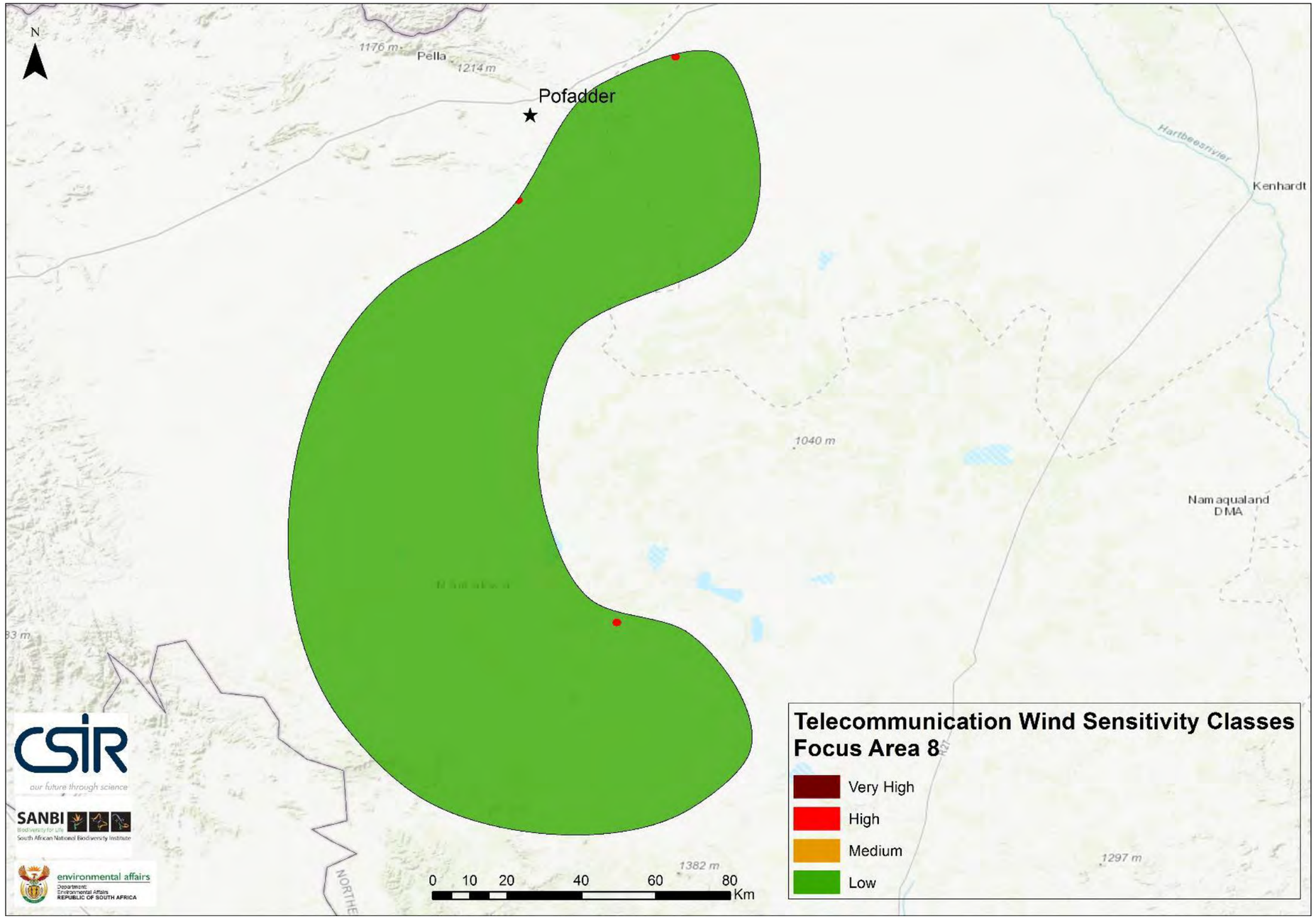

Figure 13: Telecommunication sensitivity for wind energy development in FA 8

3.11.4 Development Protocols

Considering that spatial data for high powered terrestrial broadcasting facilities operated by only one company (i.e. Sentech) are available, and the fact that the other telecommunication facility data were derived from the SACAA obstacle database and may include obstacles other than telecommunication facilities, the main objective of this section is to provide indicative spatial sensitivities of wind and solar PV developments on broadcasting and telecommunication services. Sensitivity classes for wind and solar PV developments are interpreted in Table 2. These requirements are related to the sensitivity maps in sub-Section 11.2 and will be applicable to developments proposed both inside and outside the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs). There are no proposed development protocol for this theme at this stage an applicants should ensure Sentech is consulted should development fall in any sensitive areas.

Table 2: Interpretation of telecommunication sensitivity maps

Colour	Sensitivity	Interpretation of the sensitivity	Further wind and solar PV assessment requirements
Dark red	Very High	In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	Proponents intending to develop a wind or solar PV facility that triggers an environmental assessment process anywhere in South Africa must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on telecommunication services. In order to do so, the proponent must request comment from Sentech, and any other stakeholder operating telecommunication facilities in the vicinity of the proposed development. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.
Red	High	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
Orange	Medium	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	
Green	Low	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	

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PART 3.12

VISUAL

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.12 VISUAL

The following section is informed by a high-level specialist visual assessment of the eight Focus Areas (FAs), for which the complete report is provided as Appendix A4.

This assessment builds on the previous Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015), aimed to facilitate the efficient rollout of wind and solar PV energy. The Phase 2 scoping visual assessment focused on utilising existing information to anticipate the impacts of wind and solar PV facilities on the country's scenic resources and on sensitive receptors, as well as suggesting mitigation measures and identifying thresholds for cumulative impacts.

3.12.1 Renewable Energy and Landscapes

Renewable energy is an increasingly important tool in providing energy services and mitigating climate change, as well as contributing to socio-economic development in rural areas. It is, however, also important that the planning and installation of wind and solar photovoltaic (PV) facilities must be undertaken in a manner that minimises the impact on South Africa's natural and cultural landscape. Renewable energy facilities, including supporting infrastructure such as power lines, can be regarded as highly visual structures, with perceivable impacts on the landscape. The natural and cultural landscape characteristics generally encompass visual, scenic, aesthetic and amenity values, which contribute to the overall 'sense of place' of an area. While landscape components are, to some extent, easy to measure as physical aspects, landscapes and landscape perceptions are also regarded as being complex. This is attributed to the notion that the same physical landscape can be interpreted, perceived and reflected on in different ways by different actors, in different social positions[1]. Wind turbines in particular are tall structures that can be visible from long distances and have potential visual impacts and associated impact on 'sense of place' and the landscape.

The installation of high wind power structures influences the scenery, and solar facilities require spacious open land. According to the Scottish Natural Heritage Guideline[2] for siting and designing wind farms, the design and layout of the wind turbines have a significant influence on the landscape and visual impacts. The visibility and visual impacts of a wind farm depend on the distance from which it is viewed, weather conditions, turbine siting and the landscape context. In the past, several guidance documents have provided generic categories for the degrees of visibility and visual impact related to distance. These are however no longer considered beneficial due to current variation in turbine sizes and design. Wind turbines of between 100 – 150 metres (m) are regarded as visible at distances of up to 50 kilometres (km), and single turbines of up to 50m are visible at smaller distances[2].

The cumulative visual impact and impact on the landscape character of renewable energy development is of specific concern as the need for renewable energy becomes increasingly apparent in both the local and international context. It is therefore important to consider the potential cumulative impacts in order to gain a better understanding of these impacts and ultimately possible mitigation measures. The Scottish Natural Heritage Guideline[3] for cumulative effects of wind farms highlights the importance to undertake an assessment at a strategic level (such as this SEA) of the potential cumulative landscape and visual impacts associated with proposed development of wind farms. According to this Guideline, cumulative impacts on visual amenity can be largely influenced by two factors:

Combined visibility - where a static observer is able to see two or more facilities from one viewpoint, either within the observer's arc vision at the same time or that the observer has to turn to see them from a static viewpoint; and

Sequential effects - occur when several facilities are seen during a single journey, that is, when the observer is travelling along a road or footpath to see the different facilities.

The Phase 1 visual assessment included developing a methodology for evaluating potential cumulative impacts for wind and solar farms, intended for the broad regional scale level of an SEA. The assessment determined development density limits, taking to account the size and spacing of the wind and solar PV facilities, as guidelines for appropriate development in landscapes of varying sensitivities.

3.12.2 Sensitivity Mapping

The approach of the Landscape sensitivity assessment expands on that of the Landscape sensitivity study undertaken as part of the 2015 SEA for wind and solar energy. Sensitivity was determined as part of this study through interpretation, using criteria that influence the value of visual/scenic resources, and ultimately their significance. The criteria are considered spatially, with the addition of buffers, based on the relative sensitivity of the feature or receptor. The study categorises four levels of sensitivity, that is, very high, high, medium and low sensitivity. The criteria considered for the sensitivity levels determination includes visually sensitive landforms and water features, proclaimed or protected areas such as national parks or nature reserves, visually sensitive receptors such as settlements and routes, as well as heritage resources. Table 1 below contains features and criteria considered during the visual assessment, as well as the sensitivity rating with buffers, providing the basis for the sensitivity mapping.

[1] Henningson et al. (2013) The Effects of Wind Power on Human Interests. Available from: http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6545-4.pdf

[2] Scottish Natural Heritage (2017) Siting and Designing Wind Farms in the Landscape Guidance. Available from: https://tethys.pnnl.gov/sites/default/files/publications/SNH-2017-Siting-Designing-Wind.pdf

[3] Scottish Natural Heritage (2012) Assessing the Cumulative Impact of Onshore Wind Energy Developments. Available from: https://www.nature.scot/assessing-cumulative-impact-onshore-wind-energy-developments

Table 1: Spatial data used in the landscape scoping assessment

Sensitivity Feature Class	Data Source & Date of Publications	Sensitivity Mapping Application			
		Wind	Wind Buffer Distance	Solar PV	Solar Buffer Distance
Topographic features, including mountain ridges	- Inferred from Digital Elevation Model (DEM), 2015, National Geospatial Information (NGI).	- **Very High Sensitivity**	- 0 - 500m	- **Very High Sensitivity**	- 0 – 250m
Steep slopes	- Modelled from DEM, 2015, NGI.	- **Very High Sensitivity** areas with slopes of more than 1:4 - **High Sensitivity** areas with slopes between 1:4 and 1:10	- Feature - Feature	- **Very High Sensitivity** areas with slopes of more than 1:4 (25%) - **High Sensitivity** areas with slopes between 1:4 and 1:10	- Feature - Feature
Major rivers, water bodies perennial rivers and wetlands with scenic value as identified by landscape specialists	- National Freshwater Ecosystem Priority Areas (NFEPA) 2011	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 0 – 250m - 250 – 500m	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 0 – 250m - 250 – 500m
Coastal zone	- Surveys and Mapping 1:50 000 topographical maps of South Africa	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 - 1km - 1 – 2km - 2 – 4km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 1km - 1 - 2km - 2 – 3km
Protected Areas : National Parks	- South African Protected Areas Database (SAPAD) – Q2, 2017, SANParks	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 5km - 5 - 10km - 10 – 15km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 2km - 2 – 4km - 4 – 6km
Protected Areas: Nature Reserves	- SAPAD – Q2, 2017 - South African Conservation Areas Database (SACAD) – Q1, 2017	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 3km - 3 – 5km - 5 – 10km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 1km - 1 – 2km - 2 – 3km

Sensitivity Feature Class	Data Source & Date of Publications	Sensitivity Mapping Application			
		Wind	Wind Buffer Distance	Solar PV	Solar Buffer Distance
Private reserves and game farms	- Provincial Private Reserves/Conservation Areas and Game Farms	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 1.5km - 1.5 – 3km - 3 – 5km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1 – 2km
Cultural landscapes	- Not mapped	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- Feature - 0 - 500m - 500m – 1km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- Feature - 500m – 1km - 1 – 2km
Heritage Sites Grades I, II and III	- SAHRA, 2015	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- Feature - 0 - 500m - 500m – 1km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- Feature - 0 - 500m - 500m – 1km
Towns and villages	- AfriGIS SG Towns, 2017	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 2km - 2 – 4km - 4 – 6km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1 – 2km
National roads	- NGI, 2016	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 1km - 1 – 2.5km - 2.5 – 5km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1 – 2km
Scenic routes	- Western Cape Department of Transport, 2013	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 1km - 1 – 2.5km - 2.5 – 5km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1 – 2km

Sensitivity Feature Class	Data Source & Date of Publications	Sensitivity Mapping Application			
		Wind	Wind Buffer Distance	Solar PV	Solar Buffer Distance
Provincial and arterial routes		- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1km – 3km	-	
Passenger rail lines		- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 500m - 500 – 1km - 1 – 3km	- **Very High Sensitivity** - **High Sensitivity** - **Medium Sensitivity**	- 0 – 250m - 250 – 500m - 500 – 1km
Small airfields	- REDZs 1 SEA dataset, EGI SEA dataset, 2015	- **Very High Sensitivity**	- 0 – 3km	- **High Sensitivity**	- 0 – 3km
Square Kilometre Array (SKA) corridors	- Square Kilometre Array SEA	- **Very High Sensitivity**	- 0 – 36km	- **Very High Sensitivity**	- 0 – 16km

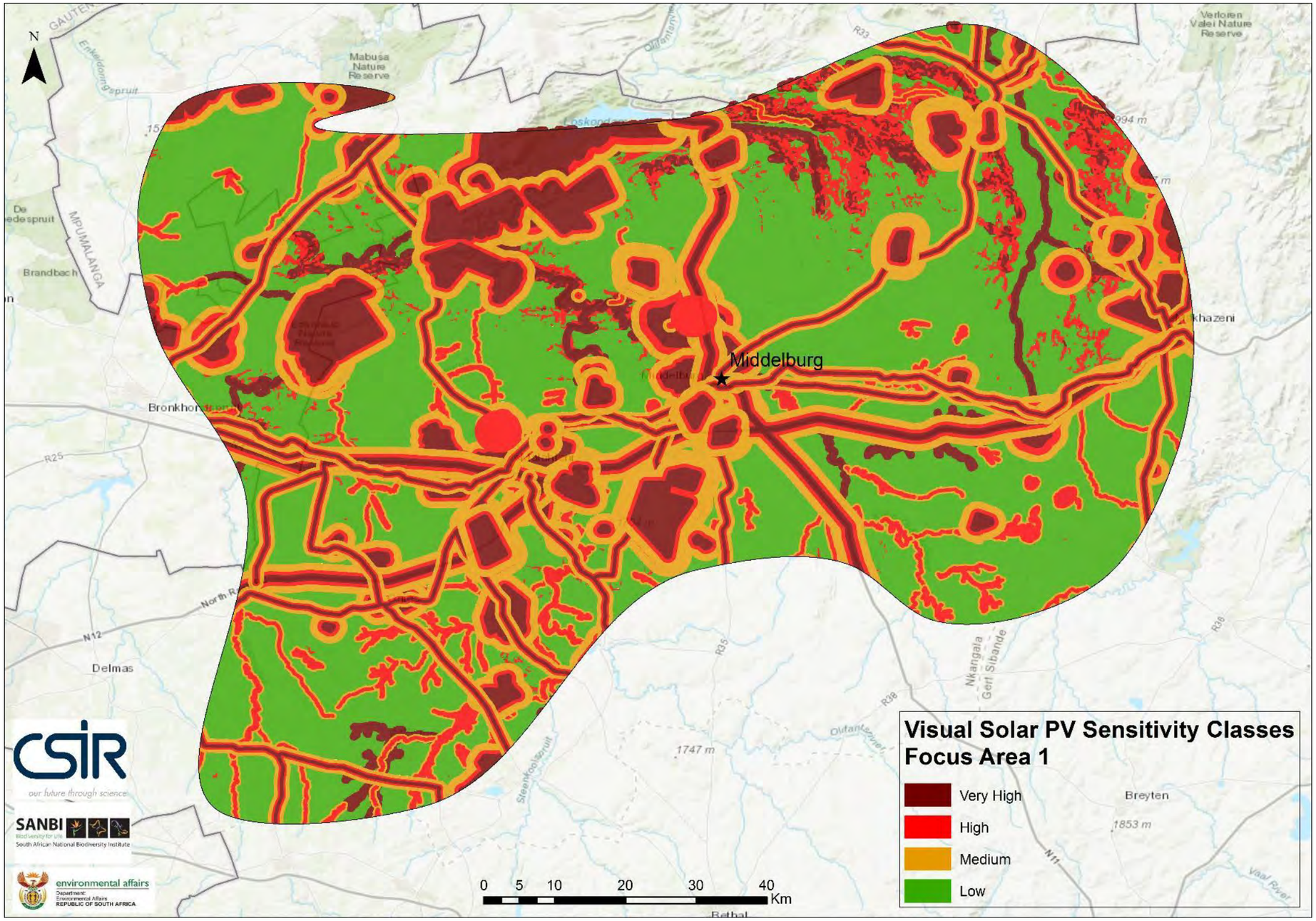

Figure 1: Visual sensitivity map for solar PV development in FA 1

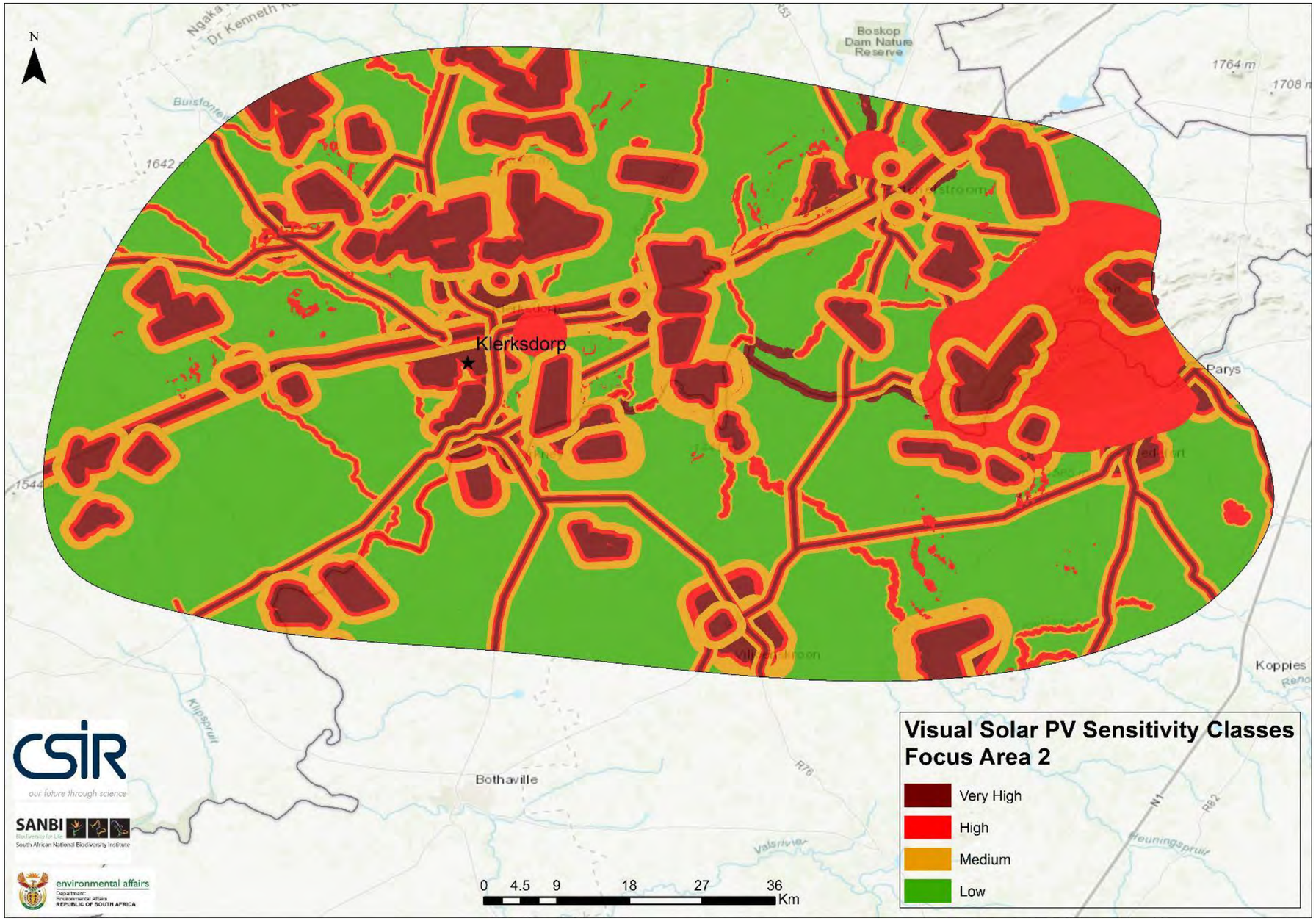

Figure 2: Visual sensitivity map for solar PV development in FA 2

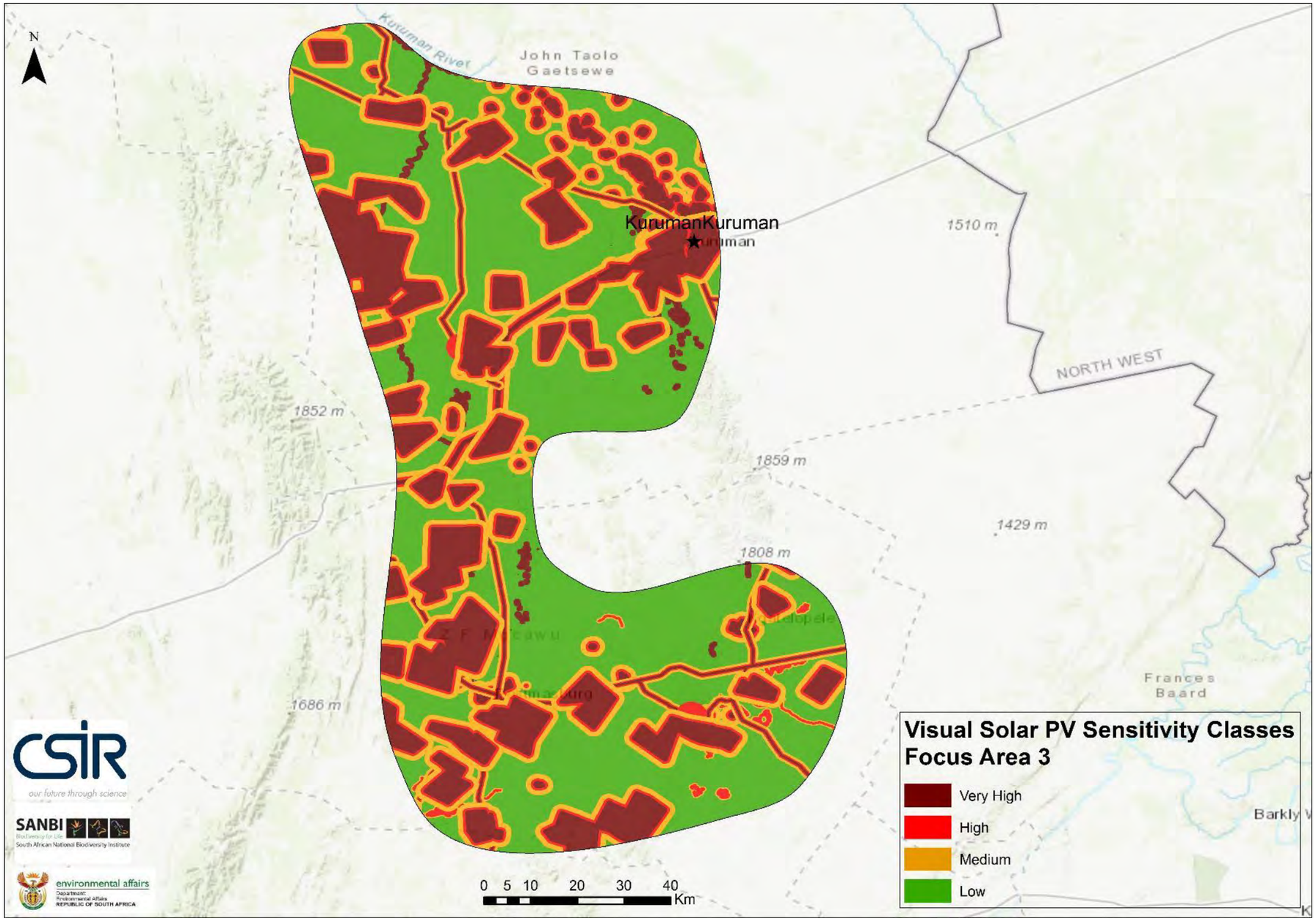

Figure 3: Visual sensitivity map for solar PV development in FA 3

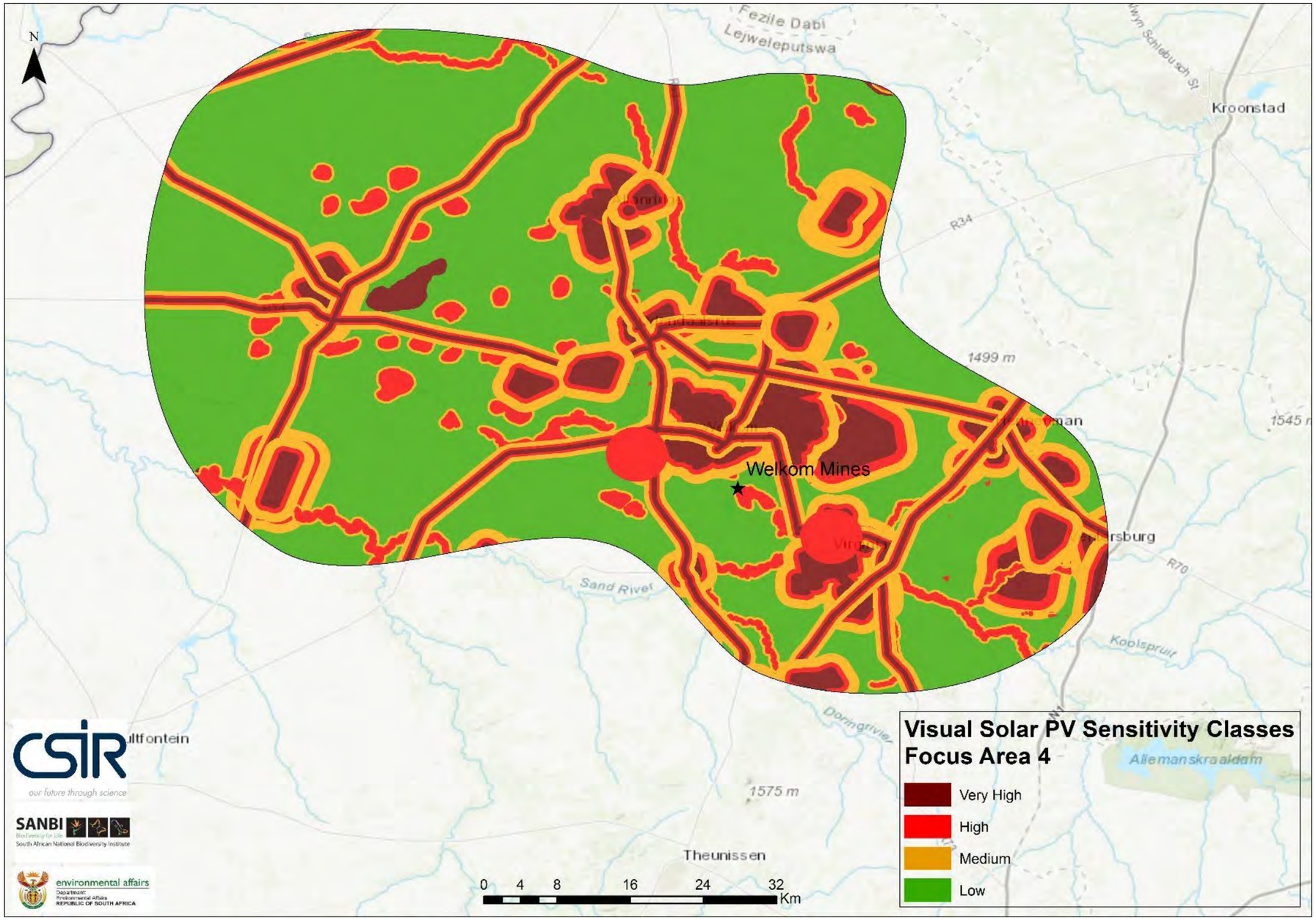

Figure 4: Visual sensitivity map for solar PV development in FA 4

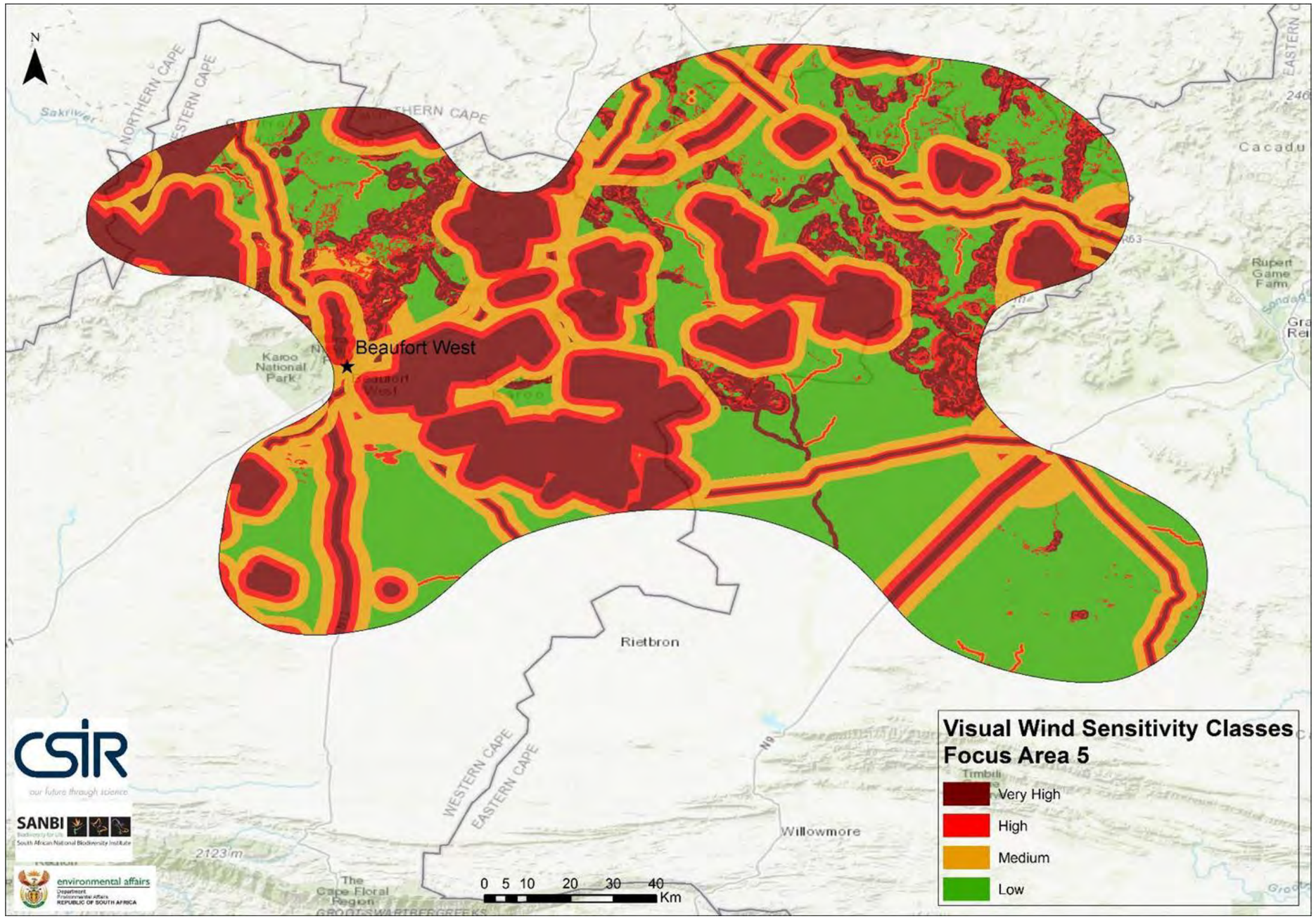

Figure 5: Visual sensitivity map for wind development in FA 5

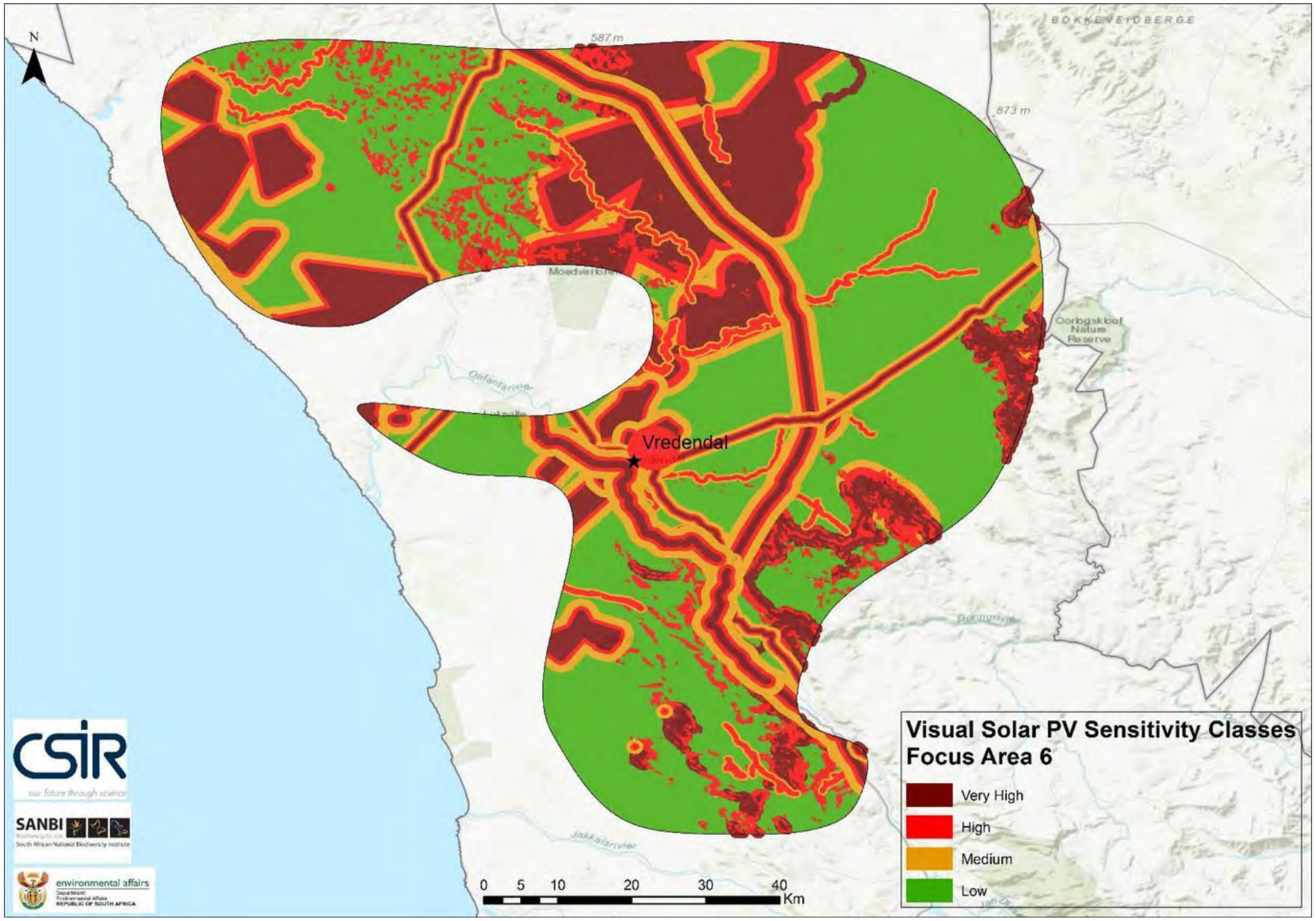

Figure 6: Visual sensitivity map for solar PV development in FA 6

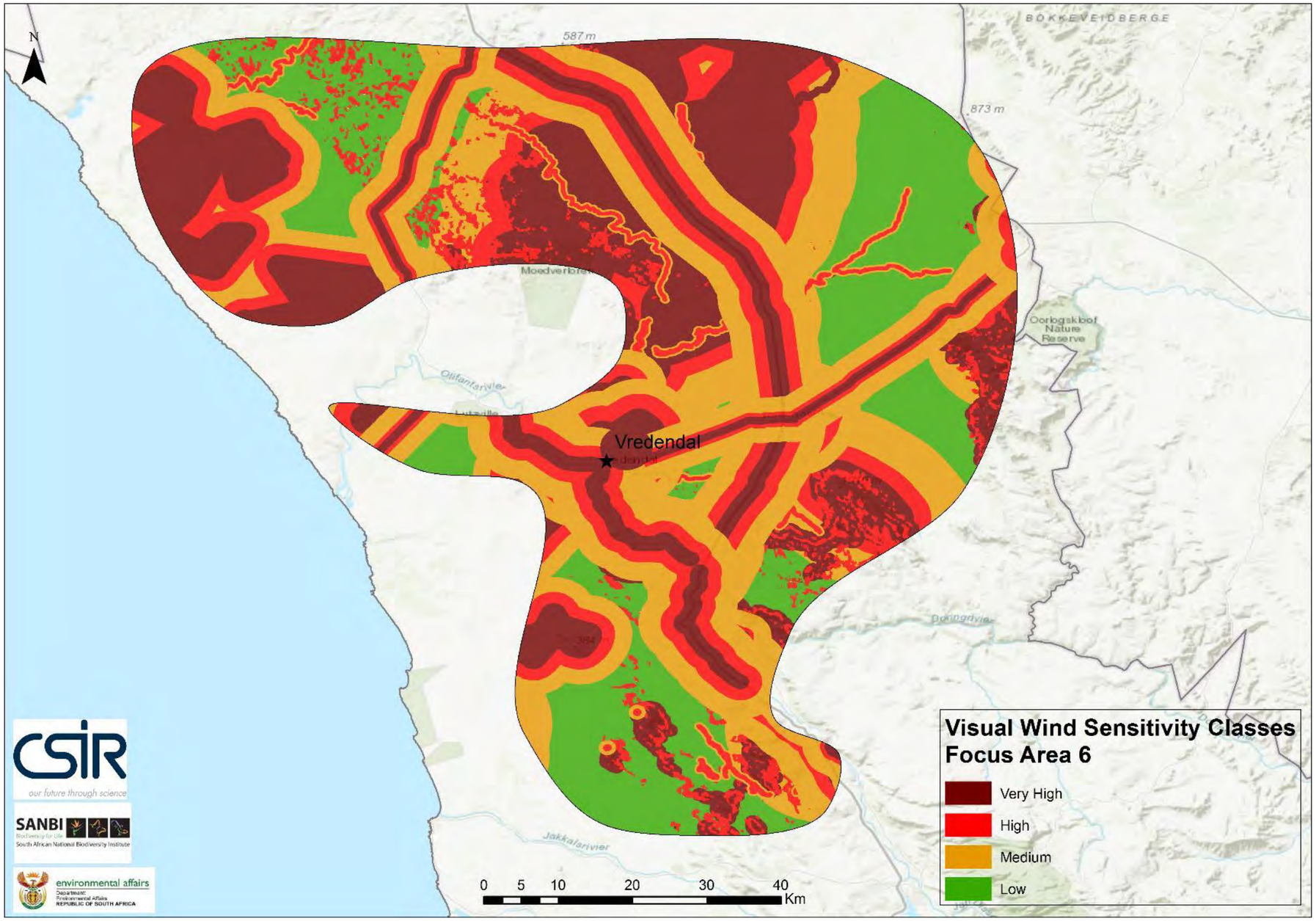

Figure 7: Visual sensitivity map for wind development in FA 6

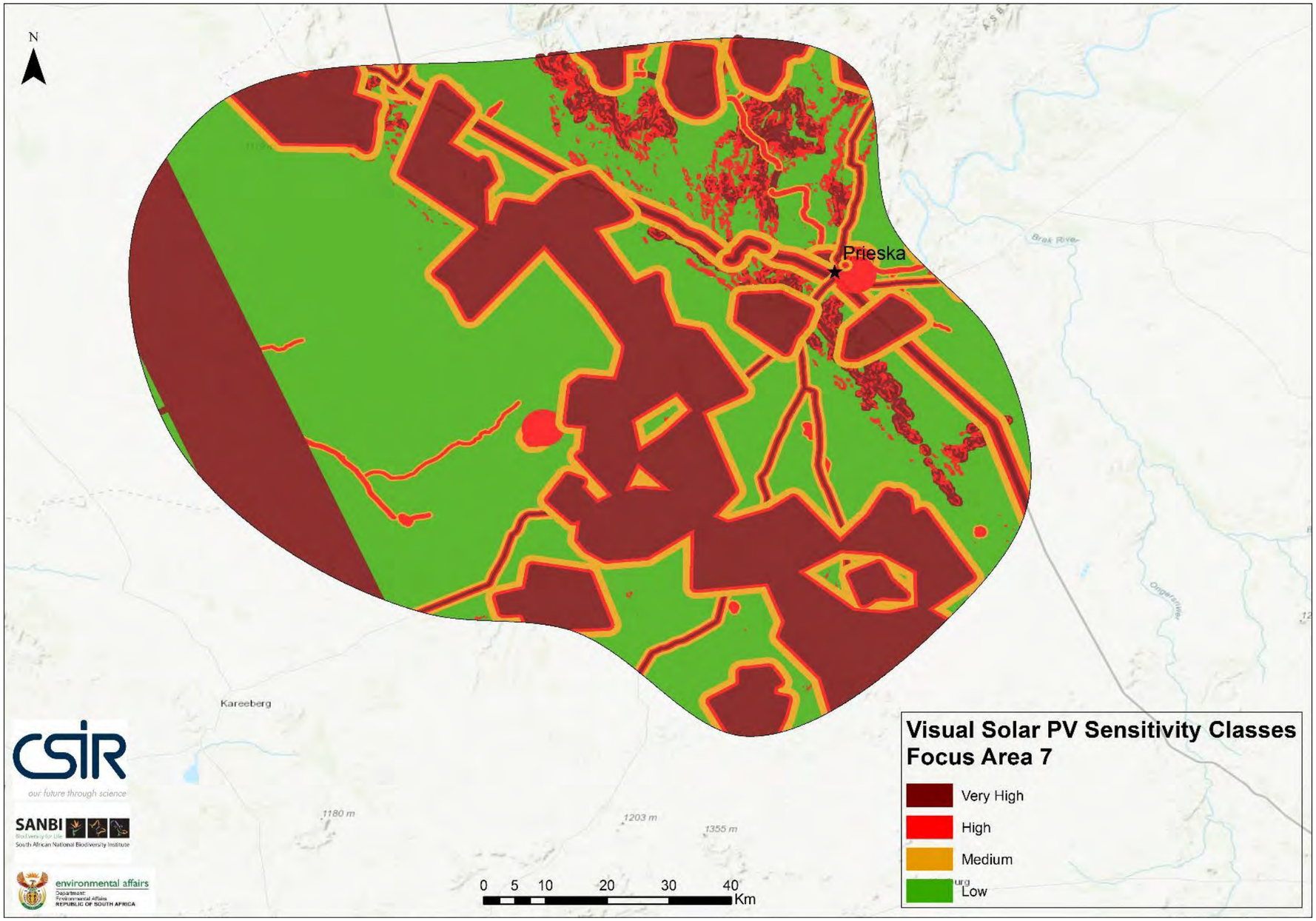

Figure 8: Visual sensitivity map for solar PV development in FA 7

Figure 9: Visual sensitivity map for wind development in FA 7

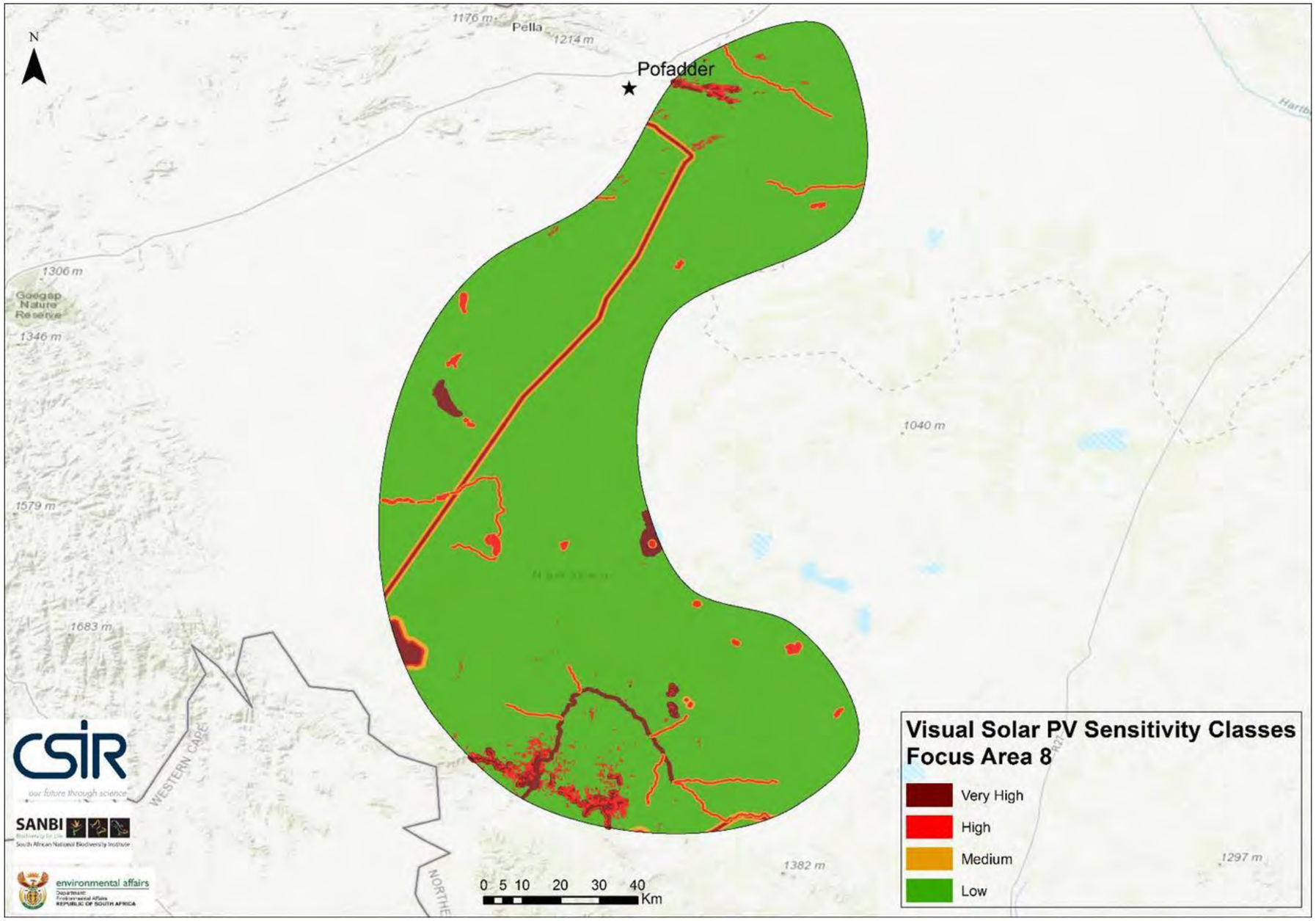

Figure 10: Visual sensitivity map for solar PV development in FA 8

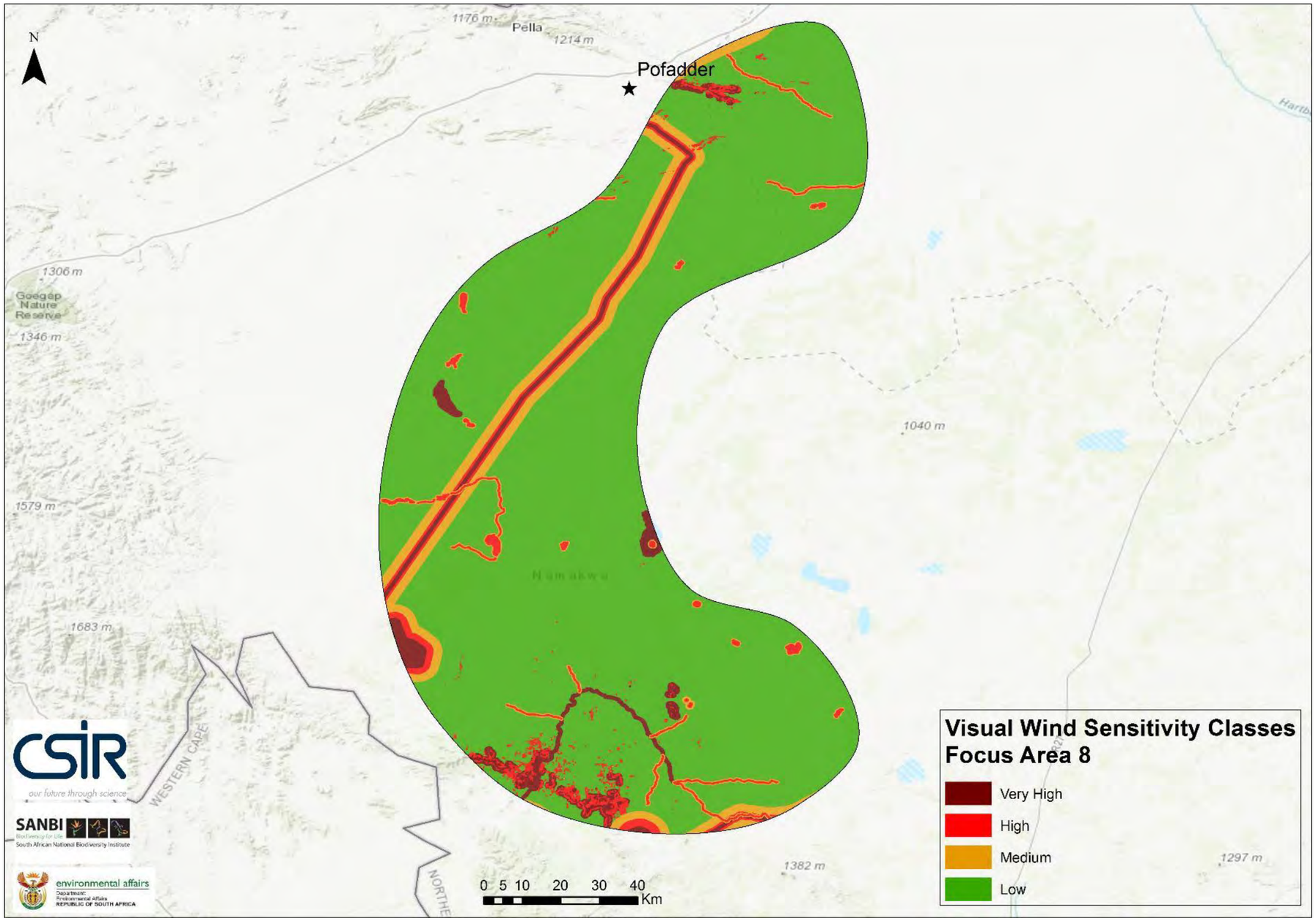

Figure 11: Visual sensitivity map for wind development in FA 8

3.12.3 Potential Visual Impacts and Management Actions

This section lists key impacts within each of the Focus Areas, as well as possible management actions to avoid or minimise potential visual impacts.

Table 2: Impacts and mitigations for each Focus Area

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.
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.
	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.

Focus Area	Potential Impacts	Typical Locations	Possible Effects	Management Actions
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 area south of Pofadder	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.
	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.

3.12.4 Determination of the Potential Visual Cumulative Impacts

The Visual Assessment undertaken as part of the Phase 1 Wind and Solar SEA included developing a methodology for evaluating potential visual cumulative impacts for wind and solar farms. This involved determining a suitable development density for each threshold of visual sensitivity, as well as determining the development clustering in relation to the threshold levels.

3.12.4.1 Development Density

The levels of landscape sensitivity determine the potential for the location of wind and solar PV facilities, thus determining a suitable development density for each threshold of visual sensitivity. The guidelines for development density indicated in **Error! Reference source not found.** apply to visual sensitivity for wind and solar energy developments.

Table 3 : Guideline for Development Density for Wind and Solar PV Energy

Threshold	Development density
Level 1 Very high sensitivity	Further assessment required before development can be considered
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.

3.12.4.2 Development Clustering

The development clustering takes into account the size and spacing of wind or solar PV facilities in relation to the threshold of visual sensitivity indicated in **Error! Reference source not found.**. These together assist in determining an acceptable level of development density in terms of mitigating cumulative visual impacts for wind and solar PV projects as indicated in Table 4 and Table 5. Therefore the size of wind and solar PV facilities would vary according to the visual sensitivity of the area.

Table 4: Size and spacing of wind farm clusters

Development density limit	Recommended cluster limit [4]	Approx. footprint/ cluster[5]	Buffer between clusters
Very high sensitivity	Further assessment required before development can be considered		
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	

Table 5: Size and spacing of solar PV farms

Development density limit	Recommended solar PV farm size limit	Buffer between solar PV farms
Very high sensitivity	Further assessment required before development can be considered	
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)	

[4] Assumes turbine hub height of 120m and rotor diameter of 130m. Larger turbines may result in fewer number of turbines.

[5] Assumes average area of 60 ha per turbine. This is the net footprint of the cluster, excluding site constraints.

3.12.5 Recommended Visual Assessment Protocols

This section provides a guideline on the interpretation of the sensitivity classes and the recommended level of visual assessment for wind and solar PV developments. It is important to note, however, that the specific circumstances of each project application need to be taken into account.

Table 6: Interpretation of sensitivities and the recommended assessment requirements

Sensitivity Class	Interpretation	Assessments at project level[6]
Very High (dark red)	Visually sensitive resources with major visual constraints and/or protected areas or sensitive receptors. (Very high potential visual impact). Very high potential visual impact are characterised by: • 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.	A **Level 4** specialist visual assessment. (Visual Impact Assessment with alternatives, management actions and 3D modeling / montages.
High (red)	High level of visual constraints and/or proximity of protected areas or sensitive receptors. (High potential visual impact). High potential visual impact are characterised by: • Intrusion on intact landscape or scenic resources; • Noticeable change in visual character of the area; • Creates a new precedent for development in the area.	A **Level 3** specialist visual assessment. (VIA with recommended management actions).
Moderate (orange)	Moderate level visual constraints and intermediate proximity of protected areas / sensitive receptors. (Moderate potential visual impact). Moderate potential visual impact are characterised by: • Some effect on intact landscape or scenic resources; • Some change in visual character of the area; • Adds to development in the area.	A **Level 2** specialist visual assessment. (Basic assessment with recommended management actions).
Low (green)	Few visual constraints and/or sensitive receptors. Disturbed or transformed land. (Minimal potential visual impact). Minimal potential visual impact are characterised by: • 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.	A **Level 1** specialist visual assessment. (Site visit and statement by a visual specialist).

[6] 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).

PHASE 2 STRATEGIC ENVIRONMENTAL ASSESSMENT
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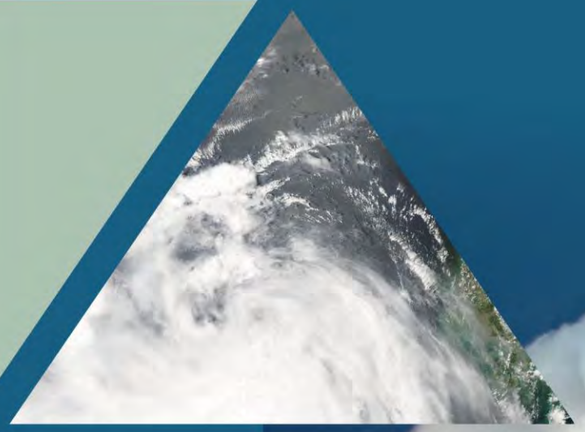
PART 3.13

WEATHER

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

3.13 WEATHER SERVICES

3.13.1 Renewable Energy and Weather Radar

An ongoing concern in terms of the development of wind and solar facilities is the potential for these facilities to interfere with nearby radar systems. Although solar PV development is generally considered not to have an impact on weather surveillance radar, wind turbines are known to affect radar systems. The rotating blades of wind turbines can severely affect the performance of surveillance radars used for defence and civilian air traffic control, as well as radar systems used for weather purposes[1]. The large size of wind turbines combined with their rotating blades cause interference as these rotating blades create a signal that is similar to radar signatures interpreted by weather radar systems. Interference types identified when wind turbines are located in the line of sight of Doppler weather radars include clutter, blockage, and erroneous velocity measurements. Considering the importance of weather radars as a meteorological tool, it is therefore necessary to understand the impact of wind turbines on radars, and to ensure that the location of wind energy facilities does not pose a disturbance to radar systems.

3.13.1.1 Summary of Impacts

As noted by the Radar Operations Centre in Norman, Oklahoma[2], wind turbines can affect radar systems by blocking the radar beam, causing energy reflections and appearing as "clutter" contaminating reflectivity, and also impacting velocity and radar spectrum width data. These can cause increasing uncertainty in weather readings and decrease accuracy in weather forecast data. These impacts are strongly marked when wind turbines are located in close proximity to radar systems, particularly within 18 km of a weather radar. There is also potential to cause damage to both the radar and turbine electrical components when located as close as within 200 m of a radar, as well as potential exposure to high microwave energy for construction or maintenance workers.

3.13.2 Sensitivity Mapping

The weather radar sensitivity criteria follows that determined for the 2015 Phase 1 SEA (DEA, 2015). It includes a spatial representation of South Africa's 14 weather radars and considers impact sensitivity as a function of distance from weather radars. The weather radar sensitivity criteria presented in Table 1 has therefore been determined for wind development and applied to the 14 radars to produce a national sensitivity map (Figure 1).

In relation to the focus areas, only two of the eight focus area overlap with a weather radar sensitivity class other than that of Low sensitivity. Focus Area 1 overlaps with a weather radar sensitivity class of Medium sensitivity, and Focus Area 2 overlaps with a weather radar sensitivity class of Very High, High and Medium sensitivity.

Table 1: Weather radar sensitivity criteria for wind development

Distance from weather radar	Sensitivity	Colour
Within 18 km	**Very High**	
Between 18 and 30km, and within the radar's line of sight*	**High**	
Between 30 and 60 km and within the radar's line of sight	**Medium**	
More than 60 km	**Low**	

*Where required (i.e. within 60 km of a radar site), viewsheds will need to be determined at a project level.

[1] Norin, L. and Haase, G. 2012. Doppler Weather Radars and Wind Turbines. 10.5772/39029. Accessed from: https://www.researchgate.net/publication/224829986_Doppler_Weather_Radars_and_Wind_Turbines

[2] Vogt, R.J., Crum, T.D., Greenwood, W., Ciardi E.J., Guenther, R.G. (2011) New Criteria for Evaluating Wind Turbine Impacts on NEXRAD Radars. Preprints, WINDPOWER 2011, American Wind Energy Association Conference and Exhibition, Anaheim, CA. Accessed from: http://www.roc.noaa.gov/WSR88D/Publicdocs/WINDPOWER2011_Final.pdf

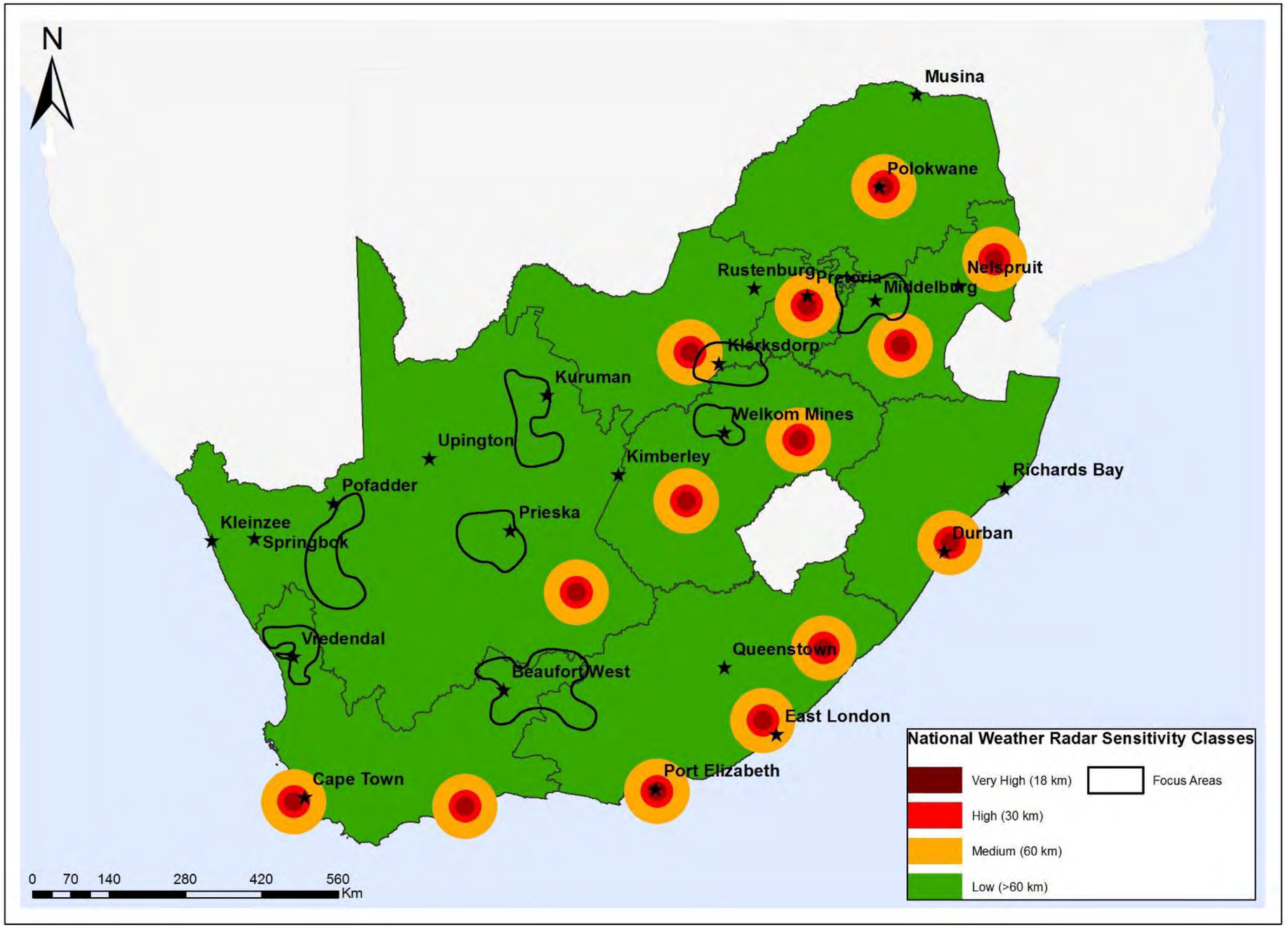


Figure 1: National weather radar sensitivity map for wind development.

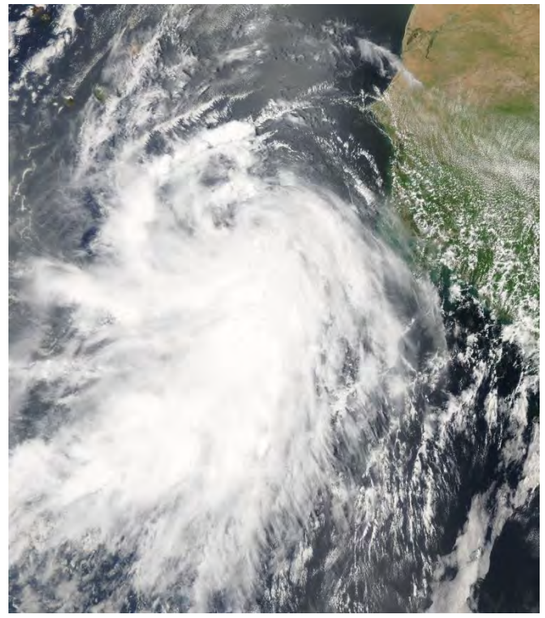
*Note: It is only Focus Area 1 and Focus Area 2 that overlap with weather radar sensitivity classes other than that of Low sensitivity.Figure 2: Weather radar sensitivity map for wind energy development in Focus Area 1.

3.13.3 Development Protocols

The main objective of this section is to clarify the different levels of sensitivity with respect to potential impacts of wind and solar PV developments on weather surveillance radars. There are no specific assessment requirements for impacts on weather radar. Applicants should consult with SAWS for comment should their development be in an area which may impact weather radars.

Table 2: Interpretation of sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity
Dark red	**Very High**	In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.
Red	**High**	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.
Orange	**Medium**	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.
Green	**Low**	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.



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

PART 4

RENEWABLE ENERGY DEVELOPMENT ZONES (REDZs)

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INTRODUCTION

This section of the report presents the analysis that led to three focus areas being recommended to be adopted as REDZs. A summary is provided of the existing and proposed generation capacity within these three REDZs, as well as showing projects in these new REDZs with preferred bidder status and existing Environmental Authorisations. Then, in order to understand the ability of new projects to connect to the grid, a summary is provided of the current transmission substations in the proposed REDZs and their remaining capacity to evacuate power from additional renewable energy projects. Lastly, the three proposed additional REDZs are shown within the context of the existing eight REDZs and the power corridors that were gazetted in 2018.

PART 4. SELECTION OF FINAL REDZS

The selection of the final three proposed REDZs was based on the outcomes of the scoping level assessments, the presence of abandoned and dormant mines, proximity to areas of high energy demand, a second iteration of the industry prioritisation exercise and relevant comments from the public commenting period on the eight focus areas during the course of this SEA. This section details how the three REDZs were chosen, the key environmental sensitivities in the REDZs, the existing and proposed generation capacity and the current evacuating capacity in the proposed REDZs.

The eight focus areas are listed below, with names of major town(s) in the area or nearby as a reference:

- FA1 – Emalahleni / Witbank
- FA2 – Klerksdorp
- FA3 – Sishen / Postmasburg
- FA4 – Welkom
- FA5 – Beaufort West / Murraysburg
- FA6 – Vredendal
- FA7 – Prieska
- FA8 – between Pofadder and Loeriesfontein

4.1.1 Industry Prioritisation exercise

A second industry survey exercise was undertaken in July 2019 with members of SAPVIA and SAWEA to determine which of the eight focus areas were the most preferable in terms of their current and future development plans. The survey requested industry members to rate the focus areas from most favourable for wind and most favourable for solar PV. The results were aggregated by SAWEA and SAPVIA to remain anonymous. The results of this survey can be seen in Figure 1. This shows that Focus area 5 was the most preferable from a wind perspective and focus areas 1 and 2 were the most favourable from a solar PV perspective. Note that Focus area 8 received no votes and is therefore not shown.

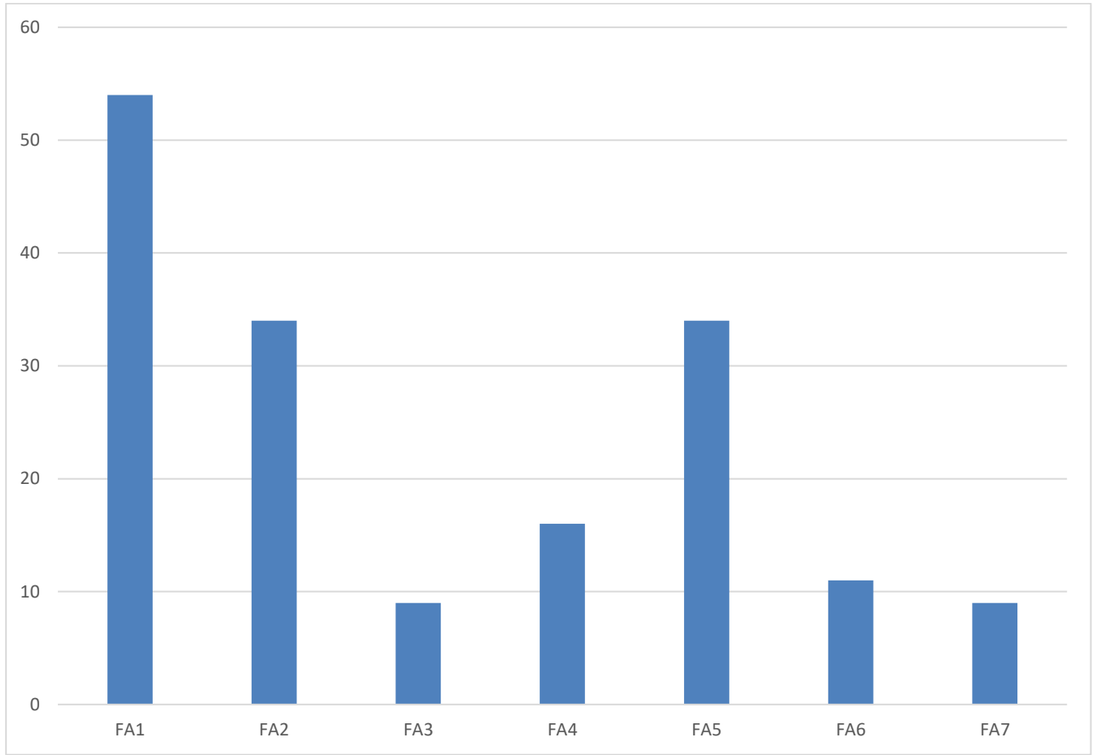

Figure 1: Outcomes of industry prioritisation exercise

4.1.2 Scoping Level Assessment:

The detailed outcomes of the scoping level of assessments of the focus areas can be found in Appendix B and in Part 3 of this report. Key sensitive features are summarised in Table 1. From a planning perspective, Table 2 contains a summary of the sensitivities and outcomes of some key considerations.

Table 1: Summary of key sensitivities in each focus area for environmental themes

Specialist Assessment	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
Agriculture	• Moderate to high land capability (8-10) • Land use conflicts are not likely due to availability of abandoned mines and other disturbed areas	• Land capability values of 7, 8 and 9 • *Land use conflicts are not likely due to availability of abandoned mines and other disturbed areas*	• Low to moderate land capability low land capability value of 5	• Land capability is mostly class 9 as moderate to high	• Very low to moderate land capability 1 to 5, 6 to 7 in some areas	• Land capability is mostly class 5, with some areas at 1 to 4	• Low land capability value of 5	• Very low to moderate land capability mostly class 5, with some areas at class 1 to 4 and class 6 to 7
Bats	• The highest potential of bat species of conservation importance occurrence – • Not an issue for solar PV	• Cave-forming Dolomite geology. • Roosting potential exists in caves, rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and smaller wetlands. • Defunct underground mines	• Cave-forming Dolomite patches. • Known bat roosts are found in this FA, with many more potential roosts in the Dolomite and tunnels/ adits in defunct mines	• Roosting potential exists in rock outcrops, trees and buildings and foraging potential over the irrigated lands, rivers and extensive wetlands	• 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	• The Succulent Karoo is a low bat activity ecoregion. • Bat activity will be highest near rock outcrops, irrigated agricultural areas, rivers and wetlands	• Cave-forming Dolomite geology in the eastern parts, the sedimentary rock, the river and the scattered wetlands • Roosting potential exists in 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	• Besides sedimentary rock outcrops and scattered ephemeral wetlands, there are no major habitat features of concern for bats in this FA
Biodiversity Note: all FAs include CBAs and FEPA Priority areas. These would require ground truthing. Applicants are encouraged to avoid priority areas and CBAs and identify already disturbed areas.	• A number of private nature reserves contained in the focus area • Land use conflicts are not likely due to availability of abandoned mines and other disturbed areas	• Private nature reserves contained in the focus area • Vredefort Dome • Land use conflicts are not likely due to availability of abandoned mines and other disturbed areas	• CBAs and FEPA Priority areas	• CBAs and FEPA Priority areas	• Karoo national park outside boundary • CBAs and FEPA Priority areas	• Oorlogskloof Provincial Nature Reserve on eastern border of FA • CBAs and FEPA Priority areas	• CBAs and FEPA Priority areas	• CBAs and FEPA Priority areas
Birds	• Sensitive species include: cranes, African Grass Owl, Southern Bald Ibis and localised, red-listed endemics	• Sensitive species include: Amur Falcon and/or Lesser Kestrel roost sites	• Sensitive species include: Verreaux's Eagle • Great Pan and Rooipan in focus area.	• Flamingo Pan and Large river systems present in focus area	• Sensitive species include; Black Harriers, Verreaux's Eagle, Booted Eagle, Lanner Falcon, Peregrine Falcon and Black Storks	• CWAC sitesin focus area • Sensitive species include Black Harrier, Verreaux's Eagle, Martial Eagle, Lanner Falcon and Peregrine Falcon	• Sensitive species include Verreaux's Eagle, Tawny Eagle, Martial Eagle, Lanner Falcon, Lappet-faced Vulture and/or White-backed Vulture roosts	• Sensitive species include Red Lark , Black Harrier, Verreaux's Eagle, Martial Eagle • Large river systems in the focus area
Heritage	• Potential heritage features to be identified at EIA level	• Vredefort Dome • Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level	• Potential heritage features to be identified at EIA level
Visual	• Olifants (Lepelle) River Valley and tributaries. Loskop and Witbank Dams	• Vredefort Dome meteorite site • Faan Meintjies NR and a number of other	• Ga-Mogara River course, The Great Pan and Rooipan.	• Sand River. Numerous salt pans between Welkom and Wesselsbron	• Nuweveld, Onder Sneeuberg, Kamdebooberg and Toorberg mountain	• Olifants River Valley and tributaries including the Doring, Vars and Sout Rivers.	• Dolomitic Asbesberg and Doringberg mountains. Numerous rock outcrops in the open plains	• Krom River in the south and numerous pans throughout the Focus Area

Specialist Assessment	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
	• Loskop Dam NR, Botshabelo NR, Zemvelo NR and Rhenosterpoort NR • National Routes N4, N11 and N12, particularly the section of the N11 at the Loskop Dam	private reserves and game farms	Natural spring at Kuruman • Billy Duvenhage NR at Kuruman. Numerous private game farms	• Nature Reserve near Welkom incorporating the Doringpan, and several other small reserves	ranges, and numerous koppies • Edge of the Karoo National Park. Numerous private game farms. • *Visual sensitivity linked to game farms*	• Nature reserves in the Knersvlakte and game farms in the Hardeveld. • Northern end of the Cederberg, including the Gifberg. Granite domes of the Hardeveld.	• Orange River Valley and numerous pans to the south including Middelwater se Pan. • Numerous private game farms. • SKA arms Exclusion Corridors	• No known reserves or game farms, but the large pans are important features • Dolerite ridges and koppies, such as the Langberg to the south
Summary of suitability	•	•	•	•	•	•	•	•

Table 1: Summary of key outcomes of the planning aspects for focus areas

Specialist Assessment	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
Civil Aviation	• Not an issue for solar PV	• Not an issue for solar PV	• Not an issue for solar PV	• Not an issue for solar PV	• Major Civil Aviation Aerodromes in focus area	• Civil Aviation Aerodromes in focus area	• Major Civil Aviation Aerodromes in focus area	• Civil Aviation Aerodromes in focus area
Defence	• 1 Very High Defence site (military base)	• 1 Very High Defence site (military base)	• 3 Very High sensitivity Defence sites • Bombing range • Telecom transmission links • Forward airfield or Ammunition Depot	• 1 Very High Defence site	• 3 Very High Defence sites	• No very high defence sites in focus area	• 2 Very High Defence sites	• 1 Very High Defence site
Flicker	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines	• All focus areas contain receptors which may be impacted by the operation of wind turbines
Noise	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines	• All focus areas contain receptors which may be impacted by the construction and operation of wind turbines
Square Kilometre Array (SKA)	• Not applicable	• Not applicable	• Not applicable	• Not applicable	• Northern part of the focus area is impacted by spiral arm buffers	• Not applicable	• Large part of the focus area falls within the medium sensitivity spiral arms buffer	• Large part of the focus area falls within the medium sensitivity spiral arms buffer
Telecommunications	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities	• Sentech High Power Terrestrial Broadcasting Facilities
Weather	• Not an issue for solar PV	• Not an issue for solar PV	• Not an issue for solar PV	• Not an issue for solar PV	• Not an issue in FA 5	• Not an issue in FA6	• Not an issue in FA7	• Not an issue in FA8
Proximity to load centre (Gauteng area)	• Close to load centre	• Close to load centre	• Considerable distance to major load centres	• Close to load centre	• Moderate distance to major load centres	• Considerable distance to major load centres	• Considerable distance to major load centres	• Considerable distance to major load centres
Potential to utilise old mines	• High potential	• High potential	• High potential	• High potential	• Limited potential	• High potential	• Limited potential	• Limited potential
Existing infrastructure	• Existing infrastructure from mining activities	• Existing infrastructure from mining activities	• Existing infrastructure from mining activities	• Existing infrastructure from mining activities	• Limited grid and infrastructure	• Existing infrastructure from mining activities	• Limited grid and infrastructure	• Limited grid and infrastructure
Summary of suitability	•	•	•	•	•	•	•	•

4.1.3 Mining and Industrial Areas

One of objectives of the SEA was to identify areas in the country with previously mined land as possible areas for the development of large scale RE. Previously mined land is defined in this SEA as any area in the country with confirmed abandoned and closed mines and where mining is one of the key economic drivers of a municipality. As can be seen in Figure 2 below, Focus Areas 1, 2, 3, 4 and 6 contain a number of abandoned mines.

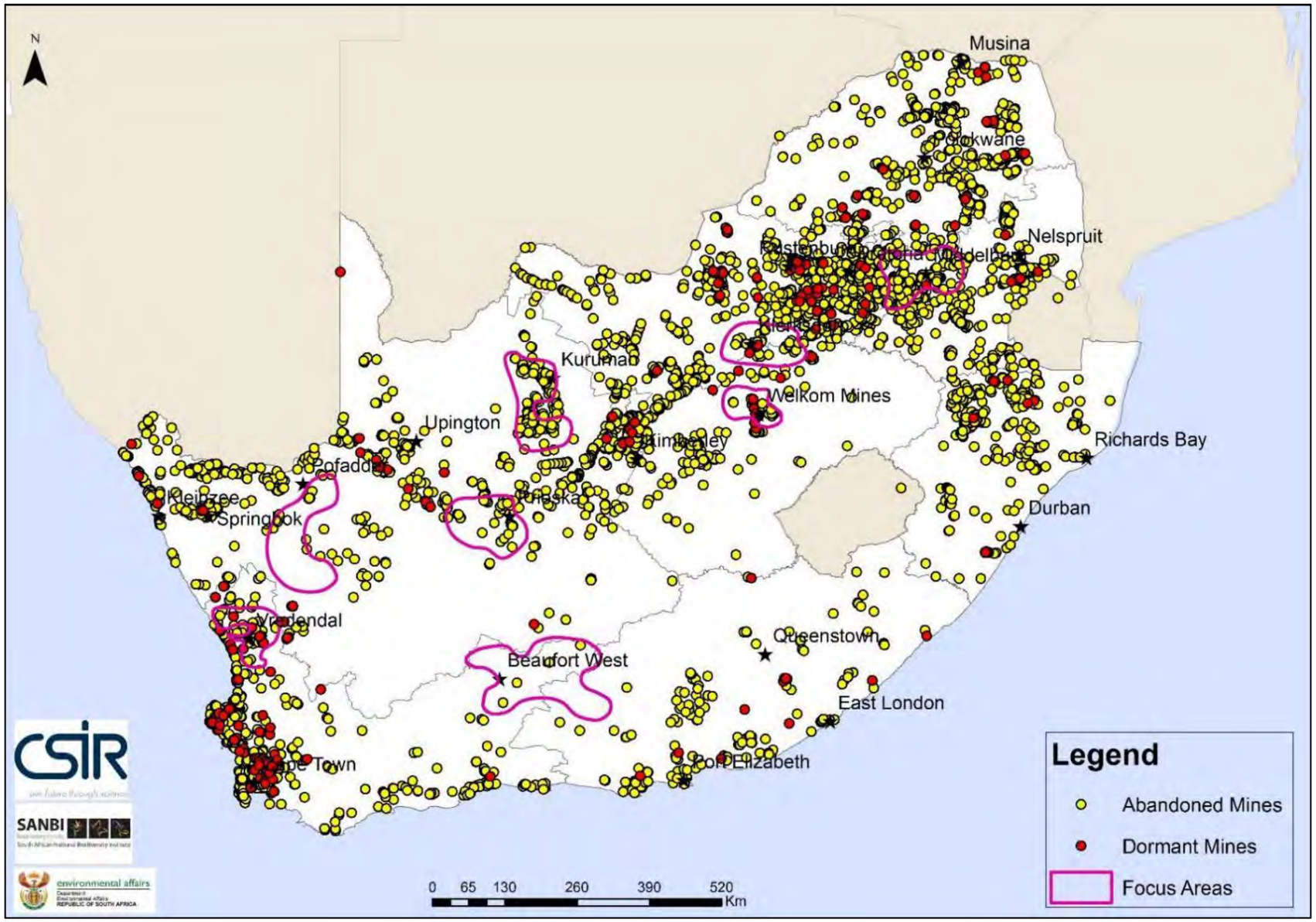

Figure 2: Abandoned and dormant mines overlayed with the eight focus areas

4.1.4 Selection of proposed REDZs

Based on the above mention criteria, Focus Areas 1, 2 and 5 (Figure 3) have been selected as the most suitable from a technical, environmental, planning and socio-economic perspective. As one of the objectives of the SEA was to identify new REDZs in provinces not covered in the Phase 1 SEA and to focus on areas with previously mined land, two solar PV REDZs were selected. In the Phase 1 SEA completed in 2015, the REDZs were numbered 1 to 8. Therefore, in the interest of continuity from the Phase 1 SEA, these new focus areas are to be named and numbered as REDZ 9 (Emalahleni), REDZ 10 (Klerksdorp) and REDZ 11 (Beaufort West).

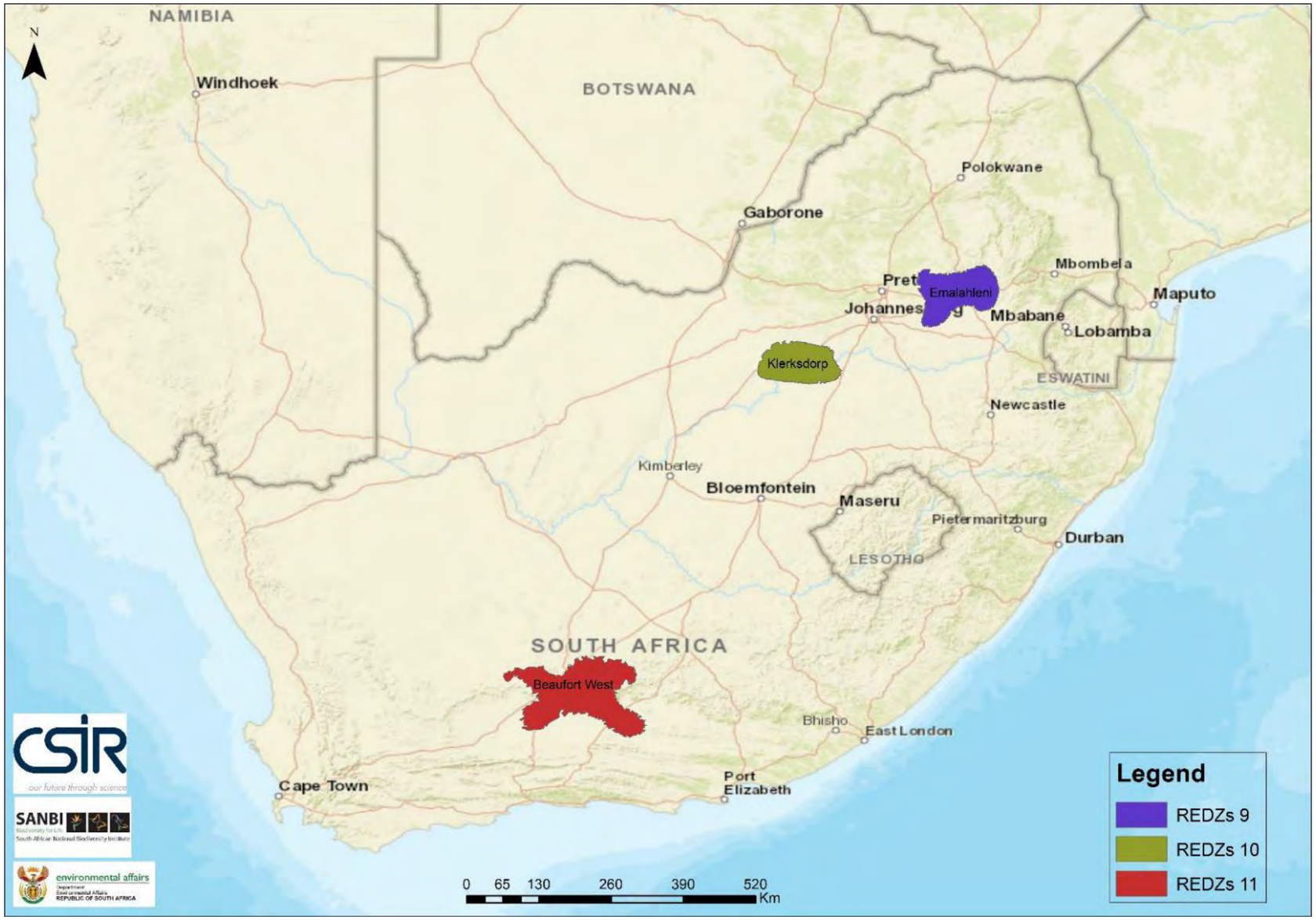

Figure 3: Proposed additional three REDZs from the Phase 2 Wind and Solar PV SEA

4.2 Existing and Proposed Generation Capacity

Table 2 presents all projects that have already received or are in the process of applying for environmental authorisation. These can be considered to represent the absolute minimum development potential proposed by developers in REDZs. One of the criteria for the selection of REDZs was the presence of projects which have received EA in the focus areas. The presence of such projects in the proposed REDZs is an indication of industry interest in the areas. As of the end of July 2019, there were a total of 46 wind and solar PV projects which had either received EA, or were in the process of application for EA in the three proposed REDZs (Table 3 and Figure 4).

Development capacity within each REDZs must be calculated on a project level based on the latest development limits presented in the agriculture protocol and sensitivities identified on the National Web Based Screening Tool. These limits can be found in the protocols presented in Part 3 of this report. Any updated versions of the limits will be housed on the National Web Based Screening Tool.

Table 2: Existing and proposed generation capacity that have already received, or are in the process of applying for Environmental Authorisation (EA) in the proposed REDZs as at July 2019

	Existing and Proposed Generation Capacity																									
	Wind								Solar PV								Wind and/or Solar PV								Total	
	Preferred Bidder		Approved EA		EA in Process		Total		Preferred Bidder		Approved EA		EA in Process		Total		Preferred Bidder		Approved EA		EA in Process		Total			
	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW
REDZ9	0	0	0	0	0	0	0	0	0	0	2	34	2	67.2	4	101.2	0	0	3	90	0	0	3	90	**7**	**191.2**
REDZ10	0	0	0	0	0	0	0	0	0	0	13	395	3	211	16	606	0	0	0	0	0	0	0	0	**16**	**606**
REDZ11	1	72.8	9	1302.8	3	280	13	1375.6	0	0	6	19	3	95	9	114	0	0	1	700	0	0	1	700	**23**	**2189.6**
Total	**1**	**72.8**	**9**	**1302.8**	**3**	**280**	**13**	**1375.6**	**0**	**0**	**21**	**448**	**8**	**373.2**	**29**	**821.2**	**0**	**0**	**4**	**790**	**0**	**0**	**4**	**790**	**46**	**2986.8**

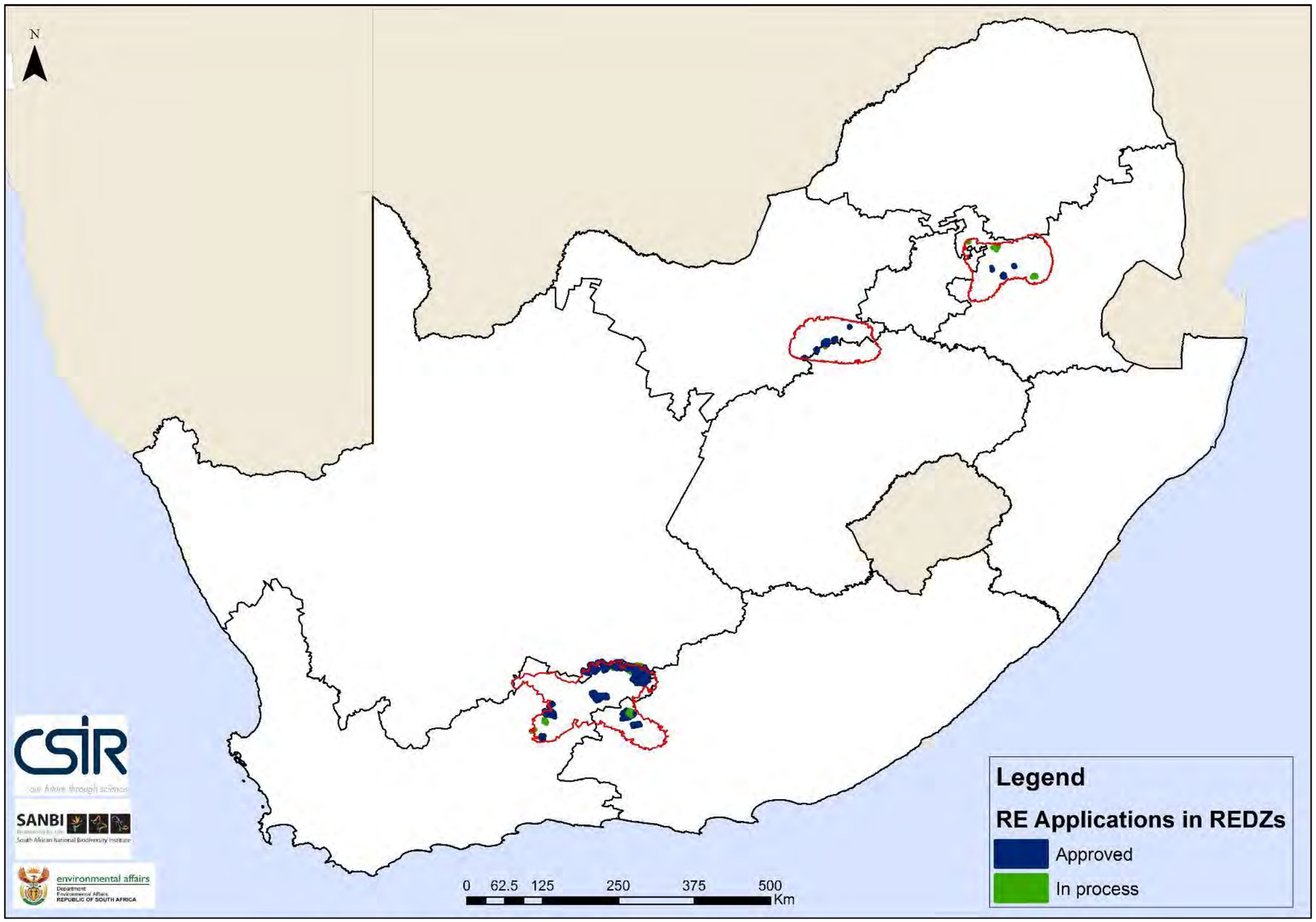

Figure 4: Existing and proposed renewable energy projects that have already received, or are in the process of applying for Environmental Authorisation (EA) in the proposed REDZs as at July2019

4.3 Evacuation Capacity

One of the biggest constraints for renewable energy development in South Africa is the capacity of the electrical grid to evacuate generation capacity. The current and future substations in the REDZs were identified and the Eskom Transmission Development Plan (TDP) for 2019 - 2028 was used as the document to determine future substation allocation for RE in the country. The current transmission substations in the proposed REDZs with their remaining capacity to connect additional renewable energy projects in the proposed REDZs with their evacuation capacities was determined from the TDP documents (Table 3). The TDP is a document that details projects intended to expand or reinforce transmission infrastructure in the year of publication as well as planned transmission infrastructure for the next 10 years. The document covers transmission networks with voltages ranging from 220 kV to 765 kV and the transmission substations where these networks terminate[1].

It must be noted that Eskom's current financial situation is likely to lead to delays in the implementation of the TDP. The SEA provides spatial location for RE in South Africa and thus assists Eskom with the justification for prioritising areas where large scale RE developments will occur. The TDP is an evolving document that is updated based on developments within Eskom as well as updates to the IRP.

Table 3: Overview of transmission evacuation capacity estimation

	Current (C)		
	MTS Substation	**GCCA Capacity 2022 High Voltage Limit LL (MW)**	**REDZ Total (MW) (C)**
REDZ9	Kruispunt	980	**3010**
	Rockdale	1050	
	Vulcan	980	
REDZ10	Hermes	1576	**2598**
	Mercury	1022	
REDZ11[2]	Droerivier	254	**254**
Total			**5862**

For future evacuation scenarios, according to the latest TDP (2019- 2028) released by Eskom for the period 2020 to 2028, RE plants have been allocated at various transmission substations to determine the overall impact on the transmission power flows. The TDP modelled wind and solar PV scenarios is based on allocated MW from the REI4P successful bidders from Rounds 1 – 4b. These substations can be seen in Table 4 and Table 5 below. Readers are encouraged to review the Eskom TDP document, which details all planned MTS generation capacity.

[1] Eskom TDP 2019.

[2] Potential to add 1000 MW evacuation capacity at Gamma substation by adding a 765/400/132 kV substation, potentially including Victoria substation

Table 4: The annual solar PV allocation per substation for the TDP 2019 to 2028 (Source: TDP 2019 -2028)

Substation	Solar PV generation allocation per year														Total per substation
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Aggeneis						140					100				240
Aries	10					200									210
Aurora	9	5	75												89
Bacchus	36														36
Bighorn	7												100		107
Boundary	78	75				75			100						328
Ferrum	149		75			100					100	100		100	624
Foskor													100		100
Garona	9														9
Harvard	64														64
Helios						75									75
Hydra	245	75													320
Hydra B								100		100		100		100	400
Juno	8,8														8,8
Kappa								100			100	100		100	400
Kronos	20	75	75			55									225
Lomond						50									50
Matimba		60													60
Mercury						67,9									68
Mookodi						75			100	100	200				475
Nama										100	100	100		100	400
Olien	139														139
Paulputs	10					75									85
Perseus	60														60
Ruigtevallei	75														75
Spencer													100		100
Tabor	28						100				200		100		428
Theseus						100						100		100	300
Upington						325			100		100				525
Watershed						75									75
Witkop	30							100					100		230
Total / year	**978**	**290**	**225**			**1 413**	**100**	**300**	**300**	**300**	**900**	**500**	**500**	**500**	**6 306**

Table 5: The annual wind allocation per substation for the TDP 2019 to 2028 (Source: TDP 2019 -2028)

Substation	Wind generation allocation per year														Total per substation
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Aggeneis						237									237
Aries							100								100
Aurora	159					100									259
Bacchus	27					32						100		100	259
Delphi	100					100	100			100	200				600
Droërivier						100				100					200
Grassridge	304	95	110			140									649
Gromis											200	100		100	400
Helios				276											276
Hydra	75	79		235											389
Hydra B						100		200	100	100	300	100		100	1 000
Juno	100														100
Komsberg						619					200				819
Kappa						108	100		100	200	200				708
Kronos						238									238
Muldersvlei		138													138
Nama								100		100					200
Pembroke		21				33			100	100	100				353
Poseidon	140	164	87			357	100			100		100		100	1 147
Thyspunt											200		1 600		1 800
Total / year	**906**	**497**	**197**	**511**		**2 163**	**400**	**300**	**300**	**800**	**1 400**	**400**	**1 600**	**400**	**9 873**

4.4 REDZs Summary

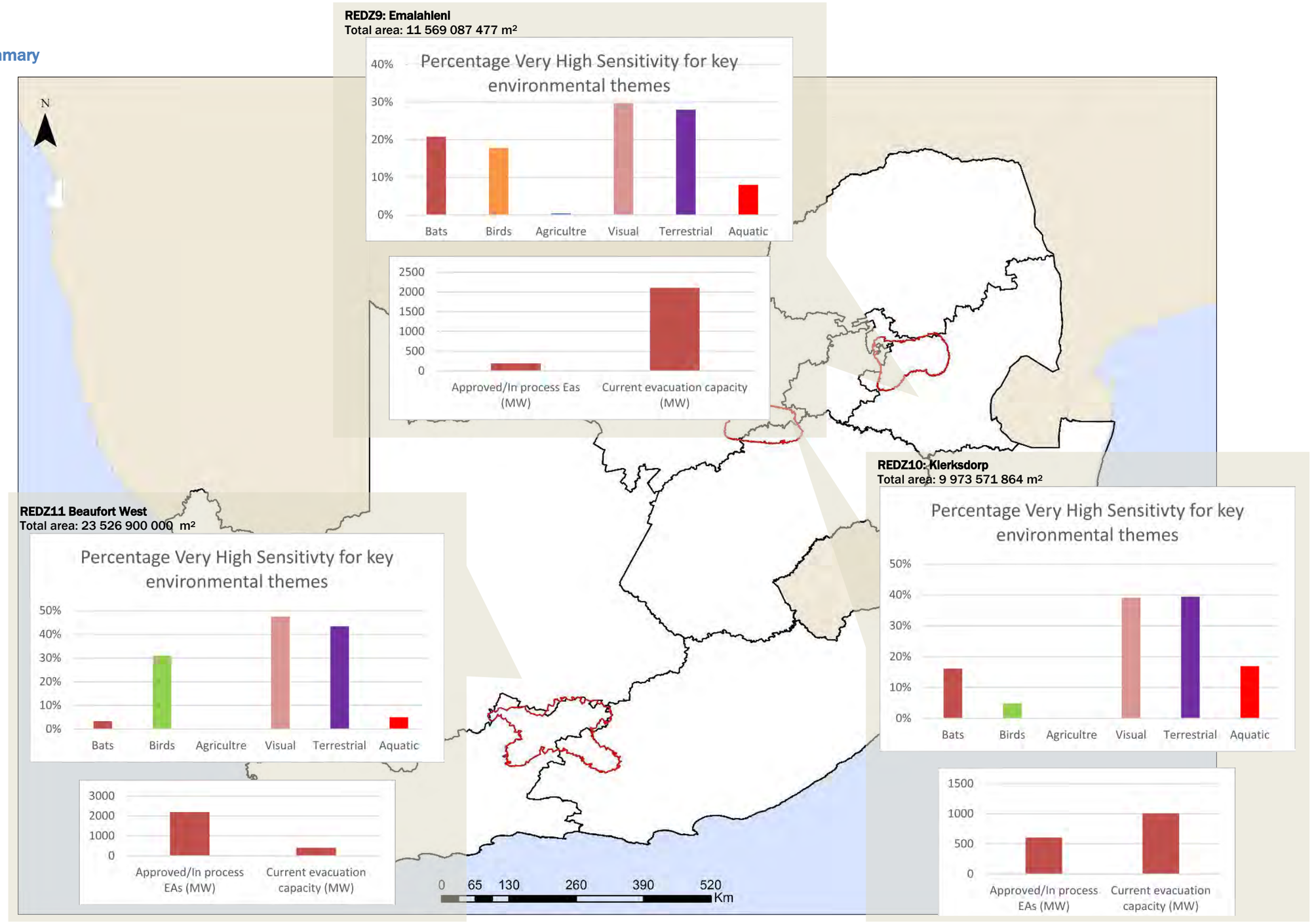

Figure 5: Summary of environmental sensitivities, existing proposed project capacity (MW) and evacuation potential (MW) in the three proposed additional REDZs

4.5 Way Forward

The outputs of the SEA in the form of the proposed three REDZs will be put forward for adoption and released for public comments through publication in the Government Gazette. The gazetting process will constitute the formal public consultation process on the proposed REDZs.

As with the Phase 1 Wind and Solar PV SEA, the gazetting process will also constitute the official adoption of the REDZs as geographical areas associated with SIP 8 and give effect to Sections 7 and 8 the Infrastructure Development Act no. 23 of 2014. Development outside the REDZs must still be considered on a project by project basis. Investment in grid infrastructure should be prioritised in the REDZs but not be limited to these areas.

The proposed Power Corridors and proposed REDZ, in combination, have a valuable role to play in contributing to the long term objectives of the National Development Plan The reduced timeframe to achieve environmental authorisation as well as the commitment at a strategic level shown by government through the gazetting of the pre-assessed Power Corridors and REDZ will serve to provide greater certainty to the power generation and electricity consuming industry of government commitment to unlock these areas, and in so doing, enable proactive and coordinated investment in these areas.

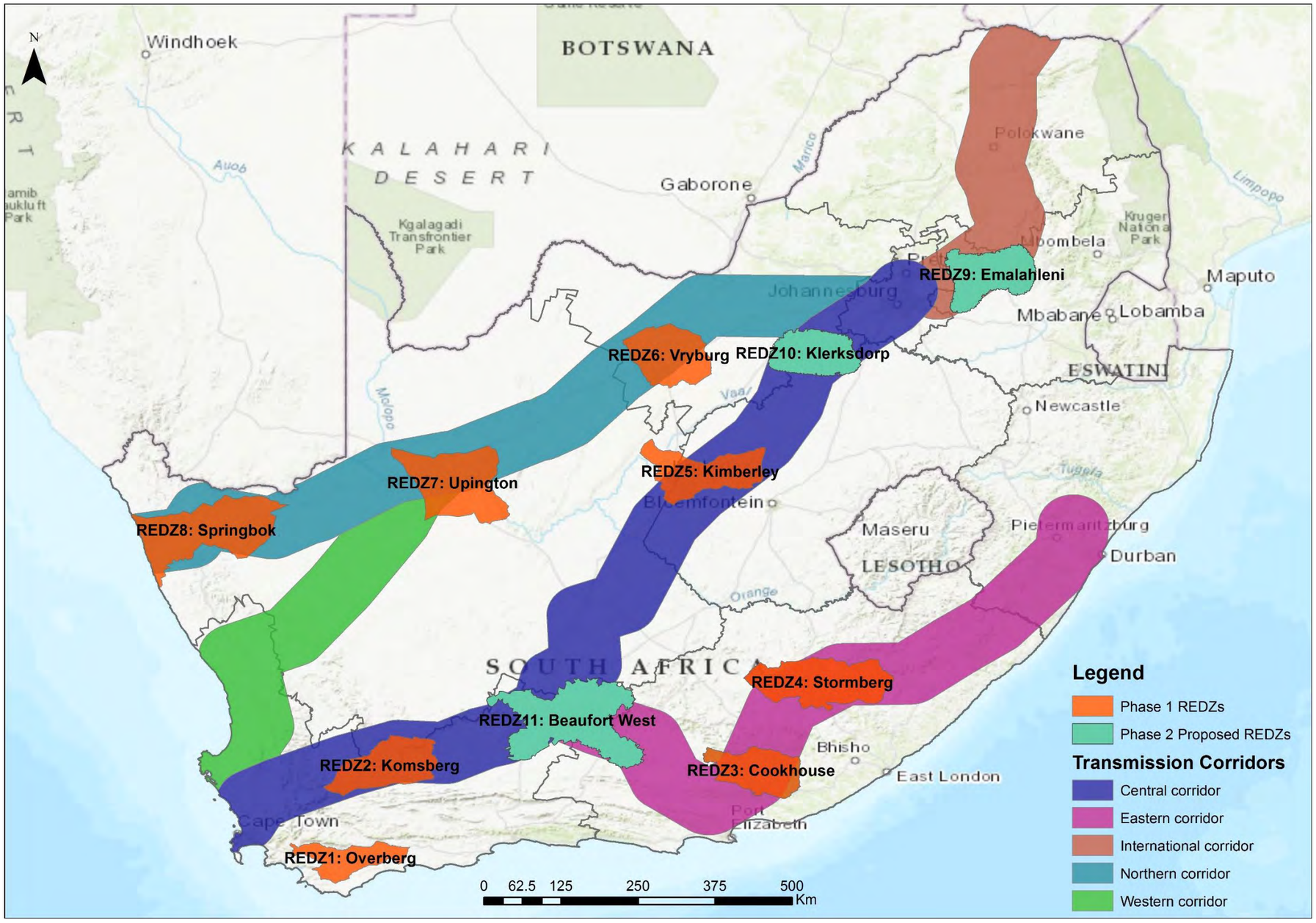

Figure 6: EGI SEA strategic transmission corridors and Phase 1 and Phase 2 REDZs

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

PART 5

GENERIC EMPr FOR WIND AND SOLAR PV ENERGY FACILITIES

Environmental Management Programme

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

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PART 5. GENERIC ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr) FOR CONSTRUCTION AND OPERATION OF WIND AND SOLAR PHOTOVOLTAIC ENERGY FACILTIES

SECTION A: BACKGROUND AND CONTEXT

5.1 Introduction

5.1.1 Need for an EMPr

The National Environmental Management Act 107 of 1998 (NEMA) requires that an Environmental Management Programme (EMPr) be submitted where an Environmental Impact Assessment (EIA) or Basic Assessment (BA) must be utilised as the basis for a decision on an application for Environmental Authorisation.

There is a reliance on the EMPr to ensure that a project's actual environmental impacts are consistent with those evaluated in the EIA/BA process. The EMPr is therefore fundamental to the EIA/BA process and should ensure that commitments given at a project's planning and assessment stage are carried through to the construction and/ or operation stage.

This Generic EMPr provides a pre-approved template that is to be used by a developer when preparing an EMPr for a wind and/or solar Photovoltaic (PV) energy facilities. This document describes the information requirements to enable the Department of Environment, Forestry and Fisheries (DEFF) to make an informed and defensible decision on an EIA/BA. This document therefore establishes a framework according to which an EMPr must be prepared when the project relates to the development of wind and solar PV facilities in South Africa.

The EMPr, as contemplated in Chapter 5 Section 24 N (1A) of NEMA, plays a vital role in the implementation of consistent and continued environmental management for the duration of a project life cycle.

5.1.2 Scope, purpose and objectives

The *scope* of this Generic EMPr is as follows:

- Spatial extent - This generic EMPr is an output from the Strategic Environmental Assessment for wind and solar PV Energy (Phases 1 and 2) in South Africa (DEA, 2015 and 2019), referred to as the wind and solar PV SEA (Phase 1 or Phase 2). These SEAs identified renewable energy development zones (REDZs) that have been subjected to a scoping-level pre-assessment of environmental sensitivity. For new wind and solar PV energy projects within these REDZs, a Basic Assessment is adequate provided specified conditions are satisfied. For wind and solar PV facilities which are outside of the REDZs and which trigger Listing Notice 2 of the 2014 NEMA EIA Regulations, as amended, a full EIA process is required. This generic EMPr can be applied to projects both inside and outside of these REDZs.
- Wind and solar PV project scale – This generic EMPr applies to potential wind and solar PV farms.
- Applicants / developers – This generic EMPr applies to potential wind and solar PV farm developers.
- Project lifecycle – This generic EMPr applies to construction and operation related activities.

The *purpose* of this document is to provide a generic EMPr that captures learning and best practice in managing the planning, construction and operation of wind and solar PV farms in sufficient detail to enable the relevant authorities to pre-approve this EMPr template, or provide approvals, general authorisations or letters of no objection under specified conditions where applicable, and thereby provide a more pro-active, responsive and efficient approval process for such projects.

The EMPr contains a general environmental controls section which describes environmental requirements relevant to all wind and solar PV energy projects. The EMPr also contains a project specific section which describes mitigation measures and environmental control requirements specific to the particular project. These requirements will be based on the findings from the EIA/BA, site walk through and any conditions attached to the Environmental Authorisation (EA), if any.

The project specific section of the EMPr identifies where project specific information from the EIA or BA will need to be included in to the EMPr. This includes:

- Environmental sensitivity mapping including "No Go" areas;
- Final project layout and footprint; and
- Project information including landowner details and specific access requirements.

The *overall objectives* of the generic EMPr are to realise the following:

- Ensure that impact avoidance and mitigation measures associated with wind and solar PV farm construction, operation and decommissioning are identified and that practical recommendations are provided to implement and monitor these actions;
- Ensure environmental protection; and
- Create a positive relationship with land owners.

5.2 Generic EMPr Framework

The structure of the generic EMPr is illustrated in Figure 1.

Part A of the document provides background context to the generic EMPr. Included in this section are general national level legal requirements for a typical wind and solar PV project, the description of the roles and responsibilities of key persons involved in the construction and operation stage of a wind and solar PV project and associated responsibilities in the context of the EMPr. This section also describes the various phases and activities in the lifecycle of a wind and solar PV farm.

Part B details environmental controls. Section 1 of Part B describes general environmental controls to be implemented for construction and operation activities relevant to the project. Controls in this section reflect minimum and general requirements for managing and mitigating impacts for specific construction related activities. Section 2 of Part B describes site specific environmental control requirements. Section 3 of Part B describes project specific environmental control requirements (including site sensitivity). These controls are based on findings of the BA/EIA.

The contractor must also include all approved Method Statements in Part C of the document, as applicable.

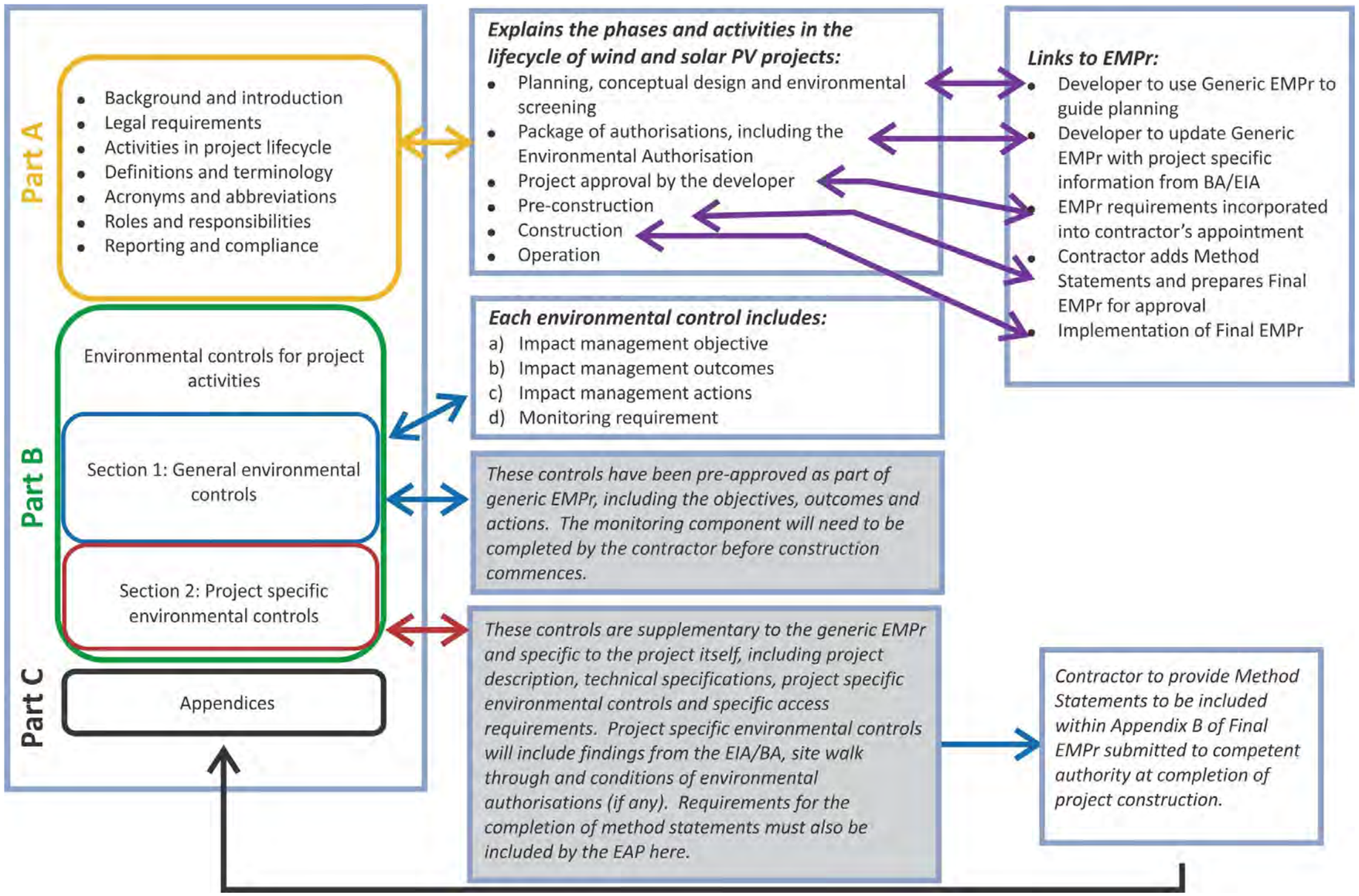

Figure 1: Framework for generic EMPr

5.3 Legal Requirements

5.3.1 Key environmental legislation and policies that are applicable to a typical wind and solar PV project

In terms of legal requirements, a crucial objective of the EMPr is to satisfy the requirements of Section 24N of the NEMA regulations and regulation 19 of the 2014 NEMA EIA Regulations, as amended. These regulations regulate and prescribe the content of the EMPr and specify the type of supporting information that must accompany the submission of the report to the authorities.

In addition to satisfying these requirements, the content of the EMPr has been compiled in accordance with the requirements of legislation of other authorising authorities responsible for providing approvals, general authorisations or letters of no objections for wind and solar PV projects. The following additional legislation was considered in this regard:

- General Authorisation of water use in terms of the amended GN 1199 of the National Water Act (No. 36 of 1998); and
- National Heritage Resources Act (No. 25 of 1999.

The Contractor must identify and comply with all South African environmental legislation, including associated regulations and all local by-laws relevant to the project. Key legislation at the time of this EMPr being in effect applicable to the construction and implementation phases of the project must be complied with. The list of applicable legislation provided below is intended to serve as a guideline only and is not exhaustive:

- **General**
  - The Constitution of South Africa Act of 1996 (Act No. 108 of 1996);
  - National Environmental Management Act of 1998 (Act No. 107 of 1998) (NEMA); and the
  - Environment Conservation Act of 1989 (Act No. 73 of 1989) and the NEMA Environmental Impact Assessment Regulations, 2014, as amended.
- **Land, Soil and Plants**
  - The Conservation of Agricultural Resources Act of 1983 (Act No. 43 of 1983);
  - National Forests Act of 1998 (Act No. 84 of 1998);
  - National Environmental Management Biodiversity Act of 2004 (Act No. 10 of 2004); and the
  - National Veld and Forest Fire Act of 1998 (Act No. 101 of 1998).
- **Protected Areas**
  - National Environmental Management: Protected Areas Act of 2003 (Act No. 57 of 2003); and the
  - The Protected Areas Amendment Act of 2004 (Act 31 of 2004).
- **Inland Water Resources**
  - National Water Act of 1998 (Act No. 36 of 1998); and the
  - Water Service Act of 1997 (Act No. 108 of 1997).
- **Cultural Resources**
  - Natural Heritage Resources Act of 1999 (Act No. 25 of 1999).
  - KZN Heritage Act
- **Animals and Wildlife**
  - Animals Protection Act of 1962 (Act No. 71 of 1962);
  - Game Theft Act of 1991 (Act No. 105 of 1991); and the
  - The National Environmental Management: Biodiversity Act of 2004 (Act No. 10 of 2004) and the regulations and lists regarding threatened and protected species.
- **Pollution Control and Waste Management**
  - National Environmental Management: Waste Act, 2008;
  - Environment Conservation Act of 1989 (Act No. 73 of 1989);
  - National Environmental Management: Waste Act 2008 (Act No. 58 of 2008); and the
  - Minimum requirements for waste disposal by landfill, Department of Water Affairs and Forestry, 2nd addition, 1998.
- **Hazardous and Toxic Substances**
  - Hazardous Substances Act of 1973 (Act No. 15 of 1973);
  - Minimum requirements for the handling, classification and disposal of hazardous waste (Department of Water Affairs and Sanitation); and the
  - Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act of 1947 (Act No. 36 of 1947).
- **Air Pollution**
  - Atmospheric Pollution Prevention Act of 1965 (Act No. 45 of 1965); and the
  - National Environmental Management: Air Quality Act of 2004 (Act No. 39 of 2004) (NEM: AQA).
- **Minerals, Energy and Mining**
  - Mineral & Petroleum Resources Development Act of 2002 (Act No. 28 of 2002.
- **Other**
  - Road Traffic Act of 1989 (Act No. 29 of 1989);
  - Explosives Act of 2003 (Act No. 15 of 2003); and the
  - Advertising on Roads and Ribbon Development Act of 1940 (Act No. 21 of 1940).

Depending on the location of the project, applicable provincial legislation will also apply.

5.3.2 Potential Permits/Authorisations/Licences required

Activities that could require a permit, licence, authorisation or consent use from various governmental bodies are listed in Table 1. The contractor is to ensure that any activity performed complies with the relevant legislation and the necessary permits are in place before commencement of the specific activity triggering the need for the relevant license or approval.

Table 1: Wind and Solar Photovoltaic Solar Facilities activities that could require either a permit, licence authorisation or consent use

Activity	Type of permit/ license/consent required	Issuing Authority
Taking water from a water resource	Licence	Department of Water and Sanitation (DWS)
Storing water	Licence	DWS
Impeding or diverting the flow of water in a watercourse	Licence	DWS
Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	Licence	DWS
Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	Licence	DWS
Disposing of waste in a manner which may detrimentally impact on a water resource	Licence	DWS
Use of treated wastewater (dust suppression)	Approval	DWS and Departemtn of Housing (DOH)
Applying for a licence regarding activities in state forest	Licence	DWS
Compliance with the Veld and Forest Fire Act	Requirement for a fire management plan	Department of Agirculure, Forestry and Fisheries (DAFF)
To impact on archaeological and paleontological sites and meteorites	Permit	SAHRA (or HWC if in W Cape or HNC if in Northern Cape)
To destroy, damage, deface, alter, remove from its original position, subdivide or change the planning status of a National Heritage Site	Permit	SAHRA (or HWC if in W Cape or HNC if in Northern Cape)
To impact on or disturb burial grounds and graves	Permit	SAHRA (or HWC if in W Cape or HNC if in Northern Cape) and other Provincial Heritage Resource Authorities
Way leave applications for accesses to provincial roads	Approval	(Department of Transport (DOT)
Design of the main access road to the site camp	Approval (Environmental Authorisation)	DEFF and Relevant Provincial Roads Dept.
Application for health permits for hostels and sanitation	Permit	DOH
Blasting	Permit	DEFF/South African Police Services (SAPS)
Commencement of construction activities	Notify one week before commencement	DEFF
Outdoor advertising of Activities	South African Manual for Outdoor Advertising Control specifications	South African Manual for Outdoor Advertising Control (SAMOAC)
Site establishment sewage disposal	Approval	Local Municipality
Site Establishment storm water & pollution control	Separate report	Local Municipality
Fuel storage	Approval-as part of BA/EIA authorisation	DEFF or the relevant provincial environmental Affairs
Hazardous material route	Approval	DOT
Other hazardous substances	Permit	DOH/DEFF (in certain cases)
Use of borrow pits	Approval	Department of Mineral Resources (DMR)
Project commencement	Notify	DOL
Land use outside Work Area	Special consent approval	Local Municipality
Detail design (water, waste water, roads design)	Approval	Local Municipality
Way leave applications – design	Approval	SANRAL
Application for obstacles which could pose an aviation hazard	Licence	South African Civil Aviation Authority (SACAA)
Impact on Square Kilometre Array (SKA)	Approval	Square Kilometre Array South Africa (SKA-SA)
Impact on the South African Astronomical Observatory (SAAO)	Approval	South African Astronomical Observatory (SAAO)
Waste storage, transportation, treatment, recycling and / or disposal (including hazardous waste)	Approval – permit under Section 20(1) of ECA, linked to an Environmental Authorisation	NEMA Competent Authority
Listed activities triggered in terms of the National Environmental Management Act 107 of 1998	Approval – Environmental Authorisation Comments from SAHRA in terms of section 38(8) of the NHRA and section 24(4)b(iii) of NEMA	DEFF or relevant provincial department
National Environmental Management: Air Quality Act of 2004 in approximately September 2009)	Permit – registration certificate (this will become an atmospheric emission licence under NEM:AQA)	DEFF – Chief Air Pollution Control Officer (to become the air quality officer in provincial or local government under NEM:AQA)

5.4 Activities in the lifecycle of a typical wind and solar PV project

There are 36 typical major activities involved in the lifecycle of a typical wind and solar PV project associated with an Environmental Authorisation. The required status of each activity in the context of submitting the application for Environmental Authorisation, both inside and outside the REDZs is described in Table 2.

Table 2: Typical activities in wind and solar PV construction lifecycle in context of submitting an application for Environmental Authorisation (ECO monitoring to be conducted at appropriate times)

Number	Activity
1	Select land parcel/s for proposed development
2	Download sensitivity maps for land parcel/s from DEA Screening Tool
3	Negotiate site with landowner
4	EAP to develop specialist terms of reference for development envelope based on Development Protocols
5	Commission specialist studies, including 12-month pre-construction bird and bat monitoring for wind farms as applicable at the time
6	Specialists to validate sensitivity maps for land parcel/s
7	Specialist to select preferred location for project footprint
8	EAP to determine preferred location of project footprint based on specialist recommendations
9	Produce draft BA report and draft EMPr for comment
10	Submit application for environmental authorisation
11	Release the draft BA report for 30-day commenting period
12	Update report with comments received
13	Submit Final BAR to DEFF
14	Decision by DEFF in terms of NEMA on EA application
15	Site walk-through with relevant specialists (e.g. Terrestrial Ecology, Birds and Bats specialists)
16	Geotechnical studies
17	Finalise project footprint
18	On basis of walk through update EMPr with any additional requirements and final project footprint (Part B Section 2)
19	Erection of camp sites for the Contractor's workforce
20	Vegetation clearing to facilitate access, construction and the safe operation of the facility
21	Construction of access roads
22	Transportation of equipment, materials and personnel to site (ongoing)
23	Level turbine/solar panel areas and excavate for cut and fill requirements (terracing)
24	Marking of turbine positions and solar panel areas
25	Foundation excavation
26	Installations of foundations for the turbines/solar PV panels
27	Turbine/solar PV panels assembly and erection
28	Equipment installation
29	Testing and commissioning
30	Rehabilitation of disturbed areas
31	Signing off of all Landowners upon completion of the construction and rehabilitation
32	Handing over of works to the Developer's Project Manager
33	Operation and maintenance of the facility
34	Post construction bird and bat monitoring for wind farms as applicable to the relevant guidelines or legislative requirements at the time.
35	Decommissioning of wind or solar PV facility
36	Site rehabilitation

5.5 Working area

Construction activities must be limited to the area for which Environmental Authorisation is applied for/issued. Location of construction camps must be carefully considered and approved by the ECOs and this involves determining whether any further approvals would be required in terms of the relevant environmental and health legislation. These areas are normally included and approved in your environmental assessment reports, i.e. in the BA or EIA Reports.

All construction areas must be cleared in accordance with the requirements of this EMPr.. All areas marked as "No Go" areas in the project layout must be treated with the utmost care and responsibility and in accordance with the requirements of the EMPr.

Should water be required from sources other than from those provided by the Developer's supply, a written agreement must be reached between the Contractor and the Landowner. Should the Contractor be required to use water from a water resource, the Contractor must supply a method statement to that effect and first obtain the required licences from DWS. Strict control must be maintained and the ECOs must regularly inspect the abstraction point and methods used. Refer to Table 1 for permitting requirements.

5.6 Definitions and terminology

For the purposes of this EMPr, the following definitions shall apply:

Assembly area means any area used for the assembly of wind and solar PV farm infrastructure prior to its erection. Such assembly areas may be within the construction camp or elsewhere within the Working Area.

Biophysical aspects are the naturally occurring objects and processes of an area on the assumption that all naturally occurring things can be classified as being either living (i.e. biotic) or non-living (physical or abiotic).

Botanical specialist, for the purposes of this Specification, means a competent botanist as identified by the Project Manager. The botanist should be Pr.Sci.Nat registered and other specialists should have appropriate professional accreditation.

cEO is a Contractor's Environmental Officer and means a qualified senior staff member and registered EHS practitioner employed full time on site by the Contractor, who shall be responsible for environmental monitoring and control.

Clearing means the clearing and removal of vegetation, whether partially or in whole, including trees and shrubs, as specified.

Construction camp is the area designated for key construction infrastructure and services, including but not limited to offices, overnight vehicle parking areas, stores, the workshop, stockpile and lay down areas, hazardous storage areas (including fuels), the batching plant (if one is located at the construction camp), designated access routes, equipment cleaning areas and the placement of staff accommodation, cooking and ablution facilities, waste and wastewater management.

Contaminated water means water contaminated by the Contractor's activities, e.g. concrete water and runoff from equipment, camp sites, ablution facilities and personnel wash areas.

dEO is an individual employed by the developer who will be present on site at all times and who will ensure implementation of the EMPr, integrated Environmental Authorisation and Waste Management Licence and Water Use Licence conditions stipulated by the authorities.

ECO means an independent and EHS registered Environmental Control Officer (ECO) appointed full time by the Employer to monitor compliance by the Contractor and his staff with the environmental requirements of the Environmental Authorisation and EMPr.

Endemic is the natural distribution of an organism (plant or animal) restricted to the local environmental conditions within an area.

Environment means the surroundings within which humans exist. It comprises:

i) The land, water and atmosphere of the earth;
ii) Micro-organisms, plant and animal life;
iii) Any part or combination of i) and ii) and the interrelationships among and between them; and
iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being (*i.e.* the social environment).

This is a definition that encompasses many different facets, including biological, physical, social, economic, cultural, historical and political components.

Heritage resource, as per the provisions of the National Heritage Resources Act (No 25 of 1999), means all those heritage resources that are of cultural significance or other special value for present and future generations, and which are accordingly considered part of the National Estate. In this regard, the National Estate includes those items identified in terms of Section 2 of National Heritage Resources Act No. 25 of 1999 and any additions as per the KZNHA.

Heritage specialist, for the purposes of this EMPr, means a specialist suitably qualified to deal with the type of heritage resource discovered. For example where the resource is an archaeological artefact or site, the heritage specialist would be an archaeologist and where it is a fossil the specialist would be a palaeontologist.

Maintenance period means the period after the establishment period up to and until the end of the defects liability period, during which the contractor must be responsible for maintaining the vegetation.

Method Statement means a written submission by the Contractor to the Project Manager in response to this EMPr or a request by the Project Manager and ECO. The Method Statement must set out the equipment, materials, labour and method(s) the Contractor proposes using to carry out an activity identified by the Project Manager when requesting the Method Statement. This must be done in such detail that the Project Manager and ECO are able to assess whether the Contractor's proposal is in accordance with this specification and/or will produce results in accordance with this specification.

The Method Statement must cover applicable details with regard to:

i) Construction procedures;
ii) Plant, materials and equipment to be used;
iii) Transporting the equipment to and from site;
iv) How the plant/ material/ equipment will be moved while on site;
v) How and where the plant/ material/ equipment will be stored;
vi) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
vii) Timing and location of activities;
viii) Compliance/ non-compliance; and
ix) Any other information deemed necessary by the Project Manager.

Indigenous vegetation means all existing species of trees, shrubs, groundcover, grasses and all other plants native to the site.

Pollution Incident means any incident that may cause or has caused damage to or the contamination of the natural environment.

Hazardous Substances is a substance governed by the Hazardous Substances Act, 1973 (Act No. 15 of 1973) as well as the Hazardous Chemical and Substances Regulations, 1995.

Sensitive area means any area that is denoted as sensitive by the BA/EIA, Environmental Authorisation, and EMPr, ECO or Project Manager due to its particular attributes, which could include the presence of rare or endangered vegetation, the presence of heritage resources (*e.g.* archaeological artefacts or graves), the presence of a unique natural feature, the presence of a watercourse or water body, the presence of steep slopes (in excess of 1:4) *etc.*

Slope means the inclination of a surface expressed as one unit of rise or fall for so many horizontal units.

Solid waste means all solid waste, including construction debris, hazardous waste, excess cement/ concrete, wrapping materials, timber, cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Spoil means excavated material which is unsuitable for use as material in the construction works or is material which is surplus to the requirements of the construction works.

Topsoil means a varying depth (up to 300 mm) of the soil profile irrespective of the fertility, appearance, structure, agricultural potential, fertility and composition of the soil.

Watercourse means any river, stream and natural drainage channel whether carrying water or not.

Water body means a body containing water and includes dams and wetlands, whether ephemeral or permanent.

Wetland means any area that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the area is covered by shallow water. Specifically, an area is classified as a "wetland" if it meets at least one of the following criteria:

i) The area predominantly supports hydrophytes, at least periodically;
ii) The substrate(soil) is predominantly undrained hydric soil; and/ or
iii) The substrate is non-soil, and is saturated with water or covered by shallow water at some time during the growing season.

Works means the Works to be executed in terms of the Contract.

Working Area means the land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the Employer in connection with the Works. The Working Area must include the site office, construction camp, stockpile and laydown areas, assembly areas, batching areas, the construction corridor, all access routes and any additional areas to which the Project Manager permits access.

5.7 Acronyms and abbreviations

BA	Basic Assessment
CARA	Conservation of Agricultural Resources Act No. 43 of 1983
cEO	Contractors Environmental Officer
DAFF	Department of Agriculture, Forestry and Fisheries
dEO	Developer Environmental Officer
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DPM	Developer Project Manager
DMR	Department of Mineral Resources
DOE	Department of Energy
DOH	Department of Health
DOL	Department of Labour
DOT	Department of Transport
DSS	Developer Site Supervisor
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act No. 73 of 1989
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
EMS	Environmental Management System
ERAP	Emergency Response Action Plan
FPA	Fire Protection Association
FPO	Fire Protection Officer
HWC	Heritage Western Cape
HNC	Heritage Northern Cape
HKZN	Heritage KwaZulu Natal
I&APs	Interested and Affected Parties
MSDS	Material Safety Data Sheet
NGL	Natural Ground Level
SAHRA	South African Heritage Resources Agency
SAMOAC	South African Manual for Outdoor Advertising Control

Table 3: EMPr roles and responsibilities

5.8 Roles and responsibility

The effective implementation of the EMPr is dependent on established and clear roles, responsibilities and reporting lines within an institutional framework. This section of the EMPr identifies the various environmental roles and reporting lines and defines responsibilities for each role within the institutional framework. This institutional structure will be maintained throughout the construction phase until such time as the final construction phase Environmental Report has been prepared and accepted.

The Environmental Responsibilities and Reporting Structure are represented in Figure 2:

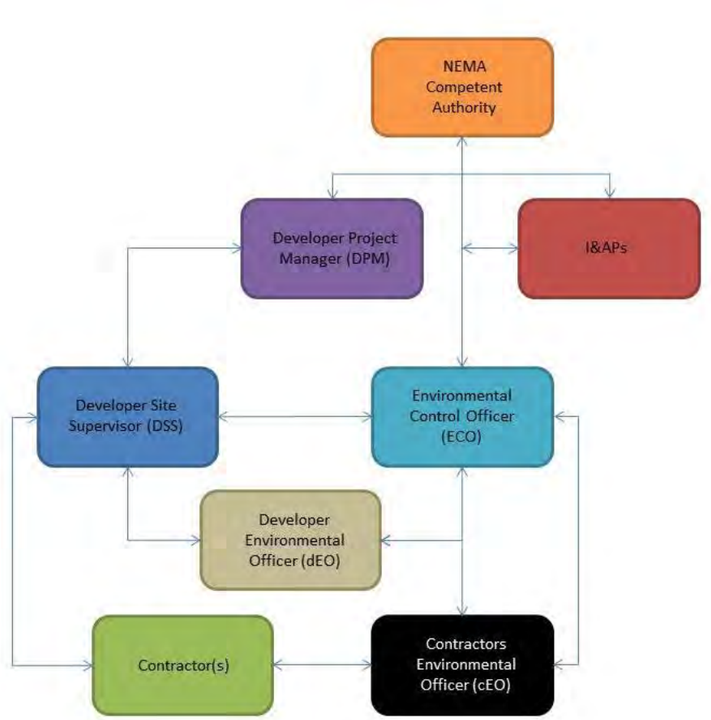

Figure 2: EMPr roles and responsibilities

Function	Role and Responsibilities
Environmental Assessment Practitioner (EAP)	<u>Role</u> The EAP is to be appointed by the Developer. The EAP is responsible for compiling the EMPr and ensuring that all the relevant mitigation measures and recommendations in the EIA/BA Report, field studies and design updates are incorporated into the EMPr. <u>Responsibility</u> The responsibility of the EAP is to supplement the pre-approved generic EMPr requirements with project specific information and requirements from the BA/EIA Report. Details of the EAP appointed by the developer including the Curriculum Vitae of the EAP must be included in the EMPr.
Project owner/Holder of the Environmental Authorisation/ Developer's Project Manager (DPM)	<u>Role</u> The holder of the Environmental Authorisation to which this EMPr relates holds legal responsibility for compliance with this EMPr and any other arrangements must be entered into between such holder and such other party. The Developer's Project Manager will have overall responsibility for the management of the project and the implementation of the EMPr. <u>Responsibilities</u> • Be fully conversant with the conditions of the Environmental Authorisation and ensure that the conditions are adhered to; • Ensure that all stipulations within the EMPr are communicated and adhered to by the Developer and its Contractor(s); • Monitor the implementation of the EMPr throughout the project by means of site inspections and meetings. Overall management of the project and EMPr implementation; • Ensure that periodic environmental performance audits are undertaken on the project implementation; and • Ensure all permits, authorisations and licences are obtained, monitored and adhered to.
Developer Site Supervisor (DSS)	<u>Role</u> The Developer Site Supervisor reports directly to the Developer's Project Manager, oversees site works, liaises with the contractor(s) and the ECO. The Developer Site Supervisor is responsible for the day to day implementation of the EMPr and for ensuring the compliance of all contractors with the conditions and requirements stipulated in the EMPr. <u>Responsibilities</u> • Ensure that all contractors identify a contractor's Environmental Officer (cEO); • Must be fully conversant with the conditions of the Environmental Authorisation. Oversees site works, liaison with Contractor, DPM and ECO; • Must ensure that all landowners have the relevant contact details of the site staff, ECO and cEO; • Will issue all non-compliances to contractors; and • Ratify the Monthly Environmental Report.
Environmental Control Officer (ECO)	<u>Role and Qualifications</u> The ECO should be employed by the developer for the duration of the project. The ECO should have appropriate training and experience in the implementation of environmental management specifications. The primary role of the Environmental Control Officer is to act as an independent quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts. In this respect, the ECO is to conduct periodic site inspections, attend regular site meetings, pre-empt problems and suggest mitigation and be available to advise on incidental issues that arise..The ECO is also required to conduct compliance audits, verifying the monitoring reports submitted by the cEO. The ECO provides feedback to the Developer Site Supervisor and Project Manager regarding all environmental matters. The Contractor, cEO and dEO are answerable to the Environmental Control Officer for non-compliance with the Performance Specifications as set out in the Environmental Authorisation and EMP. The Environmental Control Officer provides feedback to the Developer Site Supervisor and Project Manager, who in turn reports back to the Implementing Agent and I&AP's, as required. Issues of non-compliance raised by the ECO must be taken up by the Project Manager, and resolved with the Contractor as per the conditions of his contract. Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e. those that are deemed to be a variation, not allowed for in the Performance Specification) must be endorsed by the Project Manager. The ECO must also, as specified by the Environmental Authorisation, report to the Government authorizing department as and when required. <u>Responsibilities</u> The responsibilities of the ECO will include the following: • Be aware of the findings and conclusions of the Environmental Impact Assessment and Water Use Licensing process (where applicable) and the conditions stated within the environmental licenses; • Be familiar with the recommendations and mitigation measures of this EMPr; • Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them; • Undertake regular and comprehensive site inspections / audits of the construction site according to the EMPr and applicable licenses in order to monitor compliance with the EMPr; • Educate the construction team about the management measures contained in the EMPr and environmental licenses; • Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective; • Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements;

Function	Role and Responsibilities
	• In consultation with the Developer Site Supervisor order the removal of person(s) and/or equipment which are in contravention of the specifications of the EMPr and/or environmental licenses; • Liaison between the Developer Project Manager, Contractors, authorities and other lead stakeholders on all environmental concerns; • Issuing of site instructions to the Contractor for corrective actions required; • Compile a regular environmental audit report highlighting any non-compliance issues as well as satisfactory or exceptional compliance with the EMPr; • Validating the regular site inspection reports, which are to be prepared by the contractor Environmental Officer (cEO); • Checking the cEO's record of environmental incidents (spills, impacts, legal transgressions etc) as well as corrective and preventive actions taken; • Checking the cEO's public complaints register in which all complaints are recorded, as well as action taken; • Assisting in the resolution of conflicts; • Facilitate training for all personnel on the site – this may range from carrying out the training, to reviewing the training programmes of the Contractor and/or sub-contractors; • In case of non-compliances, the ECO must first communicate this to the Senior Site Supervisor, who has the power to ensure this matter is addressed. Should no action or insufficient action be taken, the ECO may report this matter to the authorities as non-compliance; • Maintenance, update and review of the EMPr; and • Communication of all modifications to the EMPr to the relevant stakeholders. Further note, the ECO function is not limited to the construction phase alone, but is also an active role during the operational and later phases of the project.
Developer Environmental Officer (dEO)	<u>Role and Qualifications</u> The dEOs will report to the Project Manager and are responsible for implementation of the EMPr, environmental monitoring and reporting, providing environmental input to the Project Manager and Contractor's Manager, liaising with contractors and the landowners as well as a range of environmental coordination responsibilities. The Developer must appoint a dEO. The dEOs will, as a minimum, have the following qualifications and experience: • Degree or diploma in environmental management, nature conservation or related discipline; • Knowledge of relevant environmental legislation; and • At least two years previous experience in environmental control, environmental monitoring or environmental management. <u>Responsibilities</u> • Be fully conversant with the EMPr; • Be fully conversant with the conditions of the Integrated Environmental Authorisation and Waste Management License and Water Use License; • Be fully conversant with all relevant environmental legislation; • Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures; • Ensure that all stipulations within the EMPr are communicated and adhered to by the Employees, Contractor(s) and its sub-contractor(s); • Confine the construction site to the demarcated area; • Conduct environmental internal audits with regards to EMPr and authorisation compliance (on cEO); • Assist the contractors in addressing environmental challenges on site; • Assist in incident management: • Reporting environmental incidents to developer and ensuring that corrective action is taken, and lessons learnt shared; • Assist the contractor in investigating environmental incidents and compile investigation reports; • Follow-up on pre-warnings, defects, non-conformance reports; • Measure and communicate environmental performance to the Contractor; • Conduct environmental awareness training on site together with ECO and cEO; • Ensure that the necessary legal permits and / or licenses are in place and up to date; • Acting as Developer's Environmental Representative on site and work together with the ECO and contractor; and • Audit carried out by an independent auditor/consultant.
Contractor (C)	<u>Role</u> The Contractor appoints the cEO and has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract are in line with the EMPr and that Method Statements are implemented as described. <u>Responsibilities</u> • Implementation and compliance with recommendations and conditions of the Environmental Authorisation and EMPr, including providing the Contractor's Environmental Protection Policy and the specific Method Statements for the project;

Function	Role and Responsibilities
	• Appoints dedicated and qualified contractor Environmental Officer (cEO) to work with the ECO; and • Ensure all site staff are trained and kept updated in terms of the Environmental Authorisation, EMPr and other legal requirements.
Contractor Environmental Officer (cEO)	<u>Role and Qualifications</u> Each Contractor affected by the EMPr should appoint a contractor Environmental Officer, who is responsible for the on-site implementation of the EMPr (or relevant sections of the EMPr). The Contractor's representative can be the site agent; site engineer; a dedicated environmental officer; or an independent consultant. The Contractor must ensure that the Contractor's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the Environmental Control Officer and the public. As a minimum the cEO must meet the following criteria: Have a degree or diploma in an appropriate environmental field; Have demonstrated environmental experience in the construction industry; and Be a senior person within the Contractor's staff with authority over all the contractors' staff working on-site. The cEO ensures that all Sub-contractors working under the Contractor abide by the requirements of the EMPr. The Contractor is answerable to the Project Manager for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria Their primary role is to coordinate the environmental management activities of the Contractor on site. <u>Responsibilities</u> • Be on site throughout the duration of the project and be dedicated to the project; • Ensure all their staff are aware of the environmental requirements, conditions and constraints with respect to all of their activities on site; • Implementing the environmental conditions, guidelines and requirements as stipulated within the Environmental Authorisation, EMPr and Method Statements; • Attend the Environmental Site Meeting; • Undertaking corrective actions where non-compliances are registered within the stipulated timeframes; • Report back formally on the completion of corrective actions; • Environmental monitoring as required by applicable legislation; • Assist the ECO in maintaining all the site documentation; • Prepare the site inspection reports and corrective action reports for submission to the ECO; • Assist the ECO with the preparing of the monthly report; and • Where more than one Contractor is undertaking work on site, each company appointed as a Contractor will appoint a cEO representing that company.
Facility Manager	• Operation of the facility; • Required maintenance of the facility; and • Overall compliance with the EMPr and Environmental Authorisation.

5.9 Environmental documentation, reporting and compliance

To ensure accountable and demonstrated implementation of the EMPr, a number of reporting systems, documentation controls and compliance mechanisms must be in place for all wind and solar PV projects as a minimum requirement. This section of the report details each of these and how they must be used throughout the project EMPr.

5.9.1 Document control & filing system

The approved filing system (in accordance with ISO 9000) must be established at the outset of the construction phase and must be maintained throughout the lifespan of the project. The ECOs are solely responsible for the upkeep and management of the EMPr file. At a minimum, all documentation detailed below will be stored in the EMPr file. A hard copy of all documentation must be filed, while an electronic copy may be kept where relevant. A duplicate file will be maintained in the office of the Developer's Site Supervisor (where applicable). This duplicate file will be the responsibility of the ECOs and must remain current and up-to-date. The filing system must be updated and relevant documents added as required. The EMPr file must be made available at all times on request by the Competent Authority (in terms of NEMA) or other relevant authorities. The EMPr file will form part of any Environmental Audits undertaken.

5.9.2 Documentation to be available

At the outset of the project the following documents must be placed in the filing system and be accessible at all times:

- Full copy of the signed Environmental Authorisation from the Competent Authority in terms of NEMA granting approval for the activity;
- Records of acknowledgement and acceptance of the EMPr from the Competent Authority in terms of NEMA;
- Complete copy of the Environmental Impact Assessment/ Basic Assessment Report;
- Complete copy of the EMPr;
- All signed copies of the Contractor's Environmental Agreement;
- All the Contractor's Method Statements;
- Completed Weekly Environmental Checklists;
- Copies of the accepted Monthly Environmental Reports;
- Minutes and attendance register of Environmental Site meetings;
- An up-to-date Environmental Incident Log;
- A copy of all non-compliances issued;
- A copy of all corrective actions signed off. The corrective actions must be filed in such a way that a clear reference is made to the non-compliance record;
- Copies of the relevant legislation, including the following:

i. National Environmental Management Act;
ii. Environmental Conservation Act;
iii. Occupational Health and Safety Act;
iv. National Water Act;
v. National Environmental Management: Air Quality Act
vi. National Environmental Management: Biodiversity Act;
vii. Conservation of Agricultural Resources Act;
viii. National Heritage Resources Act (including all relevant provincial Acts; and the
ix. Hazardous Subtances Act.

5.9.3 Weekly environmental checklists

The ECOs are required to complete a Weekly Environmental Checklist which meets the requirements of the EMPr. The ECOs are required to sign and date the checklist, retain a copy in the EMPr file and submit a copy of the completed checklist to the Developer's Site Supervisor on a weekly basis.

The checklists will form the basis for the Monthly Environmental Reports. Copies of all competed checklists will be attached as Annexures to the Final Environmental Audit Report. The ECOs will report on the week's "highs and lows" to the Senior Site Representative on a weekly basis.

5.9.4 Environmental Audit Reports

The ECOs must prepare a monthly Environmental Audit Report. The Report will be tabled as the key point on the agenda of the Environmental Site Meeting. The Report is submitted for acceptance at the meeting and the final report will be circulated to the Project Manager and filed in the EMPr file. At a frequency determined by the Environmental Authorisation, the ECOs must submit the monthly reports to the Competent Authority in terms of NEMA. At a minimum the Monthly report is to cover the following:

- Weekly Environmental Checklists;
- Deviations and non-compliances with the checklists;
- Non-compliances issued;
- Completed and reported corrective actions;
- Environmental Monitoring;
- General environmental findings and actions; and
- Minutes of the Bi-monthly Environmental Site Meetings.

5.9.5 Environmental site meetings

An Environmental Site Meeting will take place at least bi-monthly (i.e. every two weeks). The meeting will be chaired by the Project Manager or the Developer's Site Supervisor and cEOs will be required to attend. All environmental issues must be tabled at the meeting for discussion and resolution.

Minutes of the Environmental Site Meetings must be kept. The Minutes must include an attendance register and will be attached to the Monthly Report that is distributed to attendees. Each set of Minutes must clearly record Matters for Attention that will be reviewed at the next meeting.

5.9.6 Required Method Statements

A Method Statement is a written submission by the contractor to the Developer's Project Manager, Developer's Site Supervisor or ECO in response to the EMPr, setting out the plant, materials, labour and method the contractor proposes using to carry out an activity. The Method Statement will be done in such detail that the ECOs are enabled to assess whether the contractor's proposal is in accordance with the EMPr.

The Method Statement must cover applicable details with regard to:

- construction procedures;
- materials and equipment to be used;
- getting the equipment to and from site;
- how the equipment/ material will be moved while on site;
- how and where material will be stored;
- the containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
- timing and location of activities;
- compliance/ non-compliance with the EMPr; and
- any other information deemed necessary by the ECOs.

Unless indicated otherwise by the Project Manager, the Contractor must provide the following Method Statements to the Project Manager no less than 14 days prior to the programmed Commencement Date of the subject Works or activity:

- Site establishment – Camps, Lay-down or storage areas, satellite camps, infrastructure;
- Batch plants;
- Workshop or plant servicing;
- Handling, transport and storage of Hazardous Chemical Substances;
- Vegetation management – Protected, clearing, aliens, felling;
- Access management – Roads, gates, crossings etc.;
- Fire plan;
- Waste management – transport, storage, segregation, classification, disposal (all waste streams);
- Social interaction – complaints management, compensation claims, access to properties etc.;
- Water – use (source, abstraction and disposal), access and all related information, crossings and mitigation;
- Emergency preparedness – Spills, training, other environmental emergencies;
- Dust and noise;

- Fauna interaction and risk management – only if the risk was identified – wildlife interaction especially on game farms; and
- Heritage – Archaeology and palaeontology management.

The ECOs must ensure that the contractors perform in accordance with these Method Statements. Completed and authorised Method Statements must be captured in Appendix D.

5.9.7 Environmental Incident Log (Diary)

The ECOs are required to maintain an up-to-date and current Environmental Incident Log (environmental diary).

The Environmental Incident Log is a means to record all environmental incidents for which a non-compliance notice would **not** be issued. An environmental incident is defined as:

- Any deviation from the listed environmental mitigation measures (listed in this EMPr) that may be addressed immediately by the ECOs. (For example a contractor's staff member littering or a drip tray that has not been emptied);
- Any environmental impact resulting from an action or activity by a contractor in contravention of the environmental stipulations and guidelines listed in the EMPr which as a single event would have a minor impact but which if cumulative and continuous would have a significant effect (for example no toilet paper available in the ablutions for an afternoon); and
- General environmental information such as road kills or injured wildlife.

The ECOs are to record all environmental incidents in the Environmental Incident Log. All incidents regardless of severity must be reported to the Developer. The Log is to be kept in the EMPr file and at a minimum the following will be recorded for each environmental incident:

- The date and time of the incident;
- Description of the incident;
- The name of the Contractor responsible;
- The incident must be listed as significant or minor;
- If the incident is listed as significant, a non-compliance notice must be issued, and recorded in the log;
- Remedial or corrective action taken to mitigate the incident; and
- Record of repeat minor offences by the same contractor or staff member.

The Environmental Incident Log will be captured in the Environmental Audit Report.

5.9.8 Non-compliance

A non-compliance notice will be issued to the responsible contractor by the ECOs via the Developer's Site Supervisor or Project Manager. The non-compliance notice will be issued in writing; a copy filed in the EMPr file and will at a minimum include the following:

- Time and date of the non-compliance;
- Name of the contractor responsible;
- Nature and description of the non-compliance;
- Recommended / required corrective action; and
- Date by which the corrective action to be completed.

The Contractors must act immediately when a notice of non-compliance is received and correct whatever is the cause for the issuing of the notice. Complaints received regarding activities on the construction site pertaining to the environment must be recorded in a dedicated register and the response noted with the date and action taken. The ECO should be made aware of any complaints. Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed. Failure to redress the cause must be reported to the relevant authority (DAFF, DEFF, DWS, relevant provincial heritage authorities) for them to deal with the transgression, as it deems fit. The Contractor is deemed not to have complied with the EMPr if, *inter alia*:

- Deviates from the environmental conditions and requirements as set out in the EMPr that has, or may cause, an environmental impact;
- Contravenes environmental legislation; and
- Results in an unforeseen environmental impact. This may be caused by direct or indirect actions or activities on site. Significance will be determined by the ECOs, but will be informed by geographic extent, duration, lasting effects of the impact and extent of remediation to rectify the impact.

5.9.9 Corrective Action Records

For each non-compliance notice issued, a documented corrective action must be recorded. On receiving a non-compliance notice from the Developer's Site Supervisor, the contractor's ECO will ensure that the corrective actions required take place within the stipulated timeframe. On completion of the corrective action the cEO is to issue a Corrective Action Report in writing to the ECOs. If satisfied that the corrective action has been completed, the ECOs are to sign-off on the Corrective Action Report, and attach the report to the non-compliance notice in the EMPr file. A corrective action is considered complete once the report is signed off by the ECOs.

5.9.10 Contractor Environmental Agreements

Each contractor working on site is required to sign the Contractor Environmental Agreement. This agreement provides for:

- Signed acknowledgement by the Contractor of the EMPr and the environmental controls and stipulations therein;

The signed copies of the Contractor Environmental Agreements are to be filed in the EMPr file. No contractor will be allowed to start work without having signed the Contractor Environmental Agreement.

5.9.11 Photographic record

A digital photographic record will be kept. The photographic record will be used to show before, during and post rehabilitation evidence of the project as well used in cases of damages claims if they arise. Each image must be dated and a brief description note attached.

The Contractor must:

1. Allow the ECOs access to take photographs of all areas, activities and actions.

The ECOs must keep an electronic database of photographic records which will include:

1. Pictures of all areas designated as work areas, camp areas, construction sites and storage areas taken before these areas are set up;
2. All bunding and fencing;
3. Road conditions and road verges;
4. Condition of all farm fences;
5. Topsoil storage areas;
6. Waste management sites;
7. Ablution facilities (inside and out);
8. Any non-conformances deemed to be "significant";
9. All completed corrective actions for non-compliances;
10. All required signage; and
11. All areas before, during and post rehabilitation.

Include relevant photographs in the Final Environmental Audit Report

5.9.12 Complaints Register

The ECOs must keep a current and up-to-date complaints register. The complaints register is to be a record of **all** complaints received from communities, stakeholders and individuals. The Complaints Record must:

1. Record the name and contact details of the complainant;
2. Record the time and date of the complaint;
3. Contain a detailed description of the complaint;
4. Where relevant and appropriate, contain photographic evidence of the complaint or damage (ECOs to take relevant photographs); and
5. Contain a copy of the ECOs written response to each complaint received and keep a record of any further correspondence with the complainant. The ECO's written response will include a description of any corrective action to be taken and must be signed by the Contractor, ECO and

affected party. Where a damage claim is issued by the complainant, the ECOs must respond as described in (5A.9.13) below.

5.9.13 Claims for damages

In the event that a Claim for Damages is submitted by a community, landowner or individual, the ECOs must:

1. Record the full detail of the complaint as described in (9.12) above;
2. The ECOs will evaluate the claim and associated damage and submit the evaluation to the Senior Site Representative for approval;
3. Following consideration by the Developer's Project Manager, the claim is to be resolved and settled immediately, or the reason for not accepting the claim communicated in writing to the claimant. Should the claimant not accept this, the ECO must, in writing report the incident to the Developer's negotiator and legal department; and
4. A formal record of the response by the ECOs to the claimant as well as the rectification and/or payment will be recorded in the EMPr file.

5.9.14 Interaction with affected parties

Open, transparent and good relations with affected landowners, communities and regional staff are an essential aspect to the successful management and mitigation of environmental impacts. The Contractor must ensure that:

1. All negotiations with affected parties are done with the affected parties, Developer's Site Supervisor and ECO present;
2. No oral agreements between the above parties must be entered into. All agreements will be recorded in writing, signed by all parties and filed in the EMPr file;
3. Affected parties will be informed by the cEO of any changes to the construction programme;
4. The Contractor's contact telephone numbers are made available to all I&APs; and
5. Contact with all affected parties will be courteous at all times.

The ECOs must:

1. Ensure that all queries, complaints and claims are dealt with immediately;
2. Ensure that any or all negotiations take place with the affected parties, Senior Site Representative and Contractor present;
3. Ensure that any or all agreements are documented, signed by all parties and a record of the agreement kept in the EMPr file;
4. Ensure that his/her contact telephone numbers are made available to all landowners and affected parties;
5. Ensure that a current and up-to-date list of affected parties and their contact details are available at all times in the EMPr file;
6. Ensure that contact with affected parties is courteous at all times; and
7. Attach all documented agreements, settlements and claims to the Final Environmental Audit Report.

5.9.15 Environmental Audits

Environmental Audits of the construction phase and implementation of the EMPr will be undertaken by an independent Environmental Auditor and are a legal requirement in terms of NEMA once an Environmental Authorisation is issued and as long as the EMPr is valid. The findings and outcomes of these audits will be recorded in the EMPr file. The environmental audits and associated reports must be conducted and submitted to the Competent Authority at intervals as indicated in the Environmental Authorisation. If any audit findings concern heritage resources, the relevant HRA must be contacted for the way forward

5.9.16 Final Environmental Audit Report

On final completion of the Construction Phase, the independent Environmental Auditor is required to prepare a Final Environmental Audit Report. The Report is to be submitted to the Competent Authority for acceptance and approval. The Environmental Report must contain the following in accordance with Appendix 7 of National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental impact Assessment Regulations, 2014.

- Details of the independent person who prepared the report;
- Details of the expertise of independent person that compiled the report;
- A declaration that the independent auditor is independent in a form as may be specified by the Competent Authority;
- An indication of the scope of, and the purpose for which, the environmental audit report was prepared;
- A description of the methodology adopted in preparing the environmental audit report;
- An indication of the ability of the EMPr, and where applicable, the closure plan to-
- Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis;
- Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and
- Ensure compliance with the provisions of Environmental Authorisation, EMPr, and where applicable, the closure plan;
- A description of any assumptions made, and any uncertainties or gaps in knowledge;
- A description of any consultation process that was undertaken during the course of carrying out the environmental audit report;
- A summary and copies of any comments that were received during any consultation process; and
- Any other information requested by the Competent Authority.

Acceptance and approval of the Final Environmental Audit Report by the Competent Authority will end the construction phase EMPr as successful and completed.

SECTION B: ENVIRONMENTAL CONTROLS

The Environmental Controls are described in two sections:

1. **Section 1: General environmental controls**

This section refers to construction related activities that are common to most wind and solar PV projects. For each activity a set of prescribed environmental controls and associated management actions have been identified. Contractors must implement these controls for all projects as a minimum requirement for mitigating the impact of particular construction related activities.

The format of a general environmental control is illustrated below. The boxes shaded in green are predefined and represent minimum standards for the management of that particular aspect. The contractor will be required to adhere to all impact management actions (where applicable to the construction related activity) for all wind and solar PV projects. The boxes shaded in red assign responsibility for the implementation and monitoring of the impact management actions. This information is project specific and must be completed by the contractor prior to commencement of construction.

Figure 2: Format of a general environmental control illustrating aspects which are predefined vs those which still need to be completed by the contractor

Management Objective:	**PREDEFINED AS PART OF GENERIC EMPr**				
Management Outcome:	**PREDEFINED AS PART OF GENERIC EMPr**				
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
PREDEFINED AS PART OF GENERIC EMPr	**TO BE COMPLETED BY CONTRACTOR**	**TO BE COMPLETED BY CONTRACTOR**	**TO BE COMPLETED BY CONTRACTOR**	**TO BE COMPLETED BY CONTRACTOR**	**TO BE COMPLETED BY CONTRACTOR**

2. **Section 2: Project specific environmental controls**

This section refers to project specific environmental controls. These are specific actions or mitigation measures related to the project itself and based on findings from the BA/EIA, site walk through or conditions attached to the Environmental Authorisation. They are more specific than the environmental controls included in Section 1 and refer to sensitive features where additional or specific controls are needed to manage impacts. Controls in these sections must be referenced spatially in the context of the final project footprint.

The EAP is therefore required to complete this section by producing an environmental sensitivity map of the final project footprint and any specific mitigation measures required.

Additional project specific information included in this section must include landowner contact information and any specific requirements regarding access to land and specific turbine positions.

5.10 Section 1: General Environmental Controls

5.10.1 Environmental awareness training

Management Objective: Environmental training of construction staff minimises the occurrence of environmental impact to the work area.

Management Outcome: Environmental impact as a result of construction activities is minimised through the development of effective environmental awareness training material and execution of environmental awareness training all staff

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. All staff must receive environmental awareness training prior to commencement of activities; 2. The Contractor must allow for sufficient sessions to train all personnel with no more than 20 personnel attending each course; 3. All new staff coming onto site must receive environmental awareness training; 4. Refresher environmental awareness training is available as and when required; 5. All staff are aware of the conditions and controls linked to the Environmental Authorisation and within the EMPr; 6. All staff are made aware of their individual roles and responsibilities in achieving compliance with the Environmental Authorisation and EMPr; 7. The Contractor must erect and maintain information posters at key locations on site; 8. Environmental awareness training should include as a minimum the following: a) Description of significant environmental impacts, actual or potential, related to their work activities; b) Mitigation measures to be implemented when carrying out specific activities; c) Emergency preparedness and response procedures; d) Emergency procedures; e) Procedures to be followed when working near or within sensitive areas; f) Wastewater management procedures; g) Water usage and conservation; h) Solid waste management procedures; i) Sanitation procedures; j) Disease prevention; and k) Chance find procedure for archaeological/paleontological/historical sites unearthed during construction. 9. A record of all environmental awareness training courses undertaken as part of the EMPr must be available; 10. Educate workers on the dangers of open and/or unattended fires; 11. A staff attendance register of all staff to have received environmental awareness training must be available; and 12. Course material must be available and presented in all appropriate languages.					

5.10.2 Construction site establishment

Management Objectives: Ensure that environmental issues are taken into consideration in the planning and construction of site establishment

Management Outcome: Impact to the environment during site establishment is minimised.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. A Method Statement must be provided by the contractor prior to any onsite activity that includes the layout of the construction camp in the form of a plan showing the location of key infrastructure and services (where applicable), including but not limited to offices, overnight vehicle parking areas, stores, the workshop, stockpile and lay down areas, hazardous materials storage areas (including fuels), the batching plant (if one is located at the construction camp), designated access routes, equipment cleaning areas and the placement of staff accommodation, cooking and ablution facilities, waste and wastewater management; 2. The location of the construction camp/s must be within approved area to ensure that the site does not impact on sensitive areas identified in the environmental assessment or site walk through; 3. Sites should be located where possible on previously disturbed areas; 4. The construction camp must be fenced in accordance with Section 5.10.5: *Fencing and gate installation*; and 5. The use of existing accommodation for contractor staff, where possible, is encouraged.					

5.10.3 Access restricted areas

Management Objectives: Construction related activities inside access restricted areas is prevented in an effort to avoid environmental impacts to such areas.

Management Outcome: Impact to No-Go areas is avoided through the effective demarcation and management of these areas.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Identification of access restricted areas is to be informed by the environmental assessment, site walk through and any additional areas identified during development; 2. Erect, demarcate and maintain a temporary fence around the perimeter of any access restricted area, colour coding could be used if appropriate; 3. Fencing of access restricted areas is to be undertaken in accordance with Section 5.10.5: *Fencing and gate installation*; and 4. Unauthorised access and construction related activity inside access restricted areas is prohibited.					

5.10.4 Access roads

Management Objective: Minimise impact to the environment through the planned and controlled movement of vehicles on site.

Management Outcomes: Vehicle movement to adhere to agreed access plan.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Maximum use of both existing servitudes and roads must be made to ; 2. In circumstances where private roads must be used, the condition of the said roads must be recorded in accordance with Section 5.9.11: photographic record; prior to use and the condition thereof agreed by the landowner, the Development Project Manager, landowner and the contractor; 3. All private roads used for access to the site and turbine foundation areas must be maintained and upon completion of the works, be left in at least the original condition. As far as possible, access roads must follow the contours in hilly areas, as opposed to winding down steep slopes; 4. Access is to be established by vehicles passing over the same track on natural ground, multiple tracks are not permitted. 5. Access roads must only be constructed as authorised in the Environmental Authorisation; 6. Upon completion of construction, only roads as indicated by the Development Project Manager must be closed.					

5.10.5 Fencing and gate installation

Management Objective: To minimise impact to the environment and ensure safe and controlled access to the site through the erection of fencing and gates where required.

Management Outcomes: The erection of fencing and management of fencing is to be undertaken in accordance with the Fencing Act No 31 of 1963

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. The Fencing Act No 31 of 1963 must be adhered to at all times with regards to the leaving open of gates and the dropping of fences for crossing purposes, climbing and wilful damage or removal of gates; 2. Use existing gates provided to gain access to all parts of the defined Working Area, where possible; 3. All gates must be fitted with locks and be kept locked at all times during the construction phase, unless otherwise agreed with the landowner; 4. Where there is no suitable gate for access to the site,on the instruction of the Development Project Manager, a gate must be installed;					

5. Care must be taken that the gates must be so erected that there is a gap of no more than 100 mm between the bottom of the gate and the ground; 6. Where gates are installed in jackal proof fencing, a suitable reinforced concrete sill must be provided beneath the gate; 7. Original tension must be maintained in the fence wires; 8. All gates installed in electrified fencing must be re-electrified; 9. All demarcation fencing and barriers must be maintained in good working order for the duration of construction activities; 10. Fencing must be erected around the construction camp, batching plants, hazardous storage areas, and all designated no-go areas, where applicable; 11. All fencing must be constructed of high quality material bearing the SABS mark; 12. The use of razor wire as fencing must be avoided; 13. Fenced areas with gate access must remain locked after hours, during weekends and on holidays if staff are away from site. Site security will be required at all times; 14. On completion of the project all temporary fences are to be removed;; 15. The contractor must ensure that all fence uprights are appropriately removed, ensuring that no uprights are cut at ground level but rather removed completely.					

5.10.6 Water supply management

Management Objectives: Undertake responsible water usage during construction

Management Outcome: Water use during construction is compliant with the requirements of the National Water Act (No 36 of 1998)

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. All abstraction points or boreholes must be registered with the DWS and suitable water meters installed to ensure that the abstracted volumes are measured on a daily basis; 2. Should water abstraction be required and the necessary authorisation from DWS and permission from the landowner has been received, the Contractor must ensure the following: a. The vehicle abstracting water from a river does not enter or cross it and does not operate from within the river; b. No damage occurs to the river bed or banks and that the abstraction of water does not entail stream diversion activities; and c. All reasonable measures to limit pollution or sedimentation of the downstream watercourse are implemented. 3. Ensure water conservation is being practiced by: a. Minimising water use during cleaning of equipment; b. Undertaking regular audits of water systems; c. Including a discussion on water usage and conservation during environmental awareness training; and d. The use of grey water is encouraged.					

5.10.7 Storm and waste water management

Management Objectives: To avoid, manage and mitigate potential impacts to the environment caused by storm water and waste water discharge during construction.

Management Outcomes: Waste water management is undertaken in accordance with relevant national and provincial legislation and local by-laws.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Appropriate pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into watercourses or water bodies must be designed and implemented; 2. Runoff from the cement/ concrete batching areas must be strictly controlled, and contaminated water must be collected, stored and either treated or disposed of off-site, at a location approved by the Project Manager; 3. All spillage of oil onto concrete surfaces must be controlled by the use of an approved absorbent material and the used absorbent material disposed of at an appropriate waste disposal facility; 4. Natural storm water runoff not contaminated by construction operations and clean water can be discharged directly to watercourses and water bodies, subject to the Project Manager's approval and support by the ECO;					

5. Water that has been contaminated with suspended solids, such as soils and silt, may be released into watercourses or water bodies only once all suspended solids have been removed from the water by settling out these solids in settlement ponds. The release of settled water back into the environment must be subject to the Project Manager's approval and support by the ECO; 6. A stormwater management plan for the construction and operation phases of the project must be prepared and implemented on site.					

5.10.8 Solid waste management

Management Objectives: To avoid, manage and mitigate potential impacts to the environment caused by the incorrect storage, handling and disposal of general and hazardous solid waste.					
Management Outcomes: Solid waste management is undertaken in accordance with relevant national and provincial legislation and local by-laws.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. All measures regarding waste management must be undertaken using an integrated waste management approach; 2. Sufficient, covered waste collection bins (scavenger and weatherproof) must be provided; 3. A suitably positioned and clearly demarcated waste collection site must be identified and provided; 4. The waste collection site must be maintained in a clean and orderly manner; 5. Waste must be segregated into separate bins and clearly marked for each waste type; 6. Staff must be trained in waste segregation; 7. Recycling of waste types must be maximised; 8. Bins must be emptied regularly; 9. General waste must be disposed of at recognised and registered waste disposal sites/ a recycling company; 10. Hazardous waste must be disposed of at a registered waste disposal site; 11. Certificates of safe disposal for general, hazardous and recycled waste must be maintained.					

5.10.9 Protection of watercourses and water bodies

Management Objectives: Construction related activity is undertaken in a manner which prevents ipollution and contamination of the watercourses environment.					
Management Outcome: Impact to No-Go areas is avoided through the effective demarcation and management of these areas.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. All watercourses must be protected from direct or indirect spills of pollutants such as solid waste, sewage, cement, oils, fuels, chemicals, aggregate tailings, wash and contaminated water or organic material resulting from the Contractor's activities; 2. In the event of a spill, prompt action must be taken to clear the polluted or affected areas; 3. Where possible, no development equipment must traverse any seasonal or permanent wetland; 4. No excavation or construction must be permitted within the 1:100 year flood line or riparian zone (whichever is the greatest) of a watercourse or within 500 m from the boundary of a wetland area without prior approval from the Competent Authority (DWS or Catchment Management Agency) in the form of a water use authorisation; 5. When working in or near any watercourse or wetland, the following environmental controls and consideration must be taken: a) River levels during the period of construction; b) During the execution of the Works, appropriate measures to prevent pollution and contamination of the riverine environment must be implemented e.g. including ensuring that construction equipment is well maintained; c) Where earthwork is being undertaken in close proximity to any watercourse, slopes must be stabilised using suitable materials, i.e. sandbags or geotextile fabric, to prevent sand and rock from entering the channel; and d) Appropriate rehabilitation and re-vegetation measures for the river banks must be implemented timeously. In this regard, the banks should be appropriately and incrementally stabilised as soon as development allows.					

5.10.10 Vegetation clearing

Management Objective: To ensure vegetation clearance is kept to a minimum during construction and operation without causing unnecessary environmental damage.

Management Outcomes: Vegetation clearance is minimised through adherence to EMPr vegetation clearance requirements.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
General 1. Clearance of indigenous vegetation in and outside the development footprint areas must be kept to a minimum during the construction of the facility; 2. Protected or endangered species (Species of Special Concern) may occur on or near the construction site. Special care should be taken not to damage such species; 3. A Botanical Specialist should be appointed to do a final walk through of the project area. 4. Search, rescue and replanting of all protected and endangered species likely to be damaged during construction must be identified by the Botanical Specialist and completed prior to any construction or clearing; 5. Permits for removal of protected and endangered species must be obtained from the relevant Competent Authority prior to the cutting,clearing or removal of the affected species; 6. The Environmental Audit Report must confirm that all identified species have been rescued and replanted and that the location or replanting is compliant is compliant with conditions of approvals; 7. Trees felled due to construction must be documented and listed in the Final Audit Environmental Report; 8. Rivers, watercourses and other water bodies must be kept clear of felled trees, vegetation cuttings and debris; 9. The collection or harvesting of any plants or fuel wood at the site during construction must be strictly forbidden and the staff must be educated to prevent this from happening; 10. Only a registered pest control operator may apply herbicides on a commercial basis and commercial application must be carried out under the supervision of a registered pest control operator, supervision of a registered pest control operator or is appropriately trained; 11. A daily register must be kept of all relevant details of herbicide usage; 12. Trees, shrubs, grass, natural features and topsoil which are not removed during vegetation clearance must be protected from damage during operation of the facility; 13. All protected species and sensitive vegetation not removed must be clearly marked and such areas fenced off if required in accordance with to Section 5.10.3: Access restricted areas; 14. Exisiting roads/servitudes must be used and should be located along the boundaries of existing disturbed areas, if possible; 15. Undertake rehabilitation of disturbed areas as soon as possible after construction; 16. Alien vegetation on-site must be managed in terms of the GNR 1048 of 25 May 1984 (as amended) issued in terms of the Conservation of Agricultural Resources Act, Act 43 of 1983; 17. Alien invasive vegetation should be removed and disposed of at a licenced waste disposal facility.					

5.10.11 Protection of fauna

Management Objective: Ensure care is taken to minimise disturbance to fauna during construction and potential future impact during the operation of the facility.

Management Outcomes: Impact to fauna is avoided during construction and mitigated during operation of the facility

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Construction activities must not interfere or cause fatalities to animals (both wild and farm animals) as stipulated by Environmental Conservation Act 73 of 1989; 2. No Threatened or Protected species (ToPs) and/or protected fauna as listed according to the National Environmental Management: Biodiversity Act (Act No 10 of 2004) (NEMBA) and relevant provincial oridinances may be removed and/or relocated without appropriate authorisations/permits;					

3. No hunting, poaching or trapping of animals must be tolerated under any circumstances. All animal dens in close proximity to the works areas must be marked as No-Go areas; 4. No interference with livestock must occur without the landowner's written consent and with the landowner or a person representing the landowner being present; 5. The waste collection bins and skips must be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.to ensure that animals are not attracted to the site (and potenitally resulting in increased road mortality); 6. Workers and visitors to the site must adhere to the speed limits applicable to all roads on site. **Avifauna (Birds)** 7. Develop a pre-construction monitoring pogramme for birds that is in line with the applicable South African Best Practice Guidelines for pre-construction monitoring. Currently, a 12-month pre-construction bird monitoring programme is required for wind farms as per the latest Best Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa (Jenkins *et al.* 2015) [1]; 8. Develop an operational montoring programme for birds in line with the applicable South African Best Practice Guidelines; 9. Develop and implement a carcass search programme for birds during operation, in line with the applicable (i.e. at the start of operations at the wind farm) South African monitoring guidelines; 10. The pre- and post construction bird monitoring programmes must also be in accordance with the recommendations of the bird specialist in the assessment report for that specific site and must comply to the relevant conditions in the Environmental Authorisation; 11. Any bird mortality or injury at the facility must be duly recorded and reported in line with the applicable South African Bird Guidelines at the time; 12. Areas of high sensitivity and no-go areas (e.g. nesting areas) as identified by the Bird specialist in the assessment report or during the walk through prior to construction must be avoided. Any buffer areas identified by the specialist must be adhered to; 13. Breeding sites of raptors and other wild bird species must be taken into consideration during the planning of the development programme. **Bats** 14. Develop a pre-construction monitoring pogramme for bats that is in line with the applicable South African Best Practice Guidelines for pre-construction monitoring. Currently, a 12-month pre-construction bat monitoring programme is required for wind farms as per the latest South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2017)[2]; 15. Develop an operational monitoring programme for bats in line with the applicable South African Best Practice Guidelines (currently it is the "South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities, 1st Edition (Aronson et al., 2014)".)[3]; 16. Develop and implement a carcass search programme for birds during operation, in line with the applicable (i.e. at the start of operations at the wind farm) South African monitoring guidelines; 17. The pre- and post construction bat monitoring programmes must also be in accordance with the recommendations of the bat specialist in the assessment report for that specific site and must comply to the relevant conditions in the Environmental Authorisation; 18. Any bat mortality or injury at the facility must be duly recorded and reported in line with the applicable South African Bat Guidelines at the time; 19. Areas of high sensitivity and no-go areas (e.g. nesting areas) as identified by the Bat specialist in the assessment report or during the walk through prior to construction must be avoided. Any buffer areas identified by the specialist must be adhered to.					

5.10.12 Protection of heritage resources

Management Objective: Prevent damage and destruction to fossils, artefacts and materials of heritage significance
Management Outcomes: Impact to heritage resources is avoided

[1] Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. Ralston, S. 2015. Bird and Wind-Energy Best-Practice Guidelines. Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa. Third Edition (previous versions 2011 and 2012). BirdLife South Africa and Endangered Wildlife Trust, Johannesburg, South Africa.

[2] Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Forssman, K. and Lötter, C. (2017). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Edition 4.1. South African Bat Assessment Association.

3 Aronson, J., Sowler, S. and MacEwan. K. (2018). Mitigation guidance for bats at wind energy facilities in South Africa.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Identify, demarcate and prevent impact to all known sensitive heritage features on site in accordance with the No-Go procedure in Section 5.11.3: *Access restricted areas;* 2. Any buffer areas identified by the Heritage specialist in the assessment report must be adhered to (e..g for graves, caves, kraals, and ruins); Reports of monitoring to be submitted to the relevant HRA for record and commenting purposes (only if comments are required to plan way forward for chance finds) 3. Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance; 4. An archaeologist must be appointed to do a walk down survey of the site prior to construction to identify any possible heritage resources which were not recorded in the initial assessment. 5. A palaeontological walk down by a palaeontologist. A report detailing the results of the walk-down with track logs must be submitted to the relevant HRA and the site details to be lodged with SAHRIS ; 6. All work must cease immediately, if any human remains and/or other archaeological, palaeontological and historical material are uncovered. Such material, if exposed, must be reported immediately to the heritage authorities, i..e SAHRA or the relevant provincial Heriage authority or the nearest museum, archaeologist/ palaeontologist, so that a systematic and professional investigation can be undertaken. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the findings. Sufficient time must be allowed to remove/collect such material before construction recommences. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit and the South African Police Services (the current officers are must be alerted immediately as per section 36(6) of the NHRA to inspect the findings.					

5.10.13 Safety of the public

Management Objective: Reasonable measures are taken to ensure the safety of the public at all times during construction

Management Outcomes: All precautions are taken where possible to minimise the risk of injury, harm or complaints

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Identify fire hazards, demarcate and restrict public access to these areas as well as notify the local authority of any potential threats e.g. large brush stockpiles, fuels etc.; 2. All unattended open excavations must be adequately fenced or demarcated; 3. Ensure wind turbines and other structures vulnerable to high winds are secured; 4. Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.					

5.10.14 Sanitation

Management Objective: An abundant supply of suitably located, clean and well maintained toilet facilities are available to all staff in an effort to minimise the risk of disease and impact to the environment.					
Management Outcomes: No pollution or disease arises on-site as a result of sanitation facilities or lack thereof.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Mobile chemical toilets are installed onsite if no other ablution facilities are available; 2. The use of ablution facilities and or mobile toilets must be used at all times and no indiscriminate use of the veld for the purposes of ablutions must be permitted under any circumstances; 3. Ablution facilities must be located within 100 m of any work place and must be numerous enough to accommodate the workforce (minimum requirement of 1:15 workers on site); 4. Where mobile chemical toilets are required, the following must be ensured: a) Toilets are located no closer than 100 m to any watercourse or water body; b) Toilets are secured to the ground to prevent them from toppling due to wind or any other cause; c) No spillage occurs when the toilets are cleaned or emptied and the contents are managed in accordance with the EMPr; d) Toilets have an external closing mechanism and are closed and secured from the outside when not in use to prevent toilet paper from being blown out; e) Toilets are emptied before long weekends and workers holidays, and must be locked after working hours; f) Toilets are serviced regularly and the ECO must inspect toilets to ensure compliance to health standards; 5. A copy of the waste disposal certificates must be maintained.					

5.10.15 Prevention of disease

Management Objective: All necessary precautions linked to the spread of disease during construction, especially to livestock, are taken.					
Management Outcomes: The risk of the occurrence and spread of disease is minimised through the effective implementation of EMPr actions.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Undertake environmentally-friendly pest control in the camp area; 2. Ensure that the workforce is sensitised to the effects of sexually transmitted diseases, especially HIV AIDS; 3. The Contractor must ensure that information posters on AIDS are displayed in the Contractor Camp area; 4. Information and education relating to sexually transmitted diseases to be made available to both construction workers and local community, where applicable; 5. Free condoms must be made available to all staff on site at central points; 6. Medical support must be made available; 7. Provide access to Voluntary HIV Testing and Counselling Services.					

5.10.16 Emergency procedures

Management Objective: Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies.

Management Outcomes: All emergency situations are managed in accordance with the emergency procedures.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Compile an Emergency Response Action Plan (ERAP) prior to the commencement of the proposed project; 2. The ERAP must deal with accidents, potential spillages and fires in line with relevant legislation; 3. All staff must be made aware of emergency procedures as part of environmental awareness training; 4. The relevant local authority must be made aware of a fire as soon as it starts; 5. In the event of emergency necessary mitigation measures to contain the spill or leak must be implemented (see Hazardous Substances Section 5.10.17).					

5.10.17 Hazardous substances

Management Objective: To minimise the risk of impact to the environment through the safe storage, handling, use and disposal of hazardous substances.

Management Outcomes: The management of hazardous substances is undertaken in accordance with the Hazardous Substances Act of 1973 (Act No. 15 of 1973), the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (Department of Water Affairs and Forestry, 1998) and Farm Feeds, Agricultural Remedies and Stock Remedies Act of 1947 (Act No. 36 of 1947) and National Environmental Management: Waste Act of 2008.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. The Occupational Health and Safety Act No 85 of 1993 must be complied with at all times; 2. The use and storage of hazardous substances to be minimised and non-hazardous and non-toxic alternatives substituted where possible; 3. All hazardous substances must be stored in suitable containers as defined in the Method Statement; 4. Containers must be clearly marked to indicate contents, quantities and safety requirements; 5. All storage areas must be bunded. The bunded area must be of sufficient capacity to contain a spill / leak from the stored containers; 6. An Alphabetical Hazardous Chemical Substance (HCS) control sheet must be drawn up and kept up to date on a continuous basis; 7. All hazardous chemicals that will be used on site must have Material Safety Data Sheets; 8. All employees working with HCS must be trained in the safe use of the substance and according to the safety data sheet; 9. Employees handling hazardous substances / materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment (PPE) must be made available; 10. The Contractor must ensure that diesel and other liquid fuel, oil and hydraulic fluid is stored in appropriate storage tanks or in bowsers; 11. The tanks/ bowsers must be situated on a smooth impermeable surface (concrete) with a permanent bund. The impermeable lining must extend to the crest of the bund and the volume inside the bund must be 130% of the total capacity of all the storage tanks/ bowsers (110% statutory requirement plus an allowance for rainfall); 12. The floor of the bund must be sloped, draining to an oil separator; 13. Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained; 14. All empty externally dirty drums must be stored on a drip tray or within a bunded area; 15. No unauthorised access into the hazardous substances storage areas must be permitted; 16. No smoking must be allowed within the vicinity of the hazardous storage areas; 17. Adequate fire-fighting equipment must be made available at all hazardous storage areas; 18. Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used as well; 19. An appropriately sized spill kit kept onsite relevant to the scale of the activity/s involving the use of hazardous substance must be available at all times; 20. The responsible operator must have the required training to make use of the spill kit in emergency situations;					

21. In the event of a spill, contaminated soil must be collected in containers and stored in a central location and disposed of according to the National Environmental Management: Waste Act 59 of 2008. Refer to Section 5.10.7 for procedures concerning waste water management and Section 5. 10.8 for solid waste management.					

5.10.18 Workshop, equipment maintenance and storage

Management Objective: The control operation, maintenance and storage of equipment prevents soil, surface water and groundwater contamination

Management Outcomes: Soil, surface water and groundwater contamination is prevented due to adherence of EMPr requirements

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Where possible and practical all maintenance of vehicles and equipment must take place in the workshop area; 2. During servicing of vehicles or equipment, especially where emergency repairs are effected outside the workshop area, a suitable drip tray must be used to prevent spills onto the soil; 3. Leaking equipment must be repaired immediately or be removed from site to facilitate repair; 4. Workshop areas must be monitored for oil and fuel spills and such spills; 5. Appropriately sized spill kit kept onsite relevant to the scale of the activity taking place must be available; 6. The responsible operator of equipment must have the required training to make use of the spill kit in emergency situations; 7. The workshop area must have a bunded concrete slab that is sloped to facilitate runoff into a collection sump or suitable oil / water separator where maintenance work on vehicles and equipment can be performed; 8. Water drainage from the workshop must be contained and managed in accordance with Section 5.10.7: *Waste water management.*					

5.10.19 Batching plants

Management Objective: To control concrete and cement batching activities in order to prevent spillages and concomitant contamination of soil, surface water and groundwater environment.

Management Outcome: The management, handling and storage of sand, stone and cement is undertake in accordance with the EMPr

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Concrete mixing must be carried out on an impermeable surface (such as on boards or plastic sheeting and/or within a bunded area with an impermeable surface); 2. Batching plants areas must be fitted with a containment facility for the collection of cement laden water. This facility must be impervious to prevent soil and groundwater contamination; 3. Dirty water from the batching plant must be contained to prevent soil and groundwater contamination; 4. Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains; 5. A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted; 6. Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licenced disposal facility; 7. Empty cement bags must be secured with adequate binding material if these must be temporarily stored on site; 8. Sand and aggregates containing cement must be kept damp to prevent the generation of dust (Refer to Section 5.10.20: *Dust emissions*); 9. Any excess sand, stone and cement must be removed from site on completion of construction period and disposed at a registered disposal facility; 10. Temporary fencing must be erected around batching plants in accordance with Section 5.10.5: *Fencing and gate installation*.					

5.10.20 Dust emissions

Management Objective: To reduce dust emissions during construction activities.					
Management Outcome: Minimal occurrence of dust due the adherence of EMPr requirements.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the ECO; 2. Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible; 3. Excavation, handling and transport of erodible materials must be avoided under high wind conditions or when a visible dust plume is present; 4. During high wind conditions, the ECO must evaluate the situation and make recommendations as to whether dust-damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level; 5. Where possible, soil stockpiles must be located in sheltered areas where they are not exposed to the erosive effects of the wind; 6. Where erosion of stockpiles becomes a problem, erosion control measures must be implemented at the discretion of the ECO; 7. Vehicle speeds must not exceed 40 km/h along dust roads or 20 km/h when traversing unconsolidated and non-vegetated areas; 8. Appropriate dust suppression measures must be used when dust generation is unavoidable, e.g. dampening with water; particularly during prolonged periods of dry weather in summer. Such measures must also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, chipping); 9. Straw stabilisation must be applied at a rate of one bale/10m² and harrowed into the top 100 mm of top material, for all completed earthworks; 10. For significant areas of excavation or exposed ground, dust suppression measures must be used to minimise the spread of dust.					

5.10.21 Noise management

Management Objective: To prevent unnecessary noise to the environment by ensuring that noise from construction activity is mitigated.					
Management Outcomes: Noise management is undertaken in accordance with SANS 10103 and requirements of the EMPr.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Operating hours as determined by the Environmental Authorisation are adhered to during the construction phase. Where not defined, construction must be limited to daylight hours; 2. Conduct noise monitoring tests, as required by the ECO or Environmental Authorisation; 3. Noise levels are to comply with ECA's 7dB rule i.e. cannot generate noise that increases the noise levels to 7dB above the current ambient; 4. The recommendations by the noise specialist as identified in the assessment must be adhered to. This includes the implementation of adequate buffer areas between the wind turbines and Noise Sensitive Developments (e.g. farm dwellings); 5. Any complaints received during the construction and operational phases of the facility (e.g noise generated from the wind turbines) must be recorded in the complaints register which must be included in the Audit Report. Where possible or applicable, provide transport to and from the site on a daily basis for construction worker.					

5.10.22 Visual impacts

Management Objective: Minimise visual clutter during the construction phase and operational phase.					
Management Outcomes: Visual impact to the environment is minimised through adherence to EMPr requirements					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Prevent unnecessary visual clutter and focusing attention of surrounding visual receptors on the proposed development; 2. Ensure that dust suppression techniques are implemented on all access roads; 3. Maintain a neat construction site; 4. Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.					

5.10.23 Fire prevention

Management Objective: To minimise the risk of fire during construction					
Management Outcomes: Fire prevention measures are carried out in accordance with the National Veld and Forest Fire Act, 101 of 1998					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
5. Designate smoking areas where the fire hazard could be regarded as insignificant; 6. Educate workers on the dangers of open and/or unattended fires; 7. No open fires must be allowed on site under any circumstances; 8. Firefighting equipment must be available on all vehicles located on site; 9. The local Fire Protection Agency (FPA) must be informed of construction activities; 10. Contact numbers for the FPA and emergency services must be communicated in environmental awareness training and displayed at a central location on site; 11. Two-way swop of contact details between ECO and FPA.					

5.10.24 Stockpiling and stockpile areas

Management Objective: To reduce potential erosion and sedimentation as a result of stockpiling of materials.					
Management Outcomes: Stockpiling management is undertaken in accordance with the requirements of the EMPr.					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. All material that is excavated during the construction phase (either during piling (if required) or earthworks) must be stored appropriately on site in order to minimise impacts to watercourses, wetlands and water bodies; 2. All stockpiled material must be maintained and kept clear of weeds and alien vegetation growth by undertaking regular weeding and control methods; 3. Topsoil stockpiles must not exceed 2 m in height; 4. During periods of strong winds and heavy rain, the stockpiles must be covered with appropriate material (e.g. cloth, tarpaulin etc.); 5. Where possible, sandbags (or similar) must be placed at the bases of the stockpiled material in order to prevent erosion of the material.					

5.10.25 Finalising turbine positions and solar PV panel areas

Management Objective: Impact to the environment is minimised during finalisation of turbine positions and solar PV panels					
Management Outcomes: Impact to the environment is minimised through adherence to EMPr requirements					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. No vegetation clearing must occur during final walk-down or survey; 2. No new access roads must be constructed to facilitate access for survey; 3. Project manager, botanical specialist, heritage specialist and contractor to agree on final turbine positions and solar PV panel areas based on final walk-down or survey.					

5.10.26 Excavation of foundations, cable trenching and drainage systems

Management Objective: Impact to the environment to be minimised during the excavation of foundations
Management Outcomes: Impact to the environment is minimised through adherence to EMPr requirements
Impact Management Actions
1. All excess spoil generated during foundation excavation must be disposed of in an appropriate manner and at a legally operated landfill site, if not used for backfilling purposes; 2. Spoil can however be used for landscaping purposes and must be covered with a layer of 150 mm topsoil for rehabilitation purposes; 3. Management of equipment for excavation purposes must be undertaken in accordance with Section 5.10.18: *Workshop equipment maintenance and storage;* 4. Excavated slopes must be no greater that 1:3, but where this is unavoidable, appropriate measures must be undertaken to stabilise the slopes; 5. Hazardous substances spills from equipment must be managed in accordance with Section 5.10.17: *Hazardous substances.*

5.10.27 Installation of foundations, cable trenching and drainage systems

Management Objective: Impact to the environment to be minimised during the installation of foundations					
Management Outcome: Impact to the environment is minimised through adherence to EMPr requirements					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. Residual cement must be disposed of in accordance with Section 5.10.8: *Solid waste and hazardous management;* 2. Batching of cement to be undertaken in accordance with Section 5.10.19: Batching;					

5.10.28 Turbine assembly and erection

Management Objective: Impact to the environment to be minimised during the erection of turbines.
Management Outcomes: Impact to the environment is minimised through adherence to EMPr requirements

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. In sensitive areas, turbine assembly must take place away from sensitive positions; 2. The crane used for turbine assembly must be operated in a manner which minimises impact to the environment; 3. The number of crane trips to each site must be minimised; 4. Wheeled cranes must be utilised in preference to tracked cranes; 5. Vegetation clearance to be undertaken in accordance with general vegetation clearance requirements specified in Section 5.10.10: *Vegetation clearing*; 6. No levelling at turbine sites must be permitted unless approved by the Development Project Manager or Developer Site Supervisor; 7. Only existing disturbed areas are utilised as spoil areas; 8. Drainage is provided to control groundwater exit gradient with the spill areas such that migration of fines is kept to a minimum; 9. Surface water runoff is appropriately channelled through or around spoil areas; 10. During backfilling operations, care must be taken not to dump the topsoil at the bottom of the foundation and then put spoil on top of that; 11. The surface of the spoil is appropriately rehabilitated in accordance with the requirements specified in Section 5.10.29: *Landscaping and rehabilitation*; 12. The retained topsoil must be spread evenly over areas to be rehabilitated and suitably compacted to effect re-vegetation of such areas to prevent erosion as soon as construction activities on the site is complete. Spreading of topsoil must not be undertaken at the beginning of the dry season; 13. During assembly, care must be taken to ensure that no wasted/unused materials are left on site e.g. bolts and nuts.					

5.10.29 Installation of equipment

Management Objective: Impact to the environment to be minimised during the installation of equipment

Management Outcome: Impact to the environment is minimised through adherence to EMPr requirements

Impact Management Actions
1. Management of dust must be conducted in accordance with Section 5.10. 20: *Dust emissions;* 2. Management of equipment used for installation must be conducted in accordance with Section 5.10.18: *Workshop equipment maintenance and storage;* 3. Management hazardous substances and any associated spills must be conducted in accordance with Section 5.10.17: *Hazardous substances;* 4. Residual solid waste must be recycled or disposed of in accordance with Section 5.10.8: *Solid Waste Management;* 5. Emergency repairs due to breakages of equipment must be managed in accordance with Section 5.10.18: Workshop equipment maintenance and storage and Section 5.10.16: Emergency procedures.

5.10.30 Socio-economic benefits

Management Objective: Enhanced socio-economic development.

Management Outcomes: Socio-economic development and benefits are enhanced.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
1. Develop and implement communication strategies to facilitate public participation; 2. Develop and implement a collaborative and constructive approach to conflict resolution as part of the external stakeholder engagement process; 3. Sustain continuous communication and liaison with neighboring owners and residents; 4. Set up a complaints register/grievance mechanism to allow any potentially negatively affected party to raise its concerns, which are then assessed and resolved; 5. Create local employment and training opportunities;					

6. Procure goods and services, as far as practically possible, from within the local municipalities. 7. Where feasible, no workers, with the exception of securitypersonnel, must be permitted to stay over-night on the site. This would reduce the risk to local farmers.					

5.10.31 Temporary site closure

Management Objective: Minimise the risk of environmental impact during periods of site closure greater than five days.

Management Outcomes: Site closure procedures are implemented in accordance with the EMPr.

Impact Management Actions	Implementation		Monitoring		
	Responsible person	Time Period	Method	Frequency	Mechanism for Monitoring Compliance
8. Bunds must be emptied (where applicable) and need to be undertaken in accordance with the impact management actions included in sections 5A.17: Hazardous substances and 5A.18: Workshop, equipment maintenance and storage; 9. Hazardous storage areas must be well ventilated; 10. Fire extinguishers must be serviced and accessible; 11. Emergency and contact details displayed must be displayed; 12. Fencing and barriers must be in place as per the Occupational Health and Safety Act (No 85 of 1993); 13. Security personnel must be briefed and have the facilities to contact or be contacted by relevant management and emergency personnel; 14. Night hazards such as reflectors, lighting, traffic signage etc. must have been checked; 15. Fire hazards identified and the local authority must have been notified of any potential threats e.g. large brush stockpiles, fuels etc.; 16. Structures vulnerable to high winds must be secured; 17. Wind and dust mitigation must be implemented; 18. Cement and materials stores must have been secured; 19. Toilets must have been emptied and secured; 20. Refuse bins must have been emptied and secured; 21. Drip trays must have been emptied and secured.					

5.10.32 Dismantling of old equipment during decommissioning

Management Objective: Impact to the environment to be minimised during the dismantling, storage and disposal of old equipment during decommissioning

Management Outcomes: Site closure procedures are implemented in accordance with the EMPr

Impact Management Actions
1. All old equipment removed during the project must be stored in such a way as to prevent pollution of the environment; 2. Oil containing equipment must be stored to prevent leaking or be stored on drip trays; 3. All scrap steel must be stacked neatly; 4. Once material has been scrapped and the contract has been placed for removal, the disposal Contractor must ensure that any equipment containing pollution causing substances is dismantled and transported in such a way as to prevent spillage and pollution of the environment; 5. The Contractor must also be equipped to contain and clean up any pollution causing spills; 6. Recycling of old material is encouraged as much as possible; 7. Disposal of unusable material must be at a registered waste disposal site and a certificate of disposal must be obtained and copied to the developer.

5.10.33 Landscaping and rehabilitation

Management Objectives: Areas disturbed during construction are returned to a state that approximates the state which they were before disruption

Management Outcomes: Landscaping and rehabilitation is undertaken in accordance with the approved rehabilitation plan/specification					
Impact Management Actions	**Implementation**		**Monitoring**		
	Responsible person	**Time Period**	**Method**	**Frequency**	**Mechanism for Monitoring Compliance**
1. All areas disturbed by construction activities must be subject to landscaping and rehabilitation; 2. All spoil and waste must be removed and disposed of to a registered waste site; 3. All slopes must be assessed for contouring, and to contour only when the need is identified in accordance with the Conservation of Agricultural Resources Act, No 43 of 1983 (CARA); 4. All slopes must be assessed for terracing, and to terrace only when the need is identified in accordance with the CARA; 5. Berms that have been created must have a slope of 1:4 and be replanted with indigenous species and grasses; 6. Stockpiled topsoil must be used for rehabilitation (refer to Section 5.10.23: *Stockpiling and stockpiled areas*); 7. Stockpiled topsoil must be evenly spread so as to facilitate seeding and minimise loss of soil due to erosion; 8. Before placing topsoil, all visible weeds from the placement area and from the topsoil must be removed; 9. Subsoil must be ripped before topsoil is placed; 10. The project must be timed so that rehabilitation can take place at the optimal time for vegetation establishment; 11. Where impacted through construction related activity, all sloped areas must be stabilised to ensure proper rehabilitation is effected and erosion is controlled as per the instruction from the ECO; 12. Sloped areas stabilised using design structures or vegetation as specified in the design to prevent erosion of embankments. The contract design specifications must be adhered to and implemented strictly; 13. Indigenous species must be used for replanting and rehabilitation; 14. Where required, re-vegetation can be enhanced using a vegetation seed mixture as described below. A mixture of seed can be used provided the mixture is carefully selected to ensure the following: a) Annual and perennial plants are chosen; b) Pioneer species are included; c) Species chosen must grow in the area without any problems; d) Root systems must have a binding effect on the soil; e) The final product must not cause an ecological imbalance in the area.					

5.11 Access to the generic EMPr

Once completed and signed, to allow the public access to the generic EMPr, the holder of the Environmental Authorisation must make the EMPr available to the public in accordance with regulation 26 (h) of the 2014 NEMA EIA Regulations, as amended.

5.12 Section 2: Site Specific Environmental Controls

5.12.1 Contact details and description of project

5.12.1.1 Details of the applicant

- **Name of the applicant:**
  - Tel No:
  - Fax No:
  - Email address:
  - Postal address:
  - Physical address:

- **Details and expertise of the EAP:**
  - Name of the applicant:
  - Tel No:

- Fax No:
- Email address:
- Expertise of the EAP (Curriculum Vitae included in Appendix A)

5.12.1.2 Details of the project:

- **Project name:**
- **Description of project:**
- **Project location (Map included in Appendix B):**

5.13 Section 3: Project Specific Environmental Controls

5.13.1 Description of project [to be completed by the EAP]

- **Generation capacity of the facility**
- **Anticipated construction duration**
- **Anticipated number of staff (permanent and temporary)**

5.13.2 Technical specification of the facility [to be completed by the EAP]

- **Turbine parameters**
  - Number and size of turbines
  - Turbine height
  - Rotor height
  - Rotor diameter
- **Solar PV panels and facility parameters**

5.13.3 Project site specific information and mitigation requirements [to be completed by the EAP]

The final project layout/footprint overlaid on an environmental sensitivity map must be included in Appendix C. For wind farms, all turbine positions are to be numbered. The environmental sensitivity map must indicate areas/features of sensitivity based on the findings of the BA/EIA and illustrated according to four tiers, Very High, High, Medium or Low. The sensitivity map must also identify the nature of each sensitive feature e.g. raptor nest, threatened plant species, archaeological site etc. Sensitivity maps must identify features both within the planned working area and any known sensitive features in the surrounding landscape. The map must also illustrate farm portion names. Specific mitigation measures as determined by the BA/EIA findings, site walk-through and conditions of Environmental Authorisation with reference must be identified. Where considered appropriate, photographs of sensitive features in the context of the site must be used.

Table 4: Example template for landowner details and specific access requirements

Land Owner and Access Details			
Turbine No.	419-422	423-429	430-437
Farm Name			
Farm Owner			
Contact Name			
Contact Number			
Special request by landowner			
Access requirements			

Table 5: Example template for project specific environmental controls

Project Specific Environmental Controls		
Turbine No.	Environmental Aspect	Site Specific Mitigation
419-422		
423-429		
430-437		

SECTION C: APPENDICES

Appendix A: Curriculum vitae of the EAP

Appendix B: Project location

Appendix C: The final project layout/footprint overlaid on an environmental sensitivity map

Appendix D: Method statements

[To be completed and updated by contractor on a project by project basis]