Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment

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Contents

List of Figures

List of Tables

Acronyms

ADU	Animal Demography Unit
CAA	Civil Aviation Authority
CSIR	Council of Scientific and Industrial Research
CBA	Critical Biodiversity Areas
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DoD	Department of Defence
DoE	Department of Energy
DRDLR	Department of Rural Development and Land Reform
DMR	Department of Mineral Resources
DPE	Department of Public Enterprises
DTI	Department of Trade and Industry
DWS	Department of Water and Sanitation
EGI	Electricity Grid Infrastructure
ERG	Expert Reference Group
EWT	Endangered Wildlife Trust
GIS	Geographic Information Systems
NEMPAA	National Environmental Management Protected Areas Act
NFEPA	National Freshwater Ecosystems Priority Areas
NMU	Nelson Mandela University
PICC	Presidential Infrastructure Coordinating Commission
PSC	Project Steering Committee
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SAAF	South African Air Force
SABAA	South African Bat Assessment Association
SAHRA	South African Heritage Resource Association
SANBI	South African National Biodiversity Institute
SANEDI	South African National Energy Development Institute
SANDF	South African National Defence Force
SAPAD	South African Protected Areas Database
SAPVIA	South African Photovoltaic Industry Association
SAWEA	South African Wind Energy Association
SEA	Strategic Environmental Assessment
SIPs	Strategic Integrated Projects
SKA	Square Kilometre Array
SWSA	Strategic Water Source Areas
UNESCO	United Nations Organization for Education, Science and Culture

1. Purpose

The National Department of Environmental Affairs (DEA) appointed the Council of 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 development in South Africa. Phase 2 of the SEA follows on from the recently completed Phase 1 Wind and Solar SEA which identified 8 Renewable Energy Development Zones (REDZs) in South Africa and was approved for gazette in February 2016 and went out for public comments in April 2017.

Much like its predecessor, Phase 2 of the Wind and Solar PV SEA aims to identify geographical areas best suited for the roll-out of wind and solar PV energy projects. It is envisaged that wind and solar PV development will be incentivised and streamlined in the REDZs. The SEA process also provides a platform for coordination between the various authorities responsible for issuing authorisations, permits or consents and thereby allows for a more streamlined environmental authorisation process.

The focus areas identified in this document are the result of the environmental, engineering and socio economic considerations overlay. Following comments during this 30 day period will be refined to form a second draft focus areas where further investigation which will entail the refinement of these study areas through specialist assessments. Refinement of the areas includes the possible enlargement, reduction or elimination of the identified study areas.

The purpose of this document is to provide clear and transparent information on the process followed to identify the first draft focus areas and the spatial datasets that were considered as part of the Phase 2 of the Wind and Solar PV Strategic Environmental Assessment for public comment.

2. Background Information

2.1. Objective of the Phase 2 of the Wind and Solar PV Strategic Environmental Assessment

The DEA has committed to contribute to the implementation of the National Development Plan and National Infrastructure Plan by undertaking SEA to identify adaptive processes that integrate the regulatory environmental requirements for Strategic Integrated Projects[1] (SIPs) while safeguarding the environment. The first iteration of the wind and solar photovoltaic (PV) SEA was accordingly commissioned by DEA in 2013, in support of SIP 8, which aims to facilitate the implementation of sustainable green energy initiatives.

The SEA identified areas where large scale wind and solar PV energy facilities can be developed in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as REDZs.

The REDZs also provide priority areas for investment into the electricity grid for which a Strategic Environmental Assessment was also commissioned in 2014, namely the Electricity Grid

[1] http://www.economic.gov.za/picc/sips-chairpersons

Infrastructure (EGI) SEA. The EGI SEA identified power corridors that will enable the efficient and effective expansion of key strategic transmission infrastructure designed to satisfy national transmission requirements up to 2040.

The gazetting of the outputs of these two SEAs (as illustrated in Figure 1) was approved by Cabinet on 17 February 2016[2].

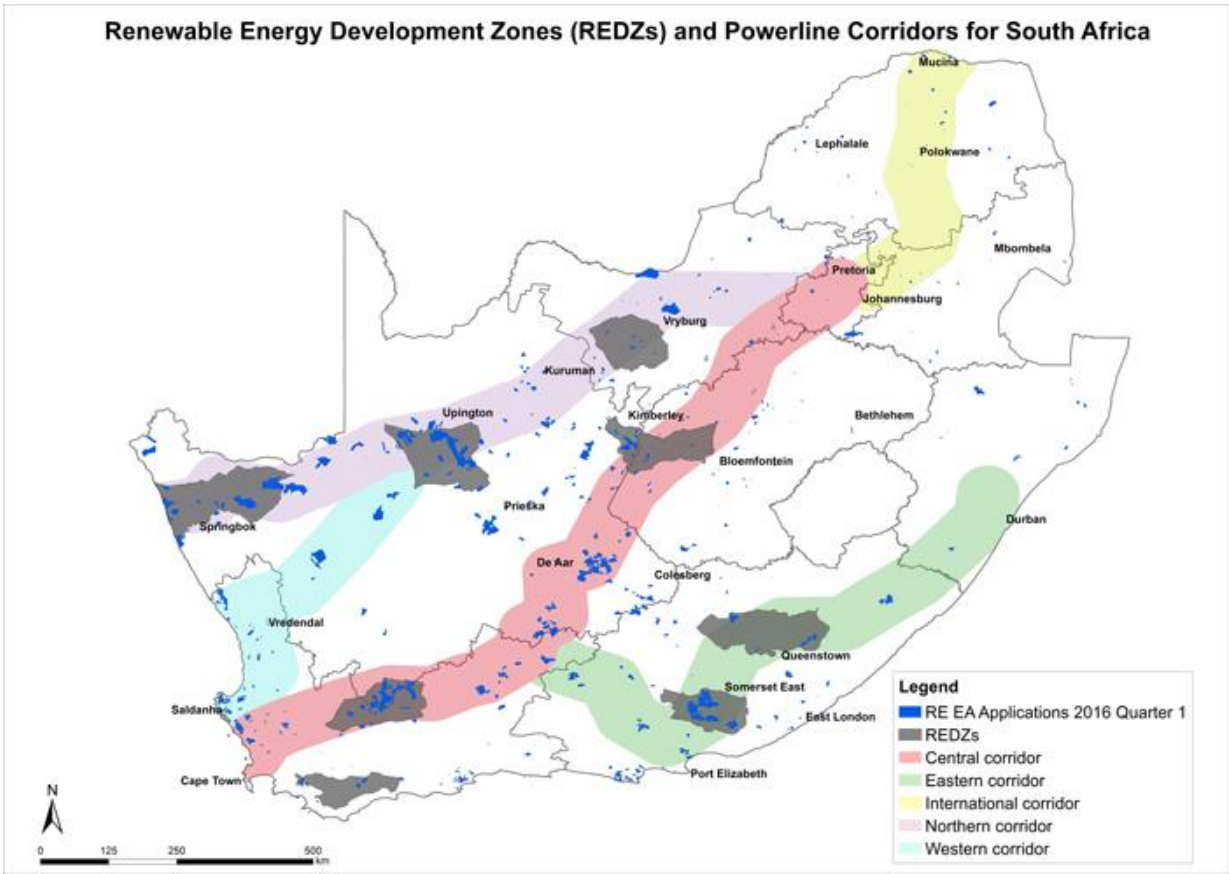


Figure 1: REDZs and Power corridors

Phase 2 of the wind and solar PV Strategic Environmental Assessment has recently been commissioned by DEA in order to identify additional REDZs and to review the four tiers sensitivity maps prepared during Phase 1 based on most recent and publicly available datasets for the strategic issues considered for the existing REDZs at national scale. This process will aim to provide additional anchor points for grid expansion and provide dedicated energy generation areas from which electricity must be collected, thereby allowing strategic investment.

The overall objective of this SEA is the identification of new REDZs to allow for the efficient and effective implementation of wind and solar photovoltaic energy projects within the timeframes that meet the country's climate change commitments and provides energy security for South Africa as well as the use of most recent existing scientific information to assist government in creating a framework and guiding principles that will inform responsible decision-making for the development of renewable energy in South Africa.

[2] http://www.gov.za/speeches/statement-cabinet-meeting-17-february-2016-18-feb-2016-0000

2.2. Project team and roles for the Wind and Solar PV Strategic Environmental Assessment

The Project team is constituted of two South African Science Councils:

- The **Council for Scientific and Industrial Research (CSIR)**

CSIR is one of the leading scientific and technology research, development and implementation councils in Africa. Constituted by Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990) as a science council, the CSIR undertakes directed and multidisciplinary research, technological innovation as well as industrial and scientific development to improve the quality of life of the country's people. Two departments of the CSIR are working together on the Strategic Environmental Assessment, namely the Environmental Management Services of the CSIR: Implementation Unit and the Spatial Planning and Systems unit of the CSIR: Built Environment. http://www.csir.co.za/

- The **South African National Biodiversity Institute (SANBI)**

SANBI conducts research, as well as monitors and reports on the state of biodiversity in South Africa. The institute provides knowledge and information, planning and policy advice, and best-practice management models in partnership with stakeholders. http://www.sanbi.org/

The Strategic Environmental Assessment will be governed by a **Project Steering Committee (PSC)** and an **Expert Reference Group (ERG)** which broadly reflect the interest of the South African public. The PSC includes the Presidential Infrastructure Coordinating Commission (PICC), the Department of Environmental Affairs (DEA), the Department of Energy (DoE), the Department of Agriculture, Forestry and Fisheries (DAFF), the Department of Water and Sanitation (DWS), the Department of Defence (DoD), the Department of Mineral Resources (DMR), the Department of Public Enterprises (DPE), the Department of Rural Development and Land Reform (DRDLR), the Department of Trade and Industry (DTI), and the Provincial Governments, the South African Air Force, the South African National Defence Force (SANDF). The ERG consists of the PSC members as well as Independent Power Producer (IPP) Office, ESKOM, Council for Geosciences (CGS), Square Kilometre Array South Africa (SKA), South African Civil Aviation Authority (CAA), Endangered Wildlife Trust (EWT), Cape Nature, South African National Energy Development Institute (SANEDI), World Bank , representatives from the renewable energy industry, active NGOs, vertical tiers of government i.e. from national to local representation, South African Local Government Association (SALGA) and experts from research institutions.

Two experts working groups were created to guide and advise the Strategic Environmental Assessment process and outputs:

- A conservation experts working group, including representatives of Birdlife SA, the South African Heritage Resource Association (SAHRA), University of Cape Town Animal Demography Unit (ADU), South African Bat Assessment Association (SABAA), Overberg Renosterveld Trust, SANBI, Cape Nature. EWT and WWF SA; and
- An industry experts working group, including representatives of South African Wind Energy Association (SAWEA), South African Photovoltaic Industry Association (SAPVIA), IPP Office, CSIR Energy Centre, DoE and Eskom.

The purpose of these working groups is to have more focused discussions and receive technical inputs from experts in the respective fields, in order to obtain up to date and precise information/data and refine the outputs of the analysis performed during the SEA process.

The Strategic Environmental Assessment will undertake an assessment of all technical, social, economic and biophysical risks and opportunities (strategic Issues) of the renewable energy industry in South Africa in order to identify the most suitable areas for the development of wind and solar PV energy facilities. Each strategic Issue will be addressed by a Multi-Author Team.

The Multi-Author Team concept relies on two principles: 1) that each Strategic Issue is addressed by a team of Authors, each a recognised expert or knowledgeable person; and 2) that remuneration is based on covering expenses rather than at a level that could be reasonably construed to constitute an inducement to give a biased finding. Authors comprising the Multi-Author Teams within the specified Strategic Issues will require acknowledged expertise and will be drawn from a broad range of sectors such as research institutions, government, NGOs, universities, the renewable energy sector, etc. and across different regions of South Africa to ensure a broad balance of interest is represented through the reporting structures.

Figure 2 presents an overview of the key stakeholders involved in the SEA process and their respective roles.

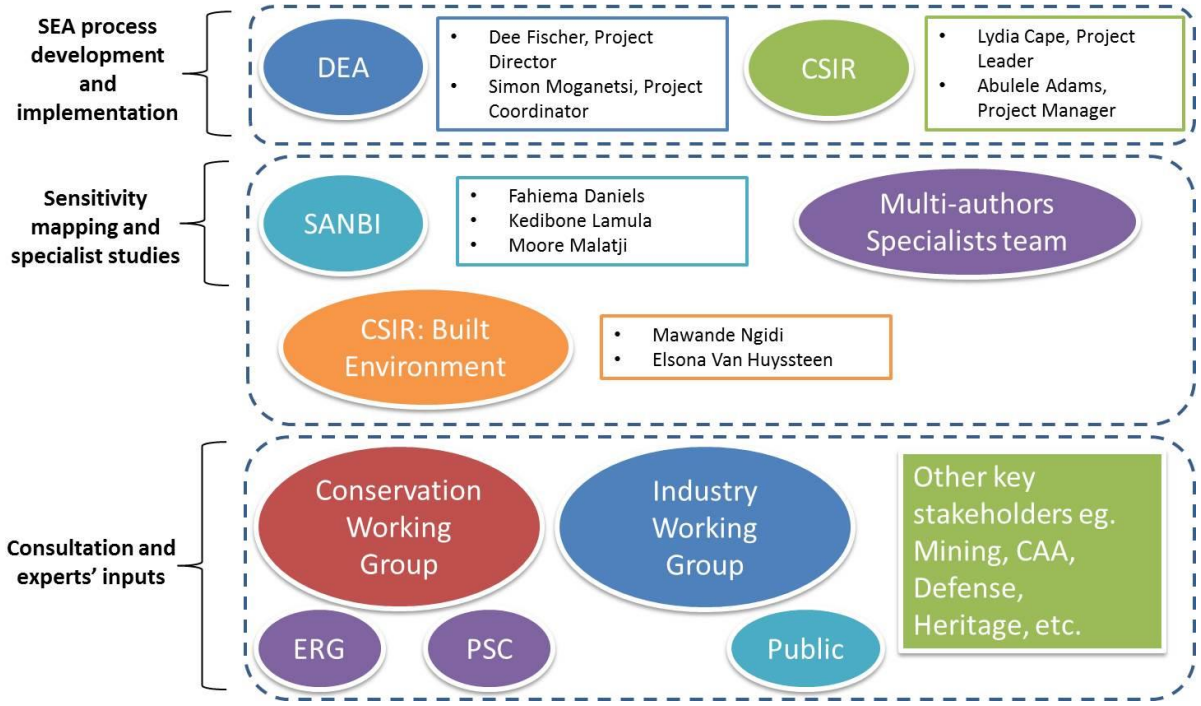


Figure 2: Strategic Environmental Assessment Project team, Strategic Environmental Assessment Governance structures, Strategic Environmental Assessment experts and roles

2.3. Methodology for the Phase 2 of the Wind and Solar PV Strategic Environmental Assessment

In consultation with various stakeholders, the CSIR SEA team has identified and mapped the first draft Focus Areas. These represent areas with high development potential and are characterised by economically feasible levels of solar irradiation, suitable wind speeds, lack of critical environmental features and suitable socio-economic criteria. The current land uses in these areas have been identified and a general impression of their environmental state has been documented and mapped.

The criteria that were used for the environmental and technical constraint mapping as well as the socio-economic activity index mapping can be found in section 4 of this report.

The approach and timeframe planned for Phase 2 of the wind and solar PV Strategic Environmental Assessment is illustrated in Figure 3 and summarized below.

1. The first draft focus areas were delineated based on environmental, technical and socio-economic criteria which were consulted with various stakeholders. The positive mapping (technical), negative mapping (environmental) and socio economic mapping processes are described in details in section 4 of this report.
2. The public will be invited to review and comment on the first draft of the Focus Areas for a period of 30 calendar days from the 21 August 2017 until the 22 September 2017.
3. A refinement of the first draft focus areas will be done based on the comments and additional inputs received during the public consultation period which will close on the 22 September 2017.
4. A four tiers sensitivity map based on desktop mapping of the environmental sensitivities of features in various fields with respect to wind and solar PV energy developments will be created. The four tiers mapping will be done in collaboration with SANBI at national scale ("wall to wall four tiers mapping);
5. Multi-author teams will be convened to assess the second draft focus areas following the refinement of the first draft focus areas based on public consultation. The multi author specialist teams will be convened for each respective field of study which constitute a "strategic issue" for the SEA.
6. A survey will then be conducted amongst the renewable energy industry and amongst conservation organisations to obtain additional inputs on the second draft focus areas to verify (1) alignment with industry development potential, and (2) alignment with national and provincial conservation targets;
7. The outputs of the Multi-author teams' assessments and inputs from the industry and conservation organisations will be used to refine and update the second draft focus areas (third draft focus areas).
8. The public will then be invited to review and comment on the third draft focus areas for a period of 30 calendar days in the first quarter of 2018 (dates to be confirmed).
9. A refinement of the third draft focus areas will be done based on the comments and additional inputs received during the public consultation period during the first quarter of 2018 (dates to be confirmed).
10. The SEA report including details on the process, milestones, consultation and outputs of the SEA will be submitted to DEA, together with supporting documents and spatial datasets to be uploaded onto the web-based DEA screening tool. This step will constitute the final hand-over of the project outputs to DEA.
11. DEA will then be responsible for the implementation of the outputs of the SEA and will publish the third draft and final focus areas (new REDZs) in a gazette and request the public to review and comment as part of a formal gazetting process (dates to be confirmed).

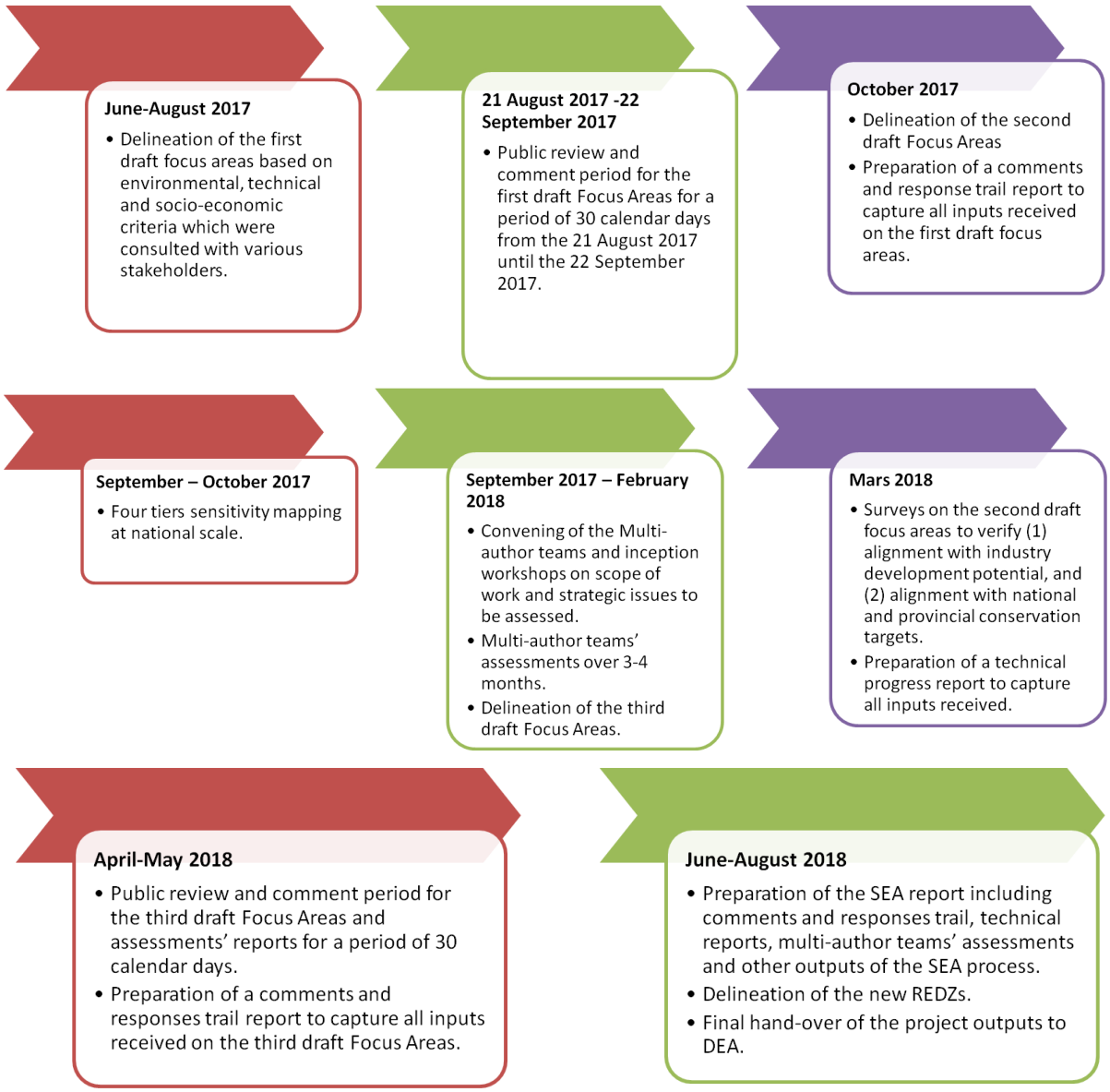


Figure 3: Timeframe and milestones of Phase 2 wind and solar PV SEA

The immediate next steps which shall be followed in the SEA are therefore:

12. Public consultation on the first draft Focus Areas for 30 days to enable stakeholders to review and comment on the identified areas, the process followed and the data used for the mapping exercises. The review and comment period will occur from the Monday 21 August 2017 to the Friday 22 September 2017. Stakeholders are invited to submit comments on the web-based project site and to send additional documents and datasets for consideration during the refinement of the first draft focus areas;
13. Four tiers desktop mapping of the environmental sensitivities of features in various fields with respect to wind and solar PV energy developments. The four tiers mapping will be done in collaboration with SANBI at national scale ("wall to wall four tiers mapping);
14. The identification of multi author specialist teams to assess the second draft focus areas following the refinement of the first draft focus areas based on public consultation. The multi author specialist teams will be convened for each respective field of study which constitute a "strategic issue" for the SEA. The multi author specialist teams will review and confirm the sensitivities and buffers identified during the four tiers desktop mapping within the second draft focus areas as well as provide inputs on cumulative assessment taking into consideration all focus areas identified for this SEA as well as existing renewable energy facilities and existing REDZs. The protocols which were prepared during Phase 1 of the wind and solar PV SEA will be discussed with the multi author specialist teams to ensure that best practice and most recent guidelines are prescribed for the required specialist fieldwork and site assessment in these focus areas.

2.4. Consultation for the Phase 2 of the Wind and Solar PV Strategic Environmental Assessment

A SEA project website has been created at the inception of the Phase 1 of the SEA and can be accessed at the following address: https://redzs.csir.co.za/. Stakeholders are invited to register as interest and affected parties using an online registration tool designed to capture stakeholders contact details. The website contains all relevant information on the SEA as well as the latest presentations and datasets related to the SEA. It is beneficial for stakeholders to register on this site to keep up to date with the SEA process and outcomes.

The outputs of the Strategic Environmental Assessment will be characterised by an extensive, transparent consultation and review process by both experts and stakeholders. The first comment and review period which will take place from 21 August – 22 September is organised for the consultation of government, conservation agencies, experts and stakeholders on the delineation of the first draft focus areas. The first draft focus areas can be viewed on the project website at the following address: https://redzs.csir.co.za/ . Further details on how to comment can be found in section 5 of this report. All comments and data submissions will be considered to further refine the first draft focus areas and included in a comments and responses report which will be uploaded onto the project website as well as included in the final SEA report.

The PSC and ERG as well as the two experts working groups will meet quarterly during the Strategic Environmental Assessment to review and discuss the outputs of the process and will verify that the process proposed at the outset has been implemented in a fair and unbiased manner in that suitably experienced experts have been involved in the process, review structures have been designed and implemented in a credible manner and queries/comments from the public have been adequately addressed.

3. Spatial Data

The following environment settings (Table 1) were specified to ensure that all the parameters are set; and the geoprocessing tools will give the appropriate results. Changing the environment settings is a crucial step before performing geoprocessing tasks as it significantly affects the results of any tool that is ran. A geodatabase was created for all the outputs that were developed.

Table 1: Parameters for environment settings.

Environment Settings	
Workspace	Renewable_Energy_SEA_gdb
Output Coordinates	WGS_1984_UTM_Zone_34S
Processing Extent	Snap to National Land Cover 2014 (NCL2013/2014)
XY Resolution and Tolerance	Unknown
M Values	Disabled
Z Values	Disabled
Geodatabase	Default
Geodatabase Advanced	Default
Fields	Default
Random Numbers	Default
Cartography	Default
Coverage	Default
Raster Analysis	Cell size 30, Mask NLC2013/2014
Raster Storage	Default
Geostatistical Analysis	Default
Parallel Processing	Default
Remote Processing Server	Default
Terrain Dataset	Minimize memory use during analysis on terrains checked
TIN	Default

4. Environmental, technical and socio-economic overlays

The delineation of the first draft focus areas for the second phase of the wind and solar PV Strategic Environmental Assessment was based on three spatial mapping exercises:

- environmental constraints mapping;
- technical constraints mapping; and
- Socio-economic activity index mapping.

4.1. Environmental constraint mapping

The environmental constraint mapping (also called negative mapping) takes into consideration various environmental spatial datasets to ensure that the first draft focus areas will not be established in areas that are significant for biodiversity conservation or result in biodiversity loss. As part of this first environmental constraint mapping, for the purpose of the delineation of the first draft focus areas, only features of critical environmental importance were included in order to highlight areas that play a vital role in preserving and keeping our biodiversity intact and that should be avoided when delineating the first draft focus areas.

The list of features of critical environmental importance (Table 2) was developed in collaboration with SANBI through an extensive consultation with various conservation agencies and NGOs (e.g. Birdlife SA, EWT, VULPRO, etc), national and provincial governmental departments and experts from research institutions. Datasets and applicable buffers for both wind and solar PV were reviewed by the PSC, ERG and the conservation working group during the quarterly meetings.

Table 2: List of environmental features of critical importance to be considered during the environmental constraint mapping

Criteria	Source	Features
Protected Areas	South African Protected Areas Database (SAPAD), Department of Environmental Affairs - Q1, 2017	National Parks
		Nature Reserves
		World Heritage Sites (Core)
		Mountain Catchment Areas (Natural)
		Protected Environments (Natural)
		Forest Nature Reserve
		Forest Wilderness Area
		Special Nature Reserve
	Additional Provincial Protected Area Data (protected areas managed as protected areas or ones not yet reflected in SAPAD added to supplement SAPAD)	KZN Protected Areas 2017
		North West Protected Areas 2015
		Gauteng Protected Areas 2011
		Mpumalanga Protected Areas 2017
		Eastern Cape de facto Protected Areas 2017
		Free State Protected Areas 2017
		Western Cape Protected Areas 2017
	SANPARKS Protected Areas (includes Protected Areas managed by SANPARKS and areas not yet included in SAPAD)	SANPARKS Protected Areas 2017
Critical Biodiversity Areas	Provincial CBA network	CBA1
Water Features	CSIR/SANBI NFEPA rivers and wetlands	Wetlands (500m) and Major Rivers(32m)
	CSIR	Estuaries (Floodplain)
	CSIR	SWSAs (Natural)
Forests	Department of Agric , Fisheries and Forestry	Forests
Square Kilometre Array (SKA) Area	Square Kilometre Array	SKA study area
Heritage	South African Heritage Resource Association (SAHRA)	All grades and declared sites (UNESCO)
Field Crop Boundaries	Department of Agric , Fisheries and Forestry	Pivot, Shadenet, Horticulture and Viticulture
Land Capability	Department of Agric , Fisheries and Forestry	Categories 11-15
Urban areas	Department of Environmental Affairs commissioned land cover 2013/14 (NCL 2013/14)	Urban areas
Defence	South African National Defence Force	Defence features
Birds	VULPRO	VULPRO cape vulture colonies
		VULPRO cape vulture restaurants
	Birdlife/ Jesse Walton	Black harrier roost sites
	Birdlife	Barlows lark distribution

	Birdlife	Important Bird Areas
	NMMU	NMMU cape vulture roost sites
Bats	South African Bat Association	Bat Roosts
		Ecoregions

All features of critical importance listed above were mosaicked into one raster dataset respectively for wind and solar PV to create two layers showing the footprint of the areas of critical importance for wind and solar PV separately. The only difference in the mapping of areas of critical importance for wind and solar PV were the buffers applied to the birds and bats features. The resulting maps identifying areas of critical importance are illustrated in Figure 4 and Figure 5.

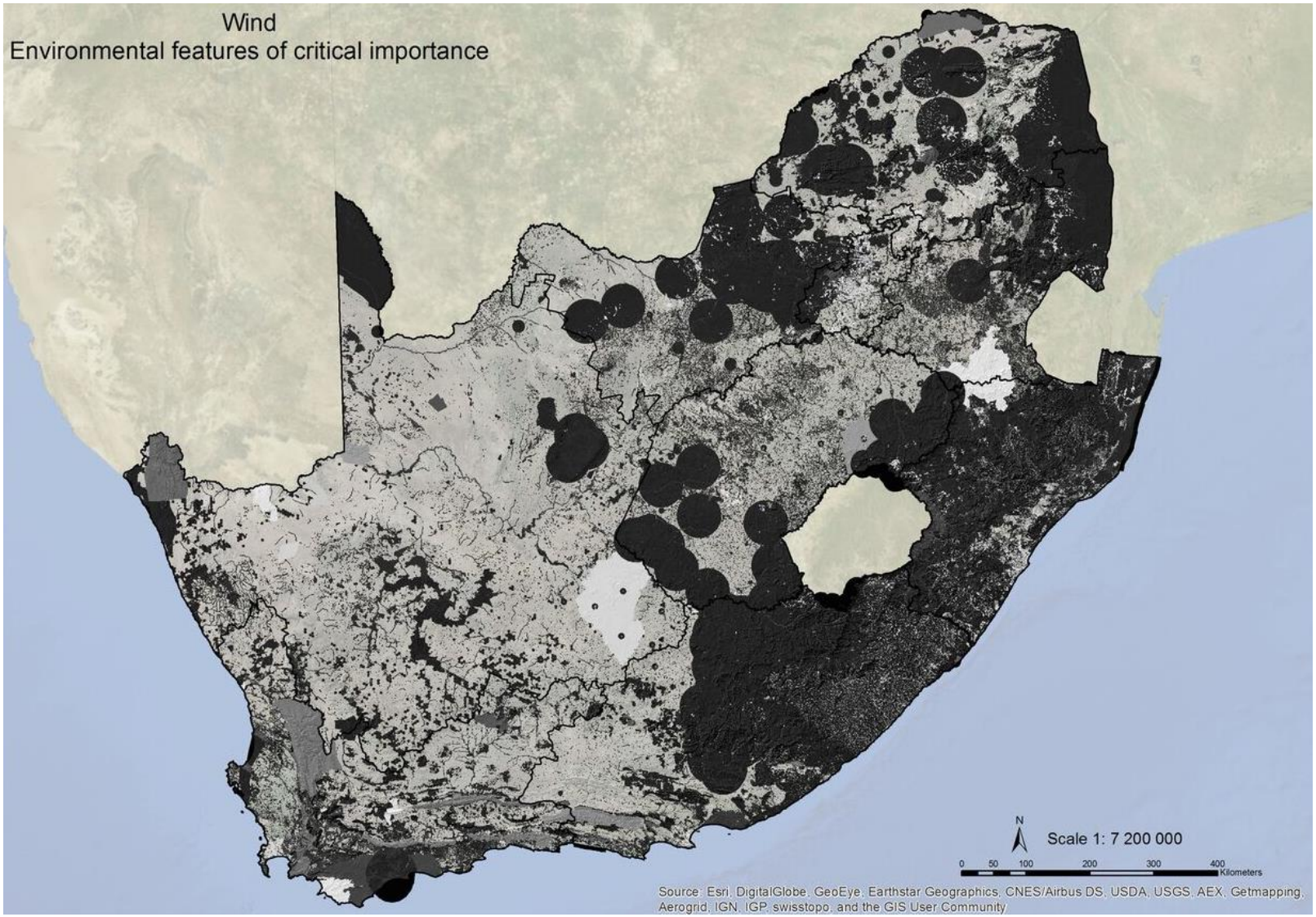


Figure 4: Environmental features of critical importance for wind energy.

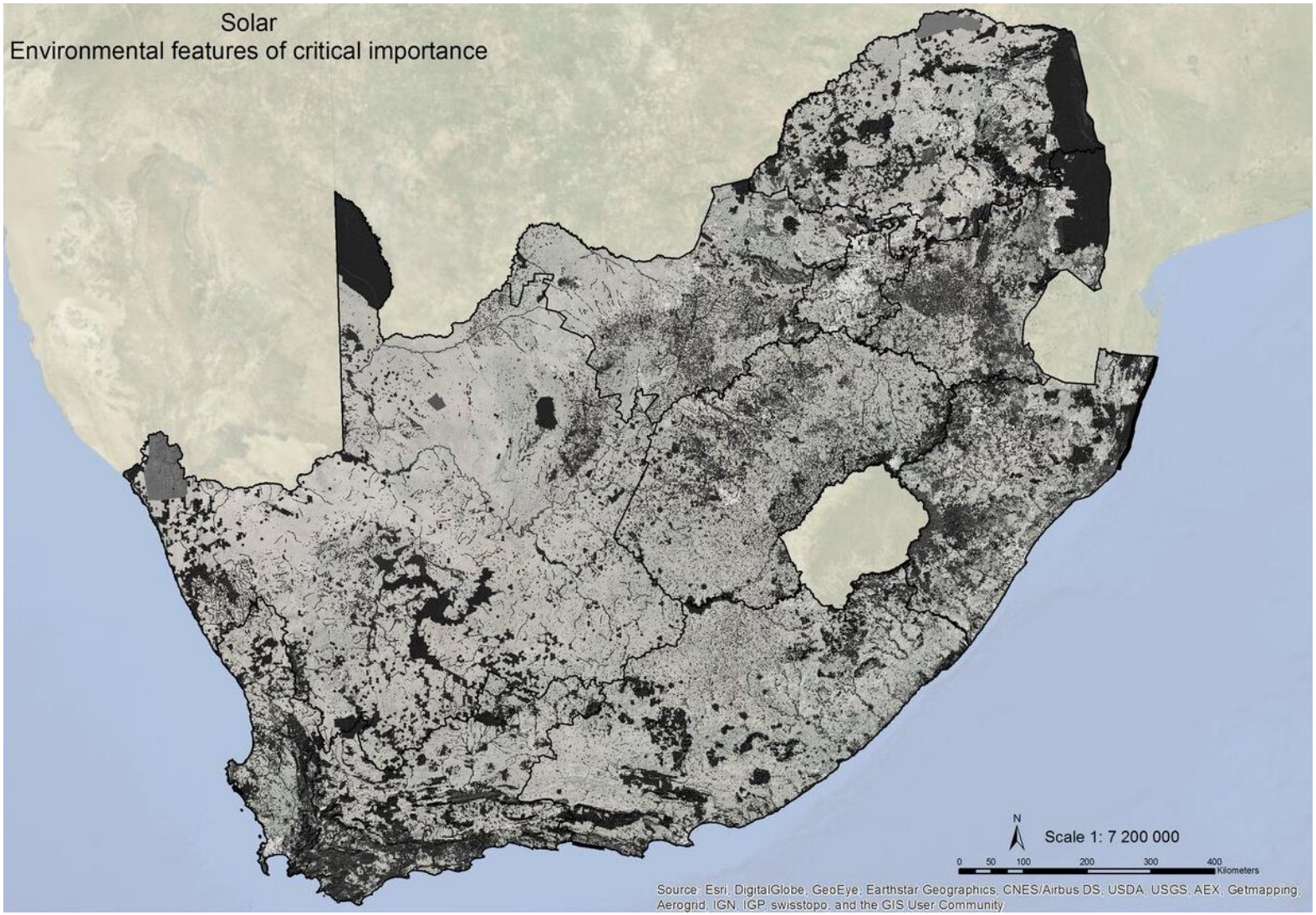


Figure 5: Environmental features of critical importance for solar PV.

4.2. Technical constraint mapping

The technical constraint mapping (also called positive mapping) takes into consideration various technical spatial datasets informing the feasibility of wind and solar PV facilities developments in certain areas.

The list of technical criteria to be considered during the technical constraint mapping (Table 3) was developed in collaboration with the Energy Centre of the CSIR through an extensive consultation with various industry-related agencies and associations including ESKOM, the Independent Power Producer (IPP) office, the South African Wind Energy Association (SAWEA), the South African Photovoltaic Industry Association (SAPVIA) and the South African National Energy Development Institute (SANEDI). Datasets and applicable buffers for both wind and solar PV were reviewed by the PSC, ERG and the industry working group during the quarterly meetings.

The spatial representation of the criteria listed in the table below is included in Appendix 1 of this document.

Table 3: List of technical criteria to be considered during the technical constraint mapping

Criteria	Source	Features
Wind resource	CSIR Energy Centre 2016 aggregation study (2016)	Wind speed > 5.5 m/s
Wind Capacity Factor	CSIR Energy Centre 2016 aggregation study (2016)	Capacity Factor > 35%
Solar Resource	GeoModel Solar, SolarGIS data for the Republic of South Africa (2013)	GHI> 2100
Solar PV tracking yield	GeoModel Solar, SolarGIS data for the Republic of South Africa (2013)	Solar PV tracking yield > 1850
Proximity to main transmission system (MTS) substations	ESKOM Generation Connection Capacity Assessment (GCCA) 2022 dataset and Transmission Development Plan 2015 to 2024* (2017)	Buffered areas within 35 km from MTS substations (in areas with Stability Limit >1000MW and existing or planned substations with Transformer limit >100MW)
Proximity to main roads	National Geo-spatial Information (NGI) South African Roads (2016)	Buffered areas within 10 km from main roads
Presence of dolerite and hardrocks for geotechnical constraints	Council for Geosciences, Simplified geological map of the Republic of South Africa and the Kingdoms of Lesotho and Swaziland (2008).	Dolerites and hardrock underlying formations

Presence of steep slope for access to site	ComputaMaps Digital Terrain Model - 20m Digital Terrain Model of South Africa, prepared by the Stellenbosch University (2013)	slope > 10%
Additional informative layers consulted:		
REIPPPP round 1 to round 4b	ESKOM GCCA 2022 (2017)	Wind energy REIPPPP round 1 to round 4b selected preferred bidders and solar PV REIPPPP round 1 to round 4b selected preferred bidders.
Approved or in progress EIA applications	Department of Environmental Affairs 2017 first quarter EIA applications (2017)	Approved or in progress EIA applications submitted to the Department of Environmental Affairs up to the first quarter of the 2017 calendar year for wind and solar PV energy development respectively.
Renewable Energy Development Zones	Phase 1 wind and solar PV SEA (2015)	Renewable Energy Development Zones boundaries
Power corridors	Electricity Grid Infrastructure SEA (2016)	Power corridors boundaries

*__Note:__ The GCCA-2022 now includes all the projects expected to be completed by 2022 as contained in the TDP for the period 2015 to 2024. The objective is to provide developers and investors with an indication of the potential available capacity for the connection of new generation at or within the supply areas of the MTS substations on the Eskom transmission network by 2022 based on the current TDP. The most significant change in the capacity calculation is that connection at the lower distribution-level voltages does not require an N-1 connection. Thus, the full installed transformer MVA capacity at an MTS substation is available for providing generation connection capacity.

For the identification of technical wind energy clusters, the following steps were followed:

Step1: Planned and existing main transmission system (MTS) substations with a 35km buffer (i.e. low and medium sensitivity areas for substations) were intersected with national roads that were buffered by 10km (i.e. low and medium sensitivity areas for roads) to identify suitable clusters for wind energy in terms of infrastructure requirements

Step 2: The output of the intersection of the buffered substations and roads was then intersected with "favourable wind energy areas" defined as data points where the wind capacity factor was more than 0.35, which was extracted from the CSIR "aggregation study" data set (2016). The output of this intersection of the roads and substations with favourable wind energy areas provided a technical justification for the selection of specific areas within South Africa where conditions were favourable for wind energy development.

Step 3: Lastly, to ensure that that none of the clusters incorporated areas that have low wind speed, all areas with a wind speed of less than 5.5m/s were removed using the erase tool from ArcGIS to produce technical wind energy clusters.

For the identification of technical solar PV energy clusters, the following steps were followed:

Step 1: Planned and existing main transmission system (MTS) substations with a 35km buffer (i.e. low and medium sensitivity areas for substations) were intersected with national roads that were buffered by 10km (i.e. low and medium sensitivity areas for roads) to identify suitable clusters for solar PV energy in terms of infrastructure requirements.

Step 2: The output of the intersection of the buffered substations and roads was then intersected with "favourable solar PV energy areas" defined as areas where the "PVOUT1X" data value was equal or more than 1850 kWh/kWp, which was extracted from the GeoModel Solar Resource and Photovoltaic potential data for South Africa (2013) and converted to a polygon shapefile. The output of this intersection of the roads and substations with favourable solar PV energy areas provided a technical justification for the selection of specific areas within South Africa where conditions were favourable for solar PV energy development.

4.3. Socio-economic activity index mapping

The objective of the socio-economic analyses was to develop a **socio-economic activity index** providing a spatial comparison of local municipal areas and cities and towns (above 1500 people) across South Africa. This document provides a brief outline of the socio-economic study[3] undertaken by the CSIR Built Environment (see Appendix 2) and outlines the Intensity Classes included within the index that will be selected as part of the delineation of the first draft focus areas.

The socio-economic activity index provides a broad categorisation of regions in terms of the intensity of socio-economic activity, based on a comparison of areas in terms of the:

- Size of *existing* population and economic output; and
- *Trends* that would indicate growth or decline of population size and economic output.

The national **socio-economic activity index** was developed to provide a:

- National comparison of both the spatial distribution of population and economic activity;
- A clear indication of areas with large and increasing population sizes and areas with high and increasing economic output (i.e. an indication of high economic growth and population growth).

- **Municipal Level Comparative Classification Process**

The data used as inputs for the municipal level analysis is:

- Population data was sourced from Statistics South Africa (StatsSA) population for the 2011 census and the 2016 community survey data.
- The economic output data used is Gross Value Added (GVA) from Quantec Easy-data for 2011 and 2016. This was Real GVA at basic prices, (in R millions) constant at 2010 prices. Having the prices constant, allows for temporal comparability.

[3] Mawande Ngidi and Elsona van Huysteen, 2017. Methodological Report for Socio-economic profiles to inform the identification of Renewable Energy Development Zones (REDZs) in support of the Phase 2 Wind and Solar Strategic Environmental Assessment, CSIR Built Environment.

The following steps were undertaken to identify the Municipal Socio-economic Intensity Index:

- Determine current population and economic *output* size and Classification;
- Population and economic output *growth* calculation and Classification;
- Creating a Size and Growth classification; and
- Creating a Combined Municipal Socio-Economic Size and Growth classification (see Table 4)

Table 4: Municipal Socio-economic Intensity Index Description

	Category	Description	Assumption
1	Very High Intensity and Growing	Mainly Metropolitan regions and big cities characterised by very high intensity of socio-economic activity (population exceeding 500 000 and economic output in most municipalities is more than R50 Billion but no less than 28 billion), and where growth in population and economic output is higher than the national growth rates (growth exceeding the national 7.5% population growth rate and 7.8% growth in economic output)	High levels of existing domestic and other energy demand, most likely to grow due to natural growth and agglomeration advantages.
2	High Intensity and Growing	Municipalities which have large secondary cities, big towns and densely populated areas that are characterised by high intensity of socio-economic activity (where population numbers exceed 50 000 and economic output generally exceeds R10 Billion), and where growth in economic output is higher than growth in population, and above national growth. Areas also include densely settled areas in Kwa-Zulu Natal and Mpumalanga and border areas in Limpopo that seem to be characterised with higher growth rates.	High levels of existing domestic and other energy demand, with demand most likely to grow due to natural growth and agglomeration advantages.
3	High Intensity and Lagging	Municipalities that are characterised by relatively high intensity of socio-economic activity, typically with big towns in surrounding agricultural and resource economy hinterlands (where population numbers generally exceed 50 000 and economic output mostly exceeds R10 Billion), and where population and economic growth is low or on par with national growth, and where growth in economic output is lagging behind the national growth. A number of municipalities in this category are located in the Free-State, Limpopo, North-West and Eastern Cape in-land regions.	Relatively high levels of existing domestic and other energy demand, where existing growth rates might point towards stagnating or lagging future growth without intervention.
4	High intensity and Declining	Municipalities that are characterised by relatively high intensity of socio-economic activity, typically with big towns in surrounding resource economy hinterlands (where population numbers exceed generally 50 000 and economic output exceeds generally R10 Billion). Municipalities in this category are areas where growth rates of population and economic output are low	Relatively high levels of existing domestic and other energy demand, where existing growth rates might

	Category	Description	Assumption
		and declining, as well as areas where economic output is in decline but population growth rates relatively high compared to national growth. These areas typically include municipalities located in resource rich mining areas in Limpopo, Free State and North-west, areas to the north and west of Gauteng (including Madibeng), as well as the Northern Cape.	point towards stagnating or declining growth in economic output, but also to the need for industrialisation, green economy and other interventions.
5	Moderate intensity	Municipalities in this category are characterised by moderate and smaller population sizes (typically in the range between 20 000 and 100 000), and moderate levels of economic output (mostly between R1 Billion and R10 Billion), however where growth rates in economic output since 2011 exceeded national growth rates, as well as local population growth rates. A number of municipalities in this category are located in the sparsely populated areas of the Western and Northern Cape.	Relatively smaller population and economic demand for energy than in other municipalities, but typically with growth in specific locations and/sectors.
6	Low intensity and Growing	Municipalities in this category are characterised by moderate and smaller population sizes (typically in the range between 10 000 to 50 000), and low levels of economic output (Less than R1 Billion), where growth rates in economic output since 2011 where on par or exceeded national growth rates.	Relatively small population and economic demand for energy than in other municipalities, but typically with growth in specific locations and/sectors.
7	Low intensity and declining	Municipalities in this category are characterised by small population sizes (less than 10 000 people), and low levels of economic output (Less than R1Billion), where growth rates in bot economic output and population were lower than the national average, as well as areas where economic output since 2011 where lagging behind the national growth rate or declining in real terms. In the latter cases population growth varies but from a very small base.	Relatively small population and economic demand for energy compared with other municipalities, and characterised with slow growing or declining economic output. Areas with where demand for energy seems very low.

- **Town Level Classification Process**

A Sub-Municipal (town level) classification of growth was undertaken for the project to indicate the growth of cities, regional centres and towns (urban agglomerations) at a finer scale than the municipal level. It was intended that through this, town population could be compared to national growth which would then in turn highlight places of high / low / negative growth within the municipalities but also factoring in the growth nationally so as to compare the growth of towns across the country.

Due to the level of detail required for this process, the analysis period for the town growth could only be undertaken for the period between 2001 and 2011. It was agreed that due to limitations of data availability at this level, only population data would be analysed for the growth.

The data that is used as inputs for the town level analysis is:

- CSIR's Meso-frame. The meso-frame is a meso-scale "geoframe" for South Africa; it is a demarcation of South Africa into a "grid" of just less than 25 000 "mesozones", each approximately 50 km2 in size (GAP 2017). (For more information of this methodology please see https://www.gap.csir.co.za/techical-overview)
- The Functional City, Town and Settlement Typology for SA. This Typology was developed by CSIR in collaboration with the South African Cities Network (SACN), and provides a mechanism to profile (identify, calculate and analyse) a set of development information and trends pertaining to the towns and cities, as well as high density rural settlements across South Africa (StepSA 2017 and Van Huysteen et al 2015)
- (For more information of this Typology aqnd its development please see http://stepsa.org/settlement_typology.html)
- Population Data. Original population data was sourced from StatsSA for the censuses of 2001 and 2011. The data was then disaggregated into the CSIR meso-frame / Functional City, Town and Settlement Typology. (Mans 2012 A and B)

The following steps were undertaken to identify the Municipal Socio-economic Intensity Index:

- Data Preparation
- Weighted Growth Calculation
- Creating a Comparative City and Town-based Growth classification (see Table 5 below)

Table 5: Town scale weighted growth index and description

CATEGORY	Description of Population Growth, Compared to average national population growth and/or real population growth (Based on town growth trends for 2001-2011)
Large Decline	More than 15% decline in population
Moderate Decline	Between 5% to 15% decline in population

Low Decline	Between 0.05% and 5% decline in real population
Lagging	Real population growth of 0% - 14.32%, but weighted against the national average of 15.57%, lagging behind the national population growth rate.
On Par	More or less on par with the national population growth rate of 15.47%
Slight Growth Above	Growth of about 1%-5% above the weighted national population growth rate (Equated to real growth of about 17-21%)
Moderate Above	Growth of between 5%-15% above the weighted national population growth rate (Equated to real growth of about 21-33%)
Large Above	Growth of between 15%-50% above the weighted national population growth rate (Equated to real growth of about 33-73%)
High Above	Growth of more than 50% above the weighted national population growth rate (Equated to real growth of more than 73%)

- **Identification of the socio-economic intensity index classes to be considered for the delineation of the first draft focus areas**

Figure 6 below shows a spatial overview of the socio-economic Intensity Index classes and includes the Municipal Index classes (discussed in Point 1 above) and the Towns Weighted Growth (discussed in Point 2 above). The spatial overview clearly shows what are the various intensity classes for the municipalities within South Africa and also the cities, regional centres and towns weighted population growth within the municipalities.

The Municipal Intensity Index shows the *current* economic and population growth and provides an indication of the possible *future trends* of economic and population growth within the municipalities. Given the level of assessment and without a detailed assessment of each Class (which is not viable on this scale), it is with certainty that it can be stated that Class 1 and Class 2 of the Municipal Intensity Index has high intensity and growth. This directly translates to a high level of economic and population activity and correlated with this, a high level of poverty, youth and dependency within these municipalities.

The key consideration within low intensity classes (Classes 6 and 7 of the Municipal Intensity Index Classes) is the proximity to towns that are growing since, even though the municipality shows low intensity, the Town Scale Weighted Growth Index shows where there are towns with a high population growth (associated with high intensity). Based on this, on a Town Scale Weighted Growth Index, Classes “large growth above” and “high growth above” show a real and weighted growth rate, compared to the average national growth rate, of over 15% (see Table 2 above). For the selection of first draft focus areas, the towns located within Classes 6 and 7 (low intensity Classes) of the Municipal Intensity Index Classes will therefore be selected.

For the remaining three Classes (High Intensity and Lagging, High intensity and Declining and Moderate intensity) within the Municipal Intensity Index, without a detailed investigation on what interventions would be appropriate and suitable for each municipality it cannot be justified with certainty that these areas should be used for the selection of the first draft focus areas. Detailed investigations would need to be undertaken to ascertain the current restrictions faced by the

municipality, the capacity of the municipality and vulnerability analysis to ensure that the interventions within these municipalities are appropriate. It should therefore be noted that these Classes are not unsuitable for the development of large scale wind and solar development but rather that detailed and fine scale planning tools are required to guide development within these areas.

Based on the above, the key socio-economic Intensity Index classes that will be used to identify the first draft focus areas are:

Municipal Intensity classes (see Table 4 *for a description of the classes):*

- Class 1: Very High Intensity and Growing
- Class 2: High Intensity and Growing

Town Weighted Growth (see Table 5 *for a description of the category):*

- Large Growth Above
- High Growth Above

within Low Intensity and Growing (Class 6) and Low Intensity and Declining (Class 7) within the Municipal Intensity Classes.

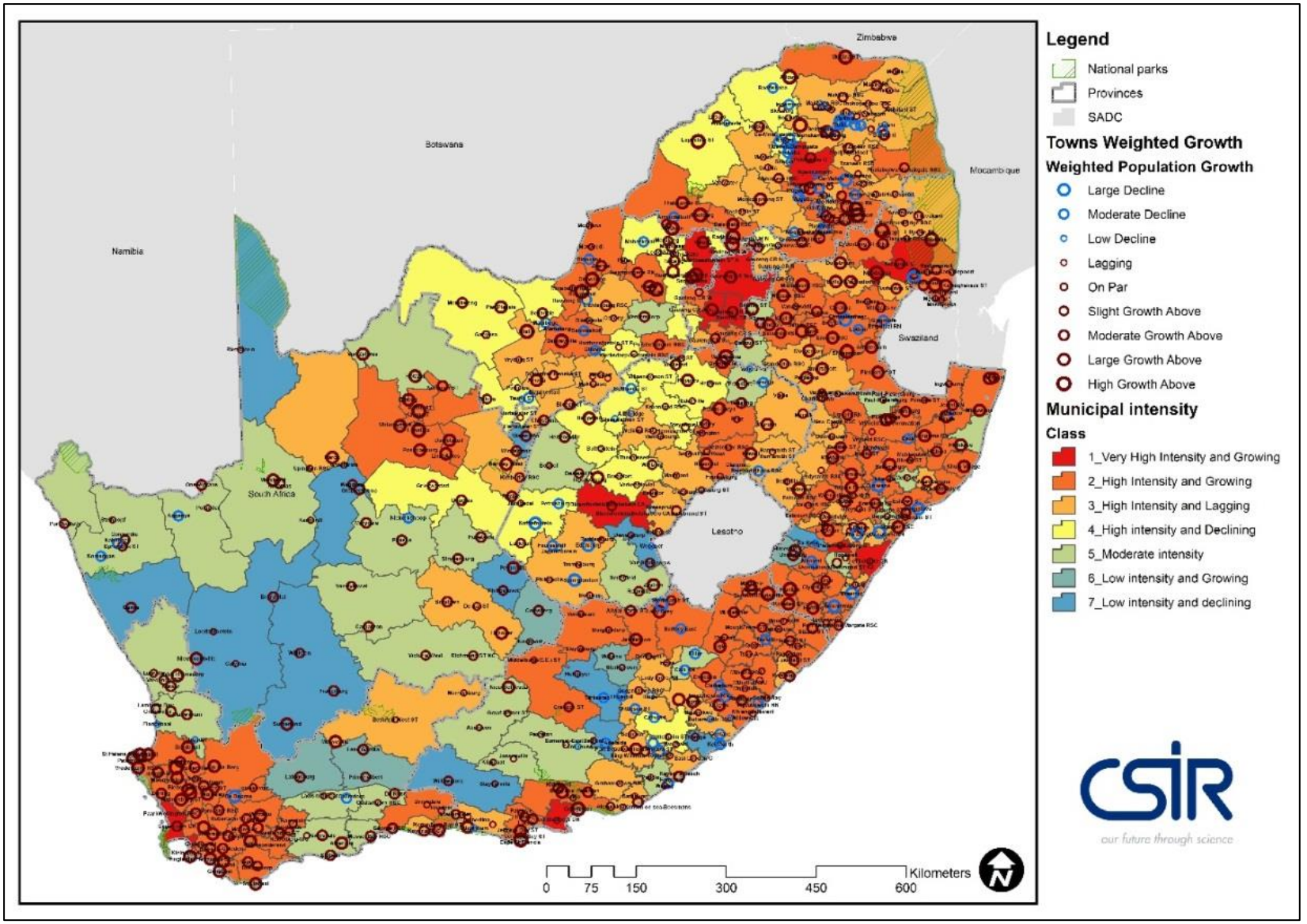


Figure 6: Socio-economic Intensity Index: Spatial Overview

5. Delineation of the first wind energy draft focus areas

For the identification of the first draft focus areas for wind energy, the following steps were followed:

Step 1: Areas with a capacity factor value superior to 0.352209 and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads were selected. The interest of the three criteria was processed in ArcgGIS10.4.

Step 2: Areas with a wind speed value inferior to 5.5 m per second at a 100m average hub height were erased from the intersect layer created in Step 1. A new layer was thus created consisting clusters of areas with a capacity factor value superior to 0.352209 and with a wind speed value superior to 5.5 m per second at a 100m average hub height, and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads.

Step 3: Areas with underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite) which present various geotechnical challenges were erased from the layer created in Step 2. A new layer was thus created consisting clusters of areas with a capacity factor value superior to 0.352209 and with a wind speed value superior to 5.5 m per second at a 100m average hub height, and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite).

Step 4: Areas with slope superior to 10% which present a logistic challenge in terms of transporting the abnormal loads of the wind energy facility components to the construction site were erased from the layer created in Step 3. A new layer was thus created consisting clusters of areas with a capacity factor value superior to 0.352209 and with a wind speed value superior to 5.5 m per second at a 100m average hub height, and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%. This layer represents the technical wind energy clusters which will be used for the delineation of the first draft focus areas for wind energy development as part of the Phase 2 of the wind and solar PV SEA.

Step 5: The layer created in Step 4 was clipped to the extent of the municipalities' boundaries of classes 1, 2, 6 and 7, identified in Section 4.3 of this report, which include 124 municipalities across the nine provinces of South Africa classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining". A new layer was thus created consisting clusters of areas with a capacity factor value superior to 0.352209 and with a wind speed value superior to 5.5 m per second at a 100m average hub height, and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%, and located within the 124 municipalities across the nine provinces of South Africa which were classified as "Very High Intensity and Growing", "High Intensity and

Growing", "Low Intensity and Growing" and "Low Intensity and declining". This layer represents the refined wind energy clusters which will be used for the delineation of the first draft focus areas for wind energy development as part of the Phase 2 of the wind and solar PV SEA.

Step 6: The layer created in Step 5 was overlaid with the mask of environmental features of critical importance described in Section 4.1 of this report. All intersect of the refined wind clusters created in Step 5 with environmental features of critical importance were erased from the layer. A new layer was thus created consisting clusters of areas with a capacity factor value superior to 0.352209 and with a wind speed value superior to 5.5 m per second at a 100m average hub height, and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%, and located within the 124 municipalities across the nine provinces of South Africa which were classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining", and without any environmental features of critical importance. This layer represents the final wind energy clusters for the delineation of the first draft focus areas for wind energy development as part of the Phase 2 of the wind and solar PV SEA and is illustrated in Figure 7.

A grid of 50 km by 50 km cells was overlaid on the final wind energy clusters to enable all stakeholders to provide comments on the delineation of the first draft focus areas for wind energy development. Stakeholders are invited to comment on the location of the final wind energy clusters by indicating the name of the grid cell e.g.: "comment on the wind energy clusters located in the grid cell "Q20": …", see Figure 8 for an illustration of the wind energy cluster located in the grid cell "Q20".

Stakeholders are invited to submit additional information in support of their comments to the SEA team, including documents and datasets to be considered during the refinement of the boundaries of the first draft focus areas for wind energy development. Documents must only be submitted in pdf or word format, and datasets must only be submitted in shapefiles (version ArcGIS 10.4 or older) or kmz/kml file (google earth spatial file).

Comments can be submitted on the project website directly at https://redzs.csir.co.za/?page_id=625

Additional documents and datasets to be considered by the SEA team must be sent via email to:
redzs@csir.co.za

If you wish to submit comments and additional documents and datasets to be considered by the SEA team, but do to have access to internet or a computer, please fax your inputs to **021 888 2473** ; or call the SEA team on **021-888-2408**.

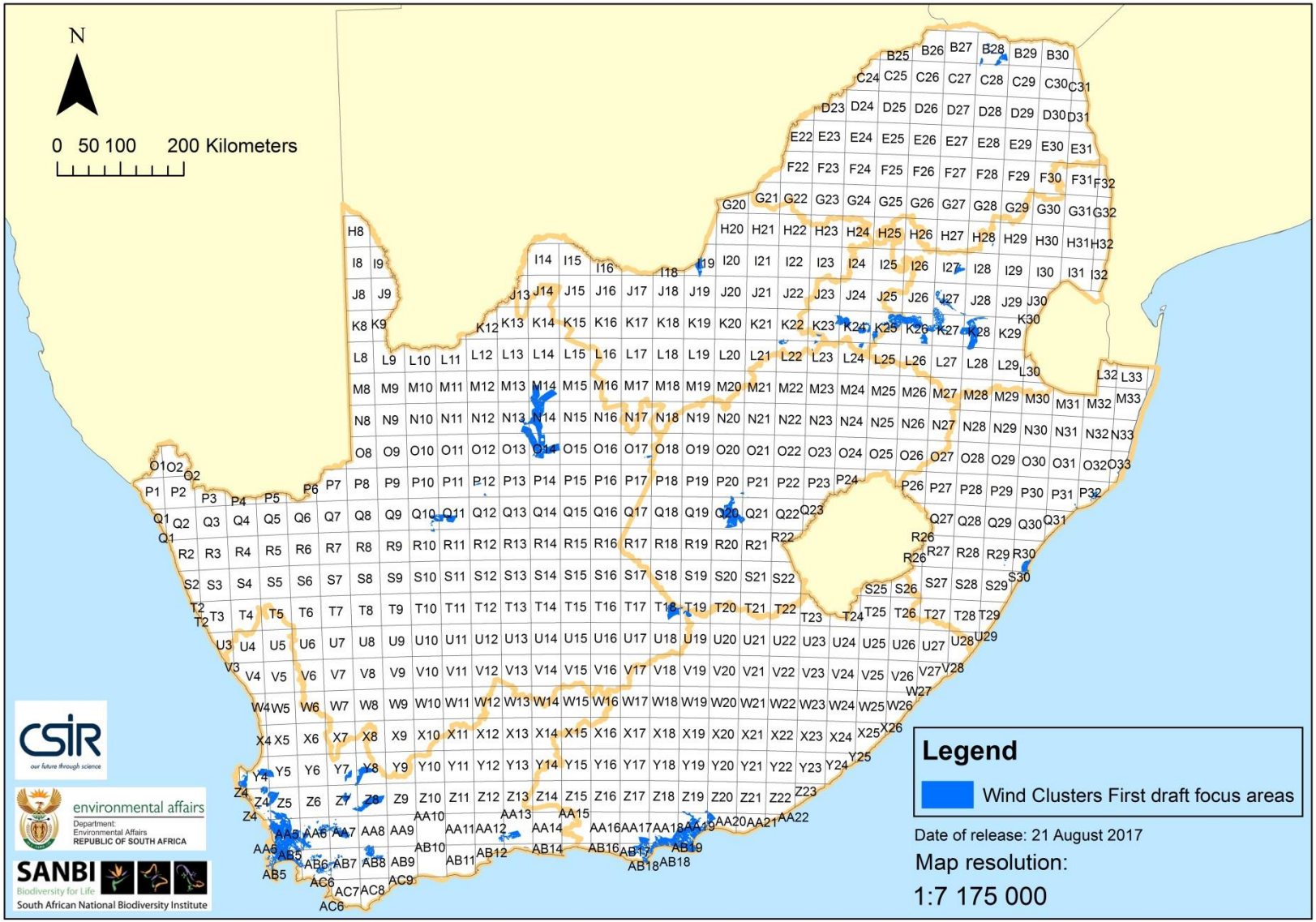


Figure 7: First draft focus areas for wind energy development

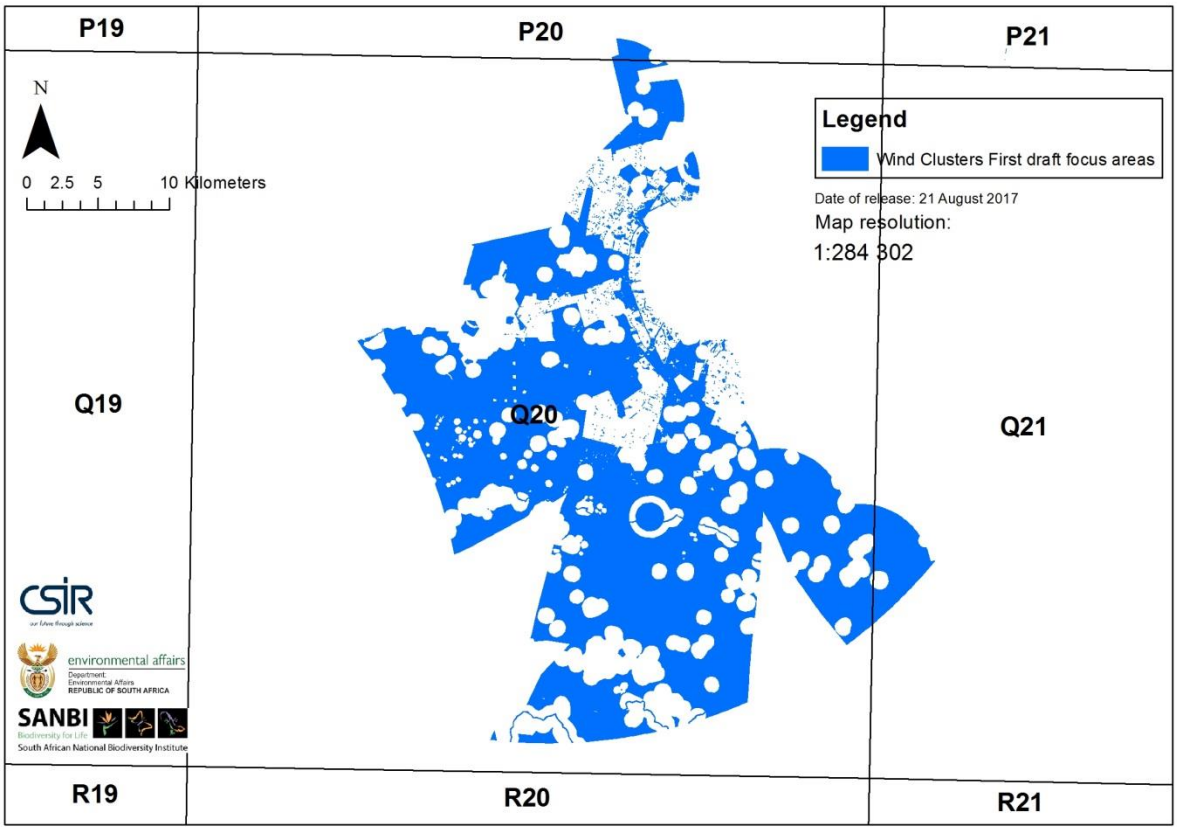


Figure 8: Wind energy cluster located in the grid cell "Q20"

6. Delineation of the first solar PV energy draft focus areas

For the identification of the first draft focus areas for solar PV energy, the following steps were followed:

Step 1: Areas with a Photovoltaic Yield with single axis tracking value superior to 1850 (kWh(electrical)/kWpeak(installed)/annum) and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads were selected. The "intersect" of the three criteria was processed in ArcgGIS10.4.

Step 2: Areas with underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite) which present various geotechnical challenges were erased from the layer created in Step 1. A new layer was thus created consisting clusters of areas with a Photovoltaic Yield with single axis tracking value superior to 1850 (kWh(electrical)/kWpeak(installed)/annum) and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite).

Step 3: Areas with slope superior to 10% which present a logistic challenge in terms of transporting the abnormal loads of the solar PV energy facility components to the

construction site were erased from the layer created in Step 2. A new layer was thus created consisting clusters of areas with a Photovoltaic Yield with single axis tracking value superior to 1850 (kWh(electrical)/kWpeak(installed)/annum) and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%. This layer represents the technical solar PV energy clusters which will be used for the delineation of the first draft focus areas for solar PV energy development as part of the Phase 2 of the wind and solar PV SEA.

Step 4: The layer created in Step 3 was clipped to the extent of the municipalities' boundaries of classes 1, 2, 6 and 7, identified in Section 4.3 of this report, which include 124 municipalities across the nine provinces of South Africa classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining". A new layer was thus created consisting clusters of areas with a Photovoltaic Yield with single axis tracking value superior to 1850 (kWh(electrical)/kWpeak(installed)/annum) and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%, and located within the 124 municipalities across the nine provinces of South Africa which were classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining". This layer represents the refined solar PV energy clusters which will be used for the delineation of the first draft focus areas for solar PV energy development as part of the Phase 2 of the wind and solar PV SEA.

Step 5: The layer created in Step 4 was overlaid with the mask of environmental features of critical importance described in Section 4.1 of this report. All intersect of the refined solar PV clusters created in Step 4 with environmental features of critical importance were erased from the layer. A new layer was thus created consisting clusters of areas with a Photovoltaic Yield with single axis tracking value superior to 1850 (kWh(electrical)/kWpeak(installed)/annum) and located within 35 km of MTS substation (GCAAA and TDP datasets) and within 10 km of main roads, without any underlying rock formation of dolorites and other hardrocks (including Gneiss, Granite, and Quartzite), without any slope superior to 10%, and located within the 124 municipalities across the nine provinces of South Africa which were classified as "Very High Intensity and Growing", "High Intensity and Growing", "Low Intensity and Growing" and "Low Intensity and declining", and without any environmental features of critical importance. This layer represents the final solar PV energy clusters for the delineation of the first draft focus areas for solar PV energy development as part of the Phase 2 of the wind and solar PV SEA and is illustrated in Figure 9.

A grid of 50 km by 50 km cells was overlaid on the final solar PV energy clusters to enable all stakeholders to provide comments on the delineation of the first draft focus areas for solar PV energy development. Stakeholders are invited to comment on the location of the final solar PV energy clusters by indicating the name of the grid cell e.g.: "comment on the solar PV energy cluster

located in the grid cell “K28”: …”, see Figure 10 for an illustration of the solar PV energy cluster located in the grid cell “K28”.

Stakeholders are invited to submit additional information in support of their comments to the SEA team, including documents and datasets to be considered during the refinement of the boundaries of the first draft focus areas for solar PV energy development. Documents must only be submitted in pdf or word format, and datasets must only be submitted in shapefiles (version ArcGIS 10.4 or older) or kmz/kml file (google earth spatial file).

Comments can be submitted on the project website directly at https://redzs.csir.co.za/?page_id=625

Additional documents and datasets to be considered by the SEA team must be sent via email to: **redzs@csir.co.za**

If you wish to submit comments and additional documents and datasets to be considered by the SEA team, but do to have access to internet or a computer, please fax your inputs to **021 888 2473** ; or call the SEA team on **021-888-2408**.

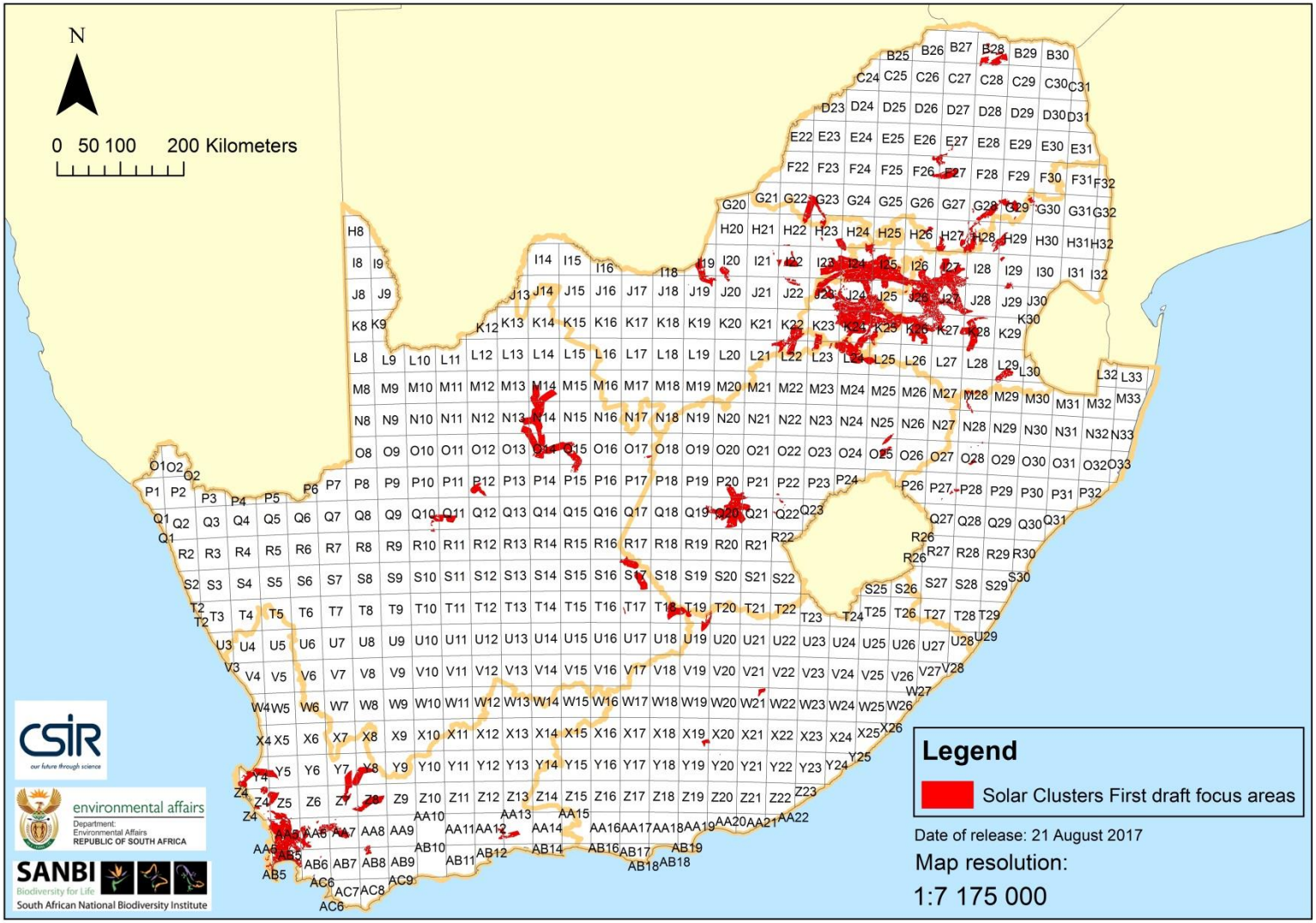


Figure 9: First draft focus areas for solar PV energy development

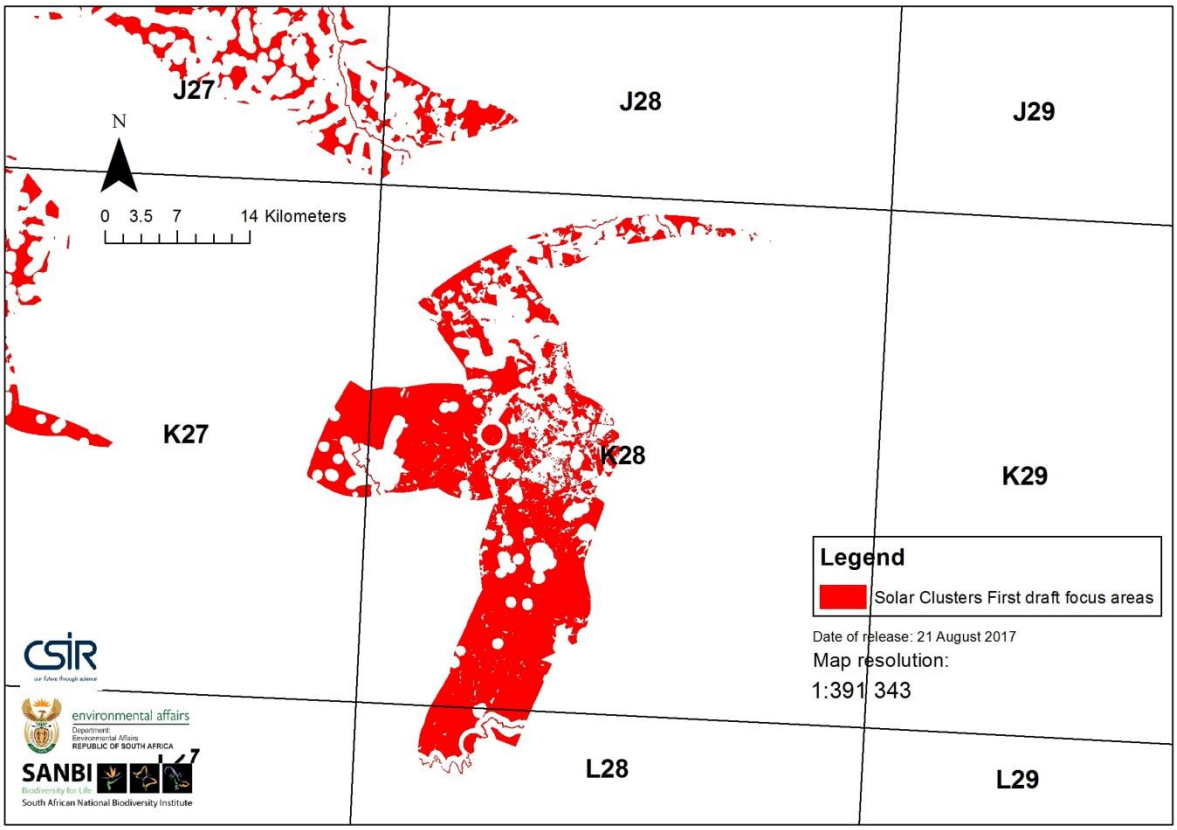


Figure 10: Solar PV energy cluster located in the grid cell "K28"

7. Next steps

Following this public participation period (21 August 2017 -22 September 2017), all comments and data submissions will be used to refine the first draft focus areas. Once this step of the SEA has been completed, the second draft focus areas will undergo four tiered sensitivity mapping based on the table below to identify very high, high, medium and low sensitivity areas. Stakeholders are kindly requested to review the table of features below and associated buffers of environmental considerations and submit any relevant comments for consideration by the SEA team. These four tiered sensitivity classes will be verified by a team of multi author specialists for each strategic topic which has been identified for the SEA.

All stakeholders are kindly requested to provide any data and information related to the sensitivity of the identified focus areas for consideration by the SEA team. This is critical to ensure that the identified focus areas represent areas where large scale renewable energy developments can occur with minimum environmental impact.

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
Protected Areas	SAPAD - Q2, 2017 and South African Conservation Areas Database (SACAD) - Q1,2017	National Parks	Very high sensitivity	feature	Very high sensitivity	feature
		Nature Reserves	Very high sensitivity	feature	Very high sensitivity	feature
		World Heritage Sites (Core)	Very high sensitivity	feature	Very high sensitivity	feature
		Mountain Catchment Areas (natural)	Very high sensitivity	feature	Very high sensitivity	feature
		Protected Environments (natural)	Very high sensitivity	feature	Very high sensitivity	feature
		Forest Nature Reserve	Very high sensitivity	feature	Very high sensitivity	feature
		Forest Wilderness Area	Very high sensitivity	feature	Very high sensitivity	feature
		Special Nature Reserve	Very high sensitivity	feature	Very high sensitivity	feature
		10 KM buffer around National Parks	High sensitivity	feature	High sensitivity	feature
		5KM buffer around Nature Reserves	High sensitivity	feature	High sensitivity	feature
		Buffer around World Heritage Sites	High sensitivity	feature	High sensitivity	feature
Conservation Areas	SACAD-Q1, 2017 and Provincial Private Reserves/Conservation Areas	Biosphere reserves (Not already protected)	Medium sensitivity	feature	Medium sensitivity	feature
		Botanical gardens	Medium sensitivity	feature	Medium sensitivity	feature
		Ramsar Sites (not already protected)	High sensitivity	feature	High sensitivity	feature
		Game farms and Private Reserves	High sensitivity	feature	High sensitivity	feature
Critical Biodiversity Areas (CBAs) categories	Provincial	CBA	Very high sensitivity	feature	Very high sensitivity	feature
		ESA	High sensitivity	feature	Medium sensitivity	feature
Threatened	South African	CR	Very high sensitivity	feature	Very high sensitivity	feature

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
Ecosystems	National Biodiversity Institute (SANBI) 2010	EN	High sensitivity	feature	High sensitivity	feature
		VU	High sensitivity	feature	High sensitivity	feature
Bats	Roost dataset from SABAAB (Kate Mc Ewan)	colony of 1 – 50 Least Concern bats + colony of 1 – 50 Low Risk Conservation Important bats	Very high sensitivity	500 m	N/A	N/A
		colony of 50 – 500 Least Concern bats + colony of 50 - 500 Low Risk Conservation Important bats + colony of 1 – 50 Med-High Risk Conservation Important bats	Very high sensitivity	1 km	N/A	N/A
		colony of >500 High Risk Least Concern bats + colony of 50 - 500 Med-High Risk Conservation Important bats + colony of 500 - 2000 Low Risk Conservation Important bats	Very high sensitivity	2.5 km	N/A	N/A
		colony of 500 - 2000 Med-High Risk Conservation Important bats	Very high sensitivity	10 km	N/A	N/A
		colony of >2000 Bats of any status or risk level	Very high sensitivity	20 km	N/A	N/A

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
Birds	Ecoregions	KwaZulu-Cape coastal forest mosaic	Very high sensitivity	feature	Very high sensitivity	feature
		Maputaland-Pondoland bushland and thickets	Very high sensitivity	feature	Very high sensitivity	feature
		Maputaland coastal forest mosaic	Very high sensitivity	feature	Very high sensitivity	feature
		Zambezian and Mopane woodlands	Very high sensitivity	feature	Very high sensitivity	feature
	REDZs Phase 1 SEA: All_Bats_Absolute_Dolomite and Limestone	Dolomite and Limestone	Very high sensitivity	feature	N/A	N/A
	REDZs Phase 1 SEA: All_Bats_Absolute_Rivers and Wetlands	Rivers and Wetlands	Very high sensitivity	feature	N/A	N/A
	REDZs Phase 1 SEA: All_Bats_Absolute_Forest	Forests	Very high sensitivity	feature	N/A	N/A
	REDZs Phase 1 SEA: All_Bats_Absolute_Cropland	Cropland	Very high sensitivity	feature	N/A	N/A
	BirdlifeSA exclusions Phase 1 SEA	Priority colonies	Very high sensitivity	feature	High sensitivity	feature
		Transkei vulture IBA	Very high sensitivity	feature	High sensitivity	feature
		Bearded vulture nest	Very high sensitivity	feature	High sensitivity	feature
		FlywayVerloernvlei	Very high sensitivity	feature	High sensitivity	feature
		IBA exclusion	Very high sensitivity	feature	High sensitivity	feature
		Lesser Kestrel	Very high sensitivity	5 km	High sensitivity	1km
		Protected Areas in IBA	Very high sensitivity	feature	High sensitivity	feature
		Potberg Cape Vulture	Very high sensitivity	feature	High sensitivity	feature

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
		Black harrier roost sites	Very high sensitivity	3km		N/A
		Barlows lark distribution				
		Southern Bald Ibis	Very high sensitivity	10km	N/A	N/A
		Saldanha Flyway	Very high sensitivity	feature	High sensitivity	feature
		Verreaux Eagles Nests	Very high sensitivity	3km	N/A	N/A
		Ludwig Bustard	High sensitivity		High sensitivity	
		Red Lark Distribution	High sensitivity		Very high sensitivity	
		Wetlands more than 2ha (2km) and Mainstem Rivers (500m)				
	VULPRO	VULPRO cape vulture colonies	Very high sensitivity	40km	High sensitivity	5km
		VULPRO cape vulture roosts	Very high sensitivity	35 km	High sensitivity	3km
		VULPRO cape vulture restaurants	Very high sensitivity	10km	High sensitivity	feature
	NMMU	NMMU cape vulture roost sites	Very high sensitivity	35km	High sensitivity	3km
	KZN wildlife	Bearded vulture collision risk model	Very high sensitivity	feature	High sensitivity	feature
Species of conservation concern (Plants, amphibians, reptiles, butterflies)	Endangered Wildlife Trust (EWT), SANBI and BirdLife South Africa	Critical Habitat for highly restricted Species Global Extent of Occurrence < 10 km2	Very high sensitivity	feature	Very high sensitivity	feature
		Confirmed occurences of rare and threatened species	High sensitivity	feature	High sensitivity	feature

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
		Suitable unsurveyed habitat for threatened, rare and data deficient species.	Medium sensitivity	feature	Medium sensitivity	feature
		No known or expected threatened or rare species.	Low sensitivity	feature	Low sensitivity	feature
National Protected Areas Expansion Strategy	Department of Environmental Affairs (DEA) and Provincial	Protected areas expansion priority areas	High sensitivity	feature	Very high sensitivity	feature
Estuaries	National Biodiversity Assessment (NBA) 2011	All estuaries	Very high sensitivity	feature	Very high sensitivity	feature
Freshwater Feature buffers	NFEPA	500m buffer around Wetlands	Very high sensitivity	500m	Very high sensitivity	500m
		32 m buffer around Rivers	Very high sensitivity	32m	Very high sensitivity	32m
Strategic Water Source Areas (SWSAs)	Council for Scientific and Industrial Research (CSIR)	SWSAs (Natural areas)	Very high sensitivity	feature	Very high sensitivity	feature
Habitat Modification layer	SANBI	Natural areas	Medium sensitivity	feature	Medium sensitivity	feature
		Modified areas	Low sensitivity	feature	Low sensitivity	feature
		Old fields	Low sensitivity	feature	Low sensitivity	feature
Forests (non-protected forest patches from National Forest Inventory)	Department of Agriculture, Forestry and Fisheries (DAFF)	Forests (National Forest Inventory)	Very high sensitivity	feature	Very high sensitivity	feature
UNESCO tentative sites	UNESCO website / SAHRA	UNESCO tentative sites	High sensitivity	feature	High sensitivity	feature
Heritage	SAHRA	Grade I and II sites	Very high sensitivity	1km	Very high sensitivity	1km
		Heritage resources	Very high sensitivity	TBC	Very high sensitivity	TBC

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
		with provisional heritage protection as defined by Section 29 of the Heritage Act [Act 25 of 1999]				
		Protected areas as defined by Section 28 of the Heritage Act	Very high sensitivity	TBC	Very high sensitivity	TBC
		Burial Grounds and Graves	High sensitivity	TBC	Very high sensitivity	TBC
		Heritage areas as defined by Section 31 of the Heritage Act	High sensitivity	TBC	High sensitivity	TBC
		Heritage Protection Overlay Zones	High sensitivity	TBC	High sensitivity	TBC
		Public monuments and memorials as defined by Section 37 of the Heritage Act	High sensitivity	TBC	High sensitivity	TBC
		Heritage registered sites as defined by Section 30 of the Heritage Act	High sensitivity	TBC	High sensitivity	TBC
		o Grade IIIa to IIIb heritage resources	Medium sensitivity	TBC	Medium sensitivity	50m
Defence	SANDF	Forward Airfield	Very high sensitivity	10 km	Very high sensitivity	1 km
					Medium sensitivity	10 km
		Air Force Bases	Very high sensitivity High sensitivity Medium sensitivity	28 km 56 km 111 km	Very high sensitivity Medium sensitivity	1 km 28 km
		High Sites	Very high sensitivity	1km	Very high sensitivity	1 km

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
		Military Bases	Very high sensitivity High sensitivity	1km 10 km	Very high sensitivity	1 km
		Operational Military Bases	Very high sensitivity High sensitivity	1km 10 km	Very high sensitivity	1 km
		Shooting Ranges	Very high sensitivity High sensitivity	1km 10 km	Very high sensitivity	1 km
		Military Training Areas	Very high sensitivity High sensitivity	1km 10 km	Very high sensitivity	1 km
		Ammunition Depots	Very high sensitivity	10km	Very high sensitivity	10 km
		Bombing Ranges	Very high sensitivity	28km	Very high sensitivity	28km
			High sensitivity	28 - 56km	High sensitivity	28 - 56km
			Medium sensitivity	56-111km	Medium sensitivity	56-111km
		Border Posts	Very high sensitivity	1km	Very high sensitivity	1km
		All Other DoD features (Including Naval Bases, Housing, Offices ect)	feature	feature	feature	feature
Airports (major, landing strips, small aerodromes)	REDZs 1 SEA dataset and EGI SEA dataset for additional features	Major Airports	Very high sensitivity	8 km	Medium sensitivity	8
			High sensitivity	8-15 km		
			Medium sensitivity	15-35 km		
		Landing strips	High sensitivity	8 km	Medium sensitivity	8km
		other civil aviation aerodromes (small aerodromes)	High sensitivity	8 km	Medium sensitivity	8 km
			Medium sensitivity	8-15 km		
Civil Aviation	REDZs 1 SEA dataset	Civil Aviation radars	Very high sensitivity	0-15 km	N/A	N/A
			Medium sensitivity	15-35 km	N/A	N/A
		Air traffic control and navigation sites	Medium sensitivity	0-5 km	N/A	N/A

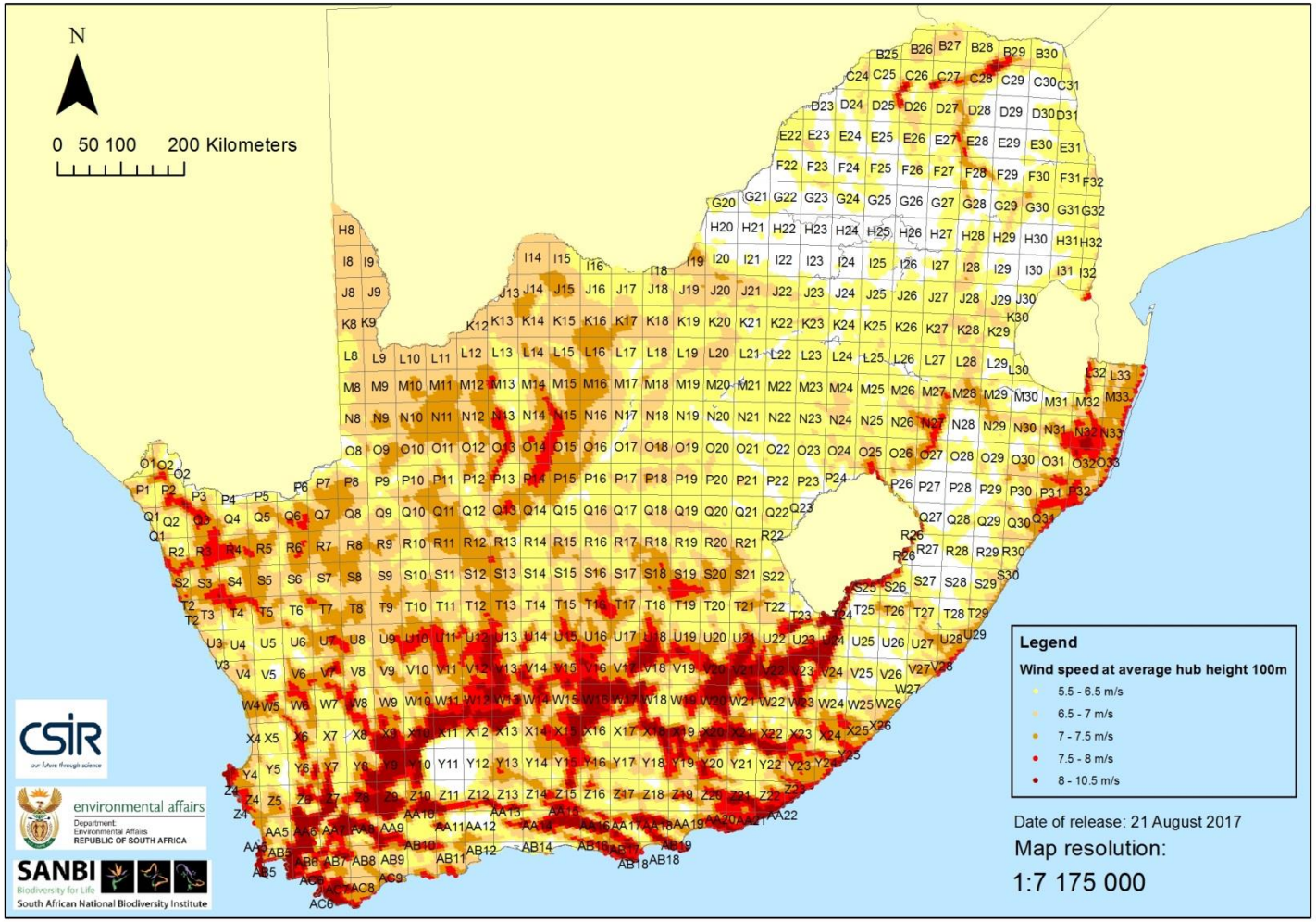
Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
		Danger and restricted airspace	High sensitivity	feature	N/A	N/A
Land Capability	DAFF	Land capability features with values ranging from 11-15	Very high sensitivity	feature	Very high sensitivity	feature
		Land capability features with values ranging from 9-10	High sensitivity	feature	High sensitivity	feature
		Land capability features class 6 to 8	Medium sensitivity	feature	Medium sensitivity	feature
		Land capability features class 1 to 5	Low sensitivity	feature	Low sensitivity	feature
Mining	CGS	Abandoned mines	Low sensitivity	feature	Low sensitivity	feature
		Active mines	Medium sensitivity	feature	Very high sensitivity	feature
		Prospecting rights	Medium sensitivity	feature	Very high sensitivity	feature
		Mining rights	Medium sensitivity	feature	Very high sensitivity	feature
Coastline	Department of Rural Development and Land Reform (DRDLR)	Buffered coastline (1km)	Very high sensitivity	1km	Very high sensitivity	1km
Major roads	SANBI dataset	Major Roads	Very high sensitivity	1km	Very high sensitivity	1km
Telecommunication Towers	REDZs 1 SEA dataset	Sentech High Power Terrestrial Broadcasting Facilities	Very high sensitivity	5km	Medium sensitivity	5km
		Other Communication Facilities	High sensitivity	1km	Medium sensitivity	1km
Weather Radars	REDZs 1 SEA dataset	Weather Radars	Very high sensitivity High sensitivity Medium sensitivity Low sensitivity	0-18 km 18-30 km 30-60 more than 60 km	N/A	N/A
Karoo Central Astronomy	CSIR	Karoo Central Astronomy	Medium sensitivity	feature	Medium sensitivity	feature

Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
Advantage Area (KCAAA)		Advantage Area				
Square Kilometre Array (SKA) SEA study area	SKA SEA	Square Kilometre Array (SKA) study area	Very high sensitivity	feature	Very high sensitivity	feature
			High sensitivity	0-20 km	High sensitivity	0-20 km
Field crop boundaries	December 2015 release of the Field crop boundary data set or any newer released version thereafter	Irrigated Areas	Very high sensitivity	feature	Very high sensitivity	feature
		Shadenet	Very high sensitivity	feature	Very high sensitivity	feature
		Viticulture	Very high sensitivity	feature	Very high sensitivity	feature
		Horticulture	Very high sensitivity	feature	Very high sensitivity	feature
		Remaining cultivated areas	High sensitivity	feature	High sensitivity	feature
Paleontological heritage resources	CSIR	Very high palaeontological sensitivities as demarcated on the SAHRIS paleomap	Very High sensitivity	feature	Very High sensitivity	feature
		High palaeontological sensitivities as demarcated on the SAHRIS paleomap	High sensitivity	feature	High sensitivity	feature
		Low and very low palaeontological sensitivities as demarcated on the SAHRIS paleomap	Low sensitivity	feature	Low sensitivity	feature
Visual	DEM or NGI	Mountain Ranges	Very high sensitivity	feature	very high sensitivity	feature
	DEM or NGI	Slopes > 25% or 1:4	Very high sensitivity	feature	very high sensitivity	feature
	NFEPA 2011	Major River	High sensitivity	32-500 m	High sensitivity	32-500 m
	SANBI dataset	Coastal zones	High sensitivity	1-2 km	Medium sensitivity	1-4 km

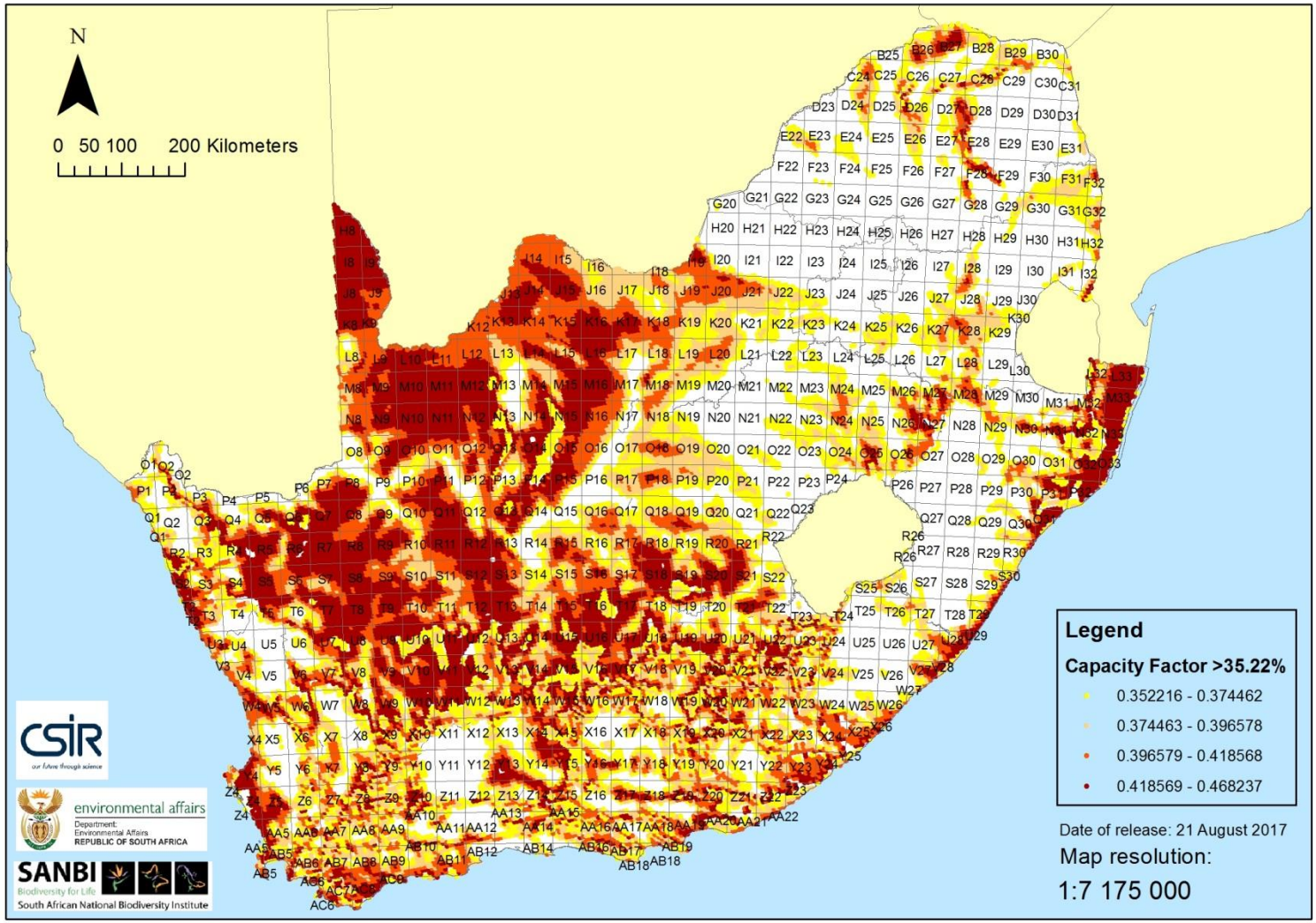
Criteria	Source	Features	Mapping Sensitivity	Sensitivity (Wind)	Mapping Sensitivity	Sensitivity (Solar)
			Medium sensitivity	2-4 km		
	South African Conservation Areas Database (SACAD) - Q1,2017 and Provincial Conservation Areas	Private reserves and game farms	High sensitivity	0-5 km	Very high sensitivity	0-2.5 km
			Medium sensitivity	5-10 km	High sensitivity	2.5-5 km
			Low sensitivity	10-20 km	Medium sensitivity	5-10 km
	SAPAD - Q2, 2017	Protected Areas	Very High	2.5km	Very High	2.5km
	?	SALT	Very high sensitivity	0-25 km	Very high sensitivity	0-25 km
			Medium sensitivity	25-75 km	Medium sensitivity	25-75 km
	SAHRA	Hearitage feature: Grade I sites	Very high sensitivity	0-1 km	Very high sensitivity	0-1 km
			Medium sensitivity	1-1.5 km	Medium sensitivity	1-1.5 km
		Hearitage feature: Grade ll sites	Very high sensitivity	0-1 km	Very high sensitivity	0-1 km
			Medium sensitivity	1-1.5 km	Medium sensitivity	1-1.5 km
		Hearitage feature: Grade llla sites	Very high sensitivity	0 -150 m	Very high sensitivity	0 -150 m
			Medium sensitivity	150 m - 1.5 km	Medium sensitivity	150 m - 1.5 km
		Hearitage feature: Grade lllb sites	Very high sensitivity	0-50m	Very high sensitivity	0-50m
			Medium sensitivity	50 m - 1.5 km	Medium sensitivity	50 m - 1.5 km
		Hearitage feature: Grade lllc sites	Very high sensitivity	0-30m	Very high sensitivity	0-30m
			Medium sensitivity	30 m - 1.5 km	Medium sensitivity	30 m - 1.5 km
	AfriGIS Towns – 2015	Town, villages and settlements outside large urban areas	Very high sensitivity	0-2 km	Very high sensitivity	0-500 m
			High sensitivity	2-4 km	High sensitivity	500 m - 1 km
			Medium sensitivity	4-6 km	Medium sensitivity	1 km-2 km
	DRDLR, NGI	National roads and scenic routes	Very high sensitivity	0-1 km	Very high sensitivity	0-500m
			High sensitivity	1-3 km	High sensitivity	500m-1km
			Medium sensitivity	3-5 km	Medium sensitivity	1 km-2 km
	Department of Transport, Western Cape	Western Cape Routes	Very high sensitivity	1km	Very high sensitivity	1km

<u>Appendix 1:</u> Technical criteria considered during the technical constraint mapping

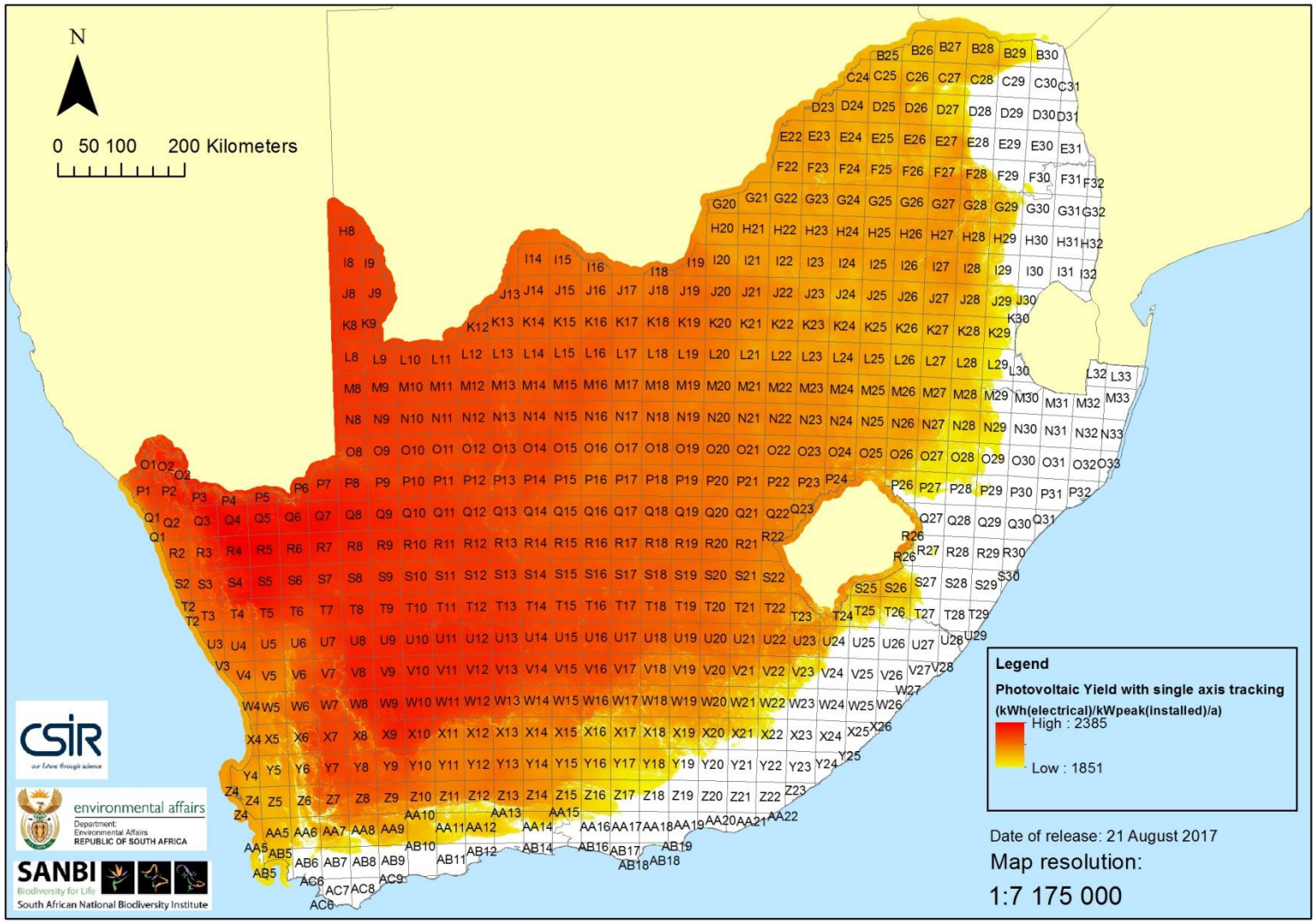
1. Wind speed > 5.5 m/s



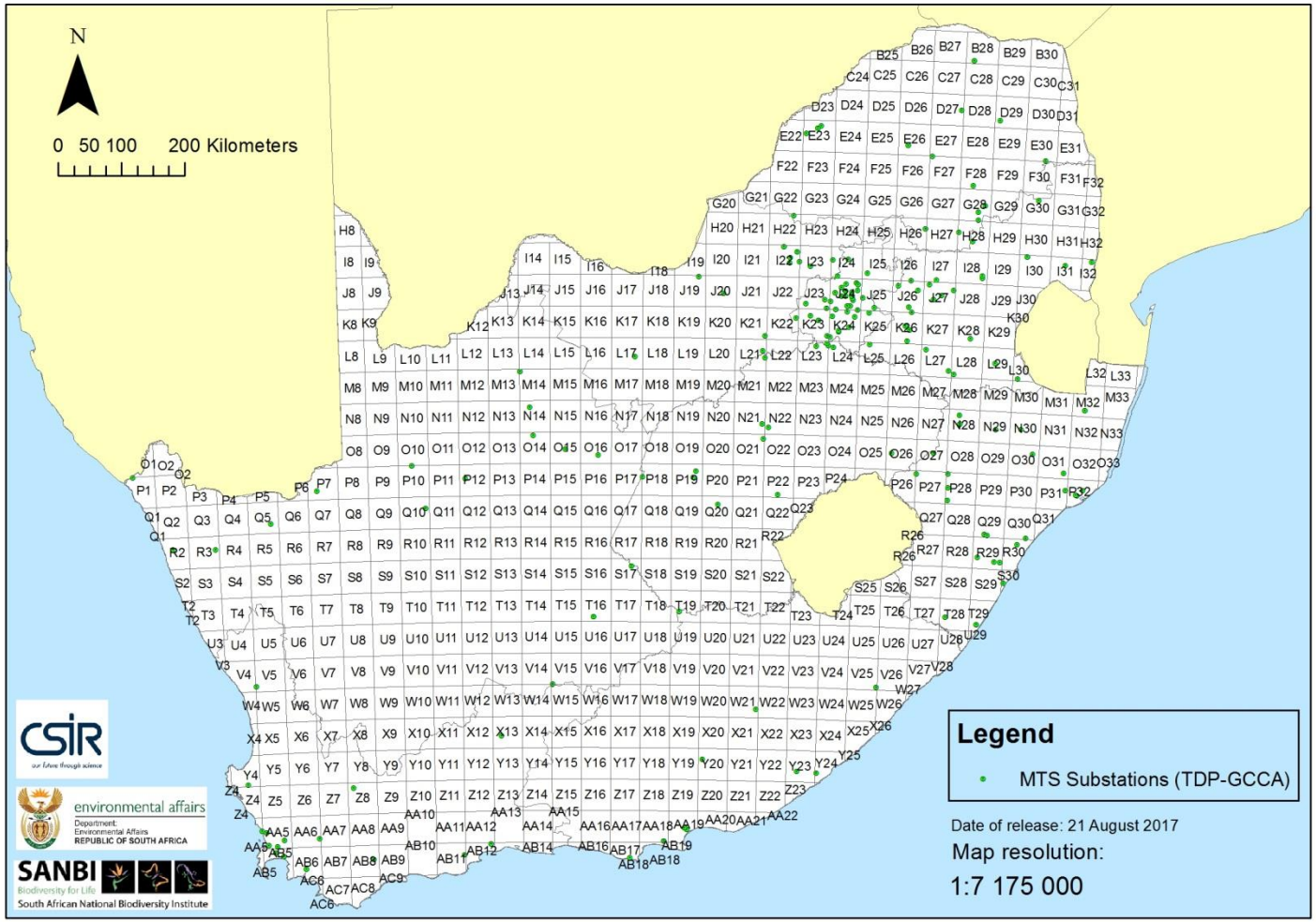
2. Capacity Factor > 35%



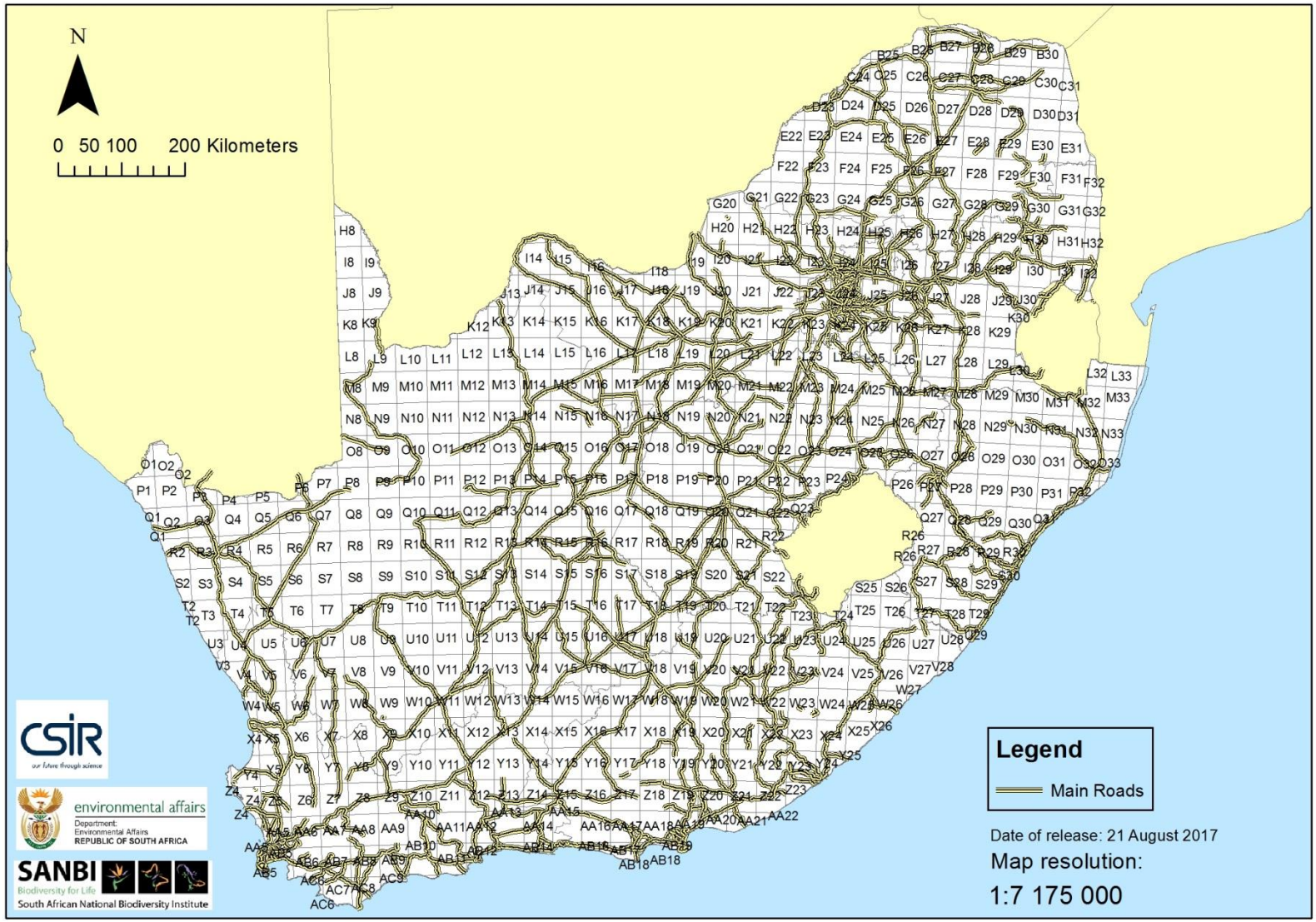
3. Solar PV tracking yield > 1850



4. **Buffered areas within 35 km from MTS substations (in areas with Stability Limit >1000MW and existing or planned substations with Transformer limit >100MW)**



5. Main roads


N
0 50 100 200 Kilometers
Legend
Main Roads
Date of release: 21 August 2017
Map resolution:
1:7 175 000
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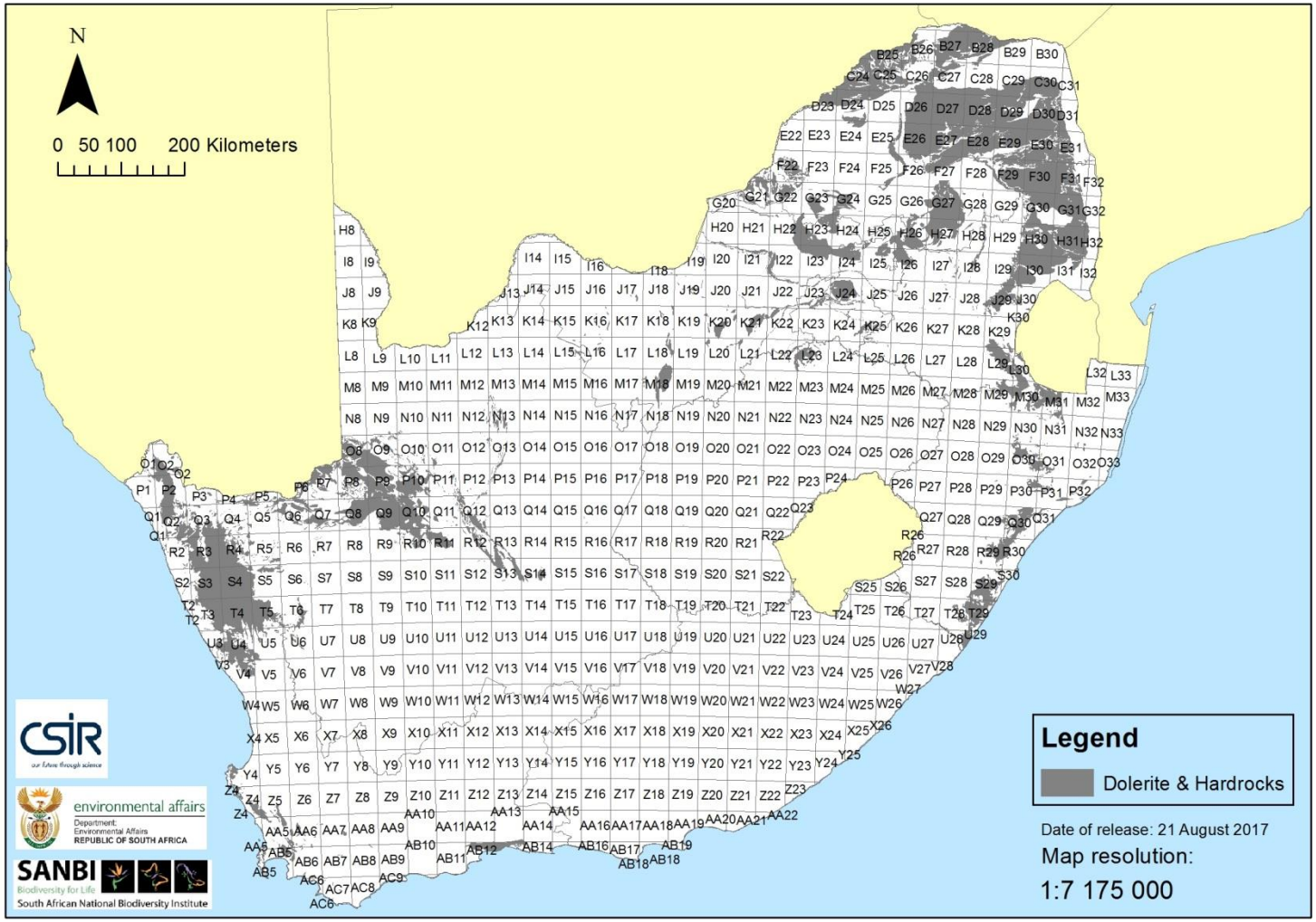
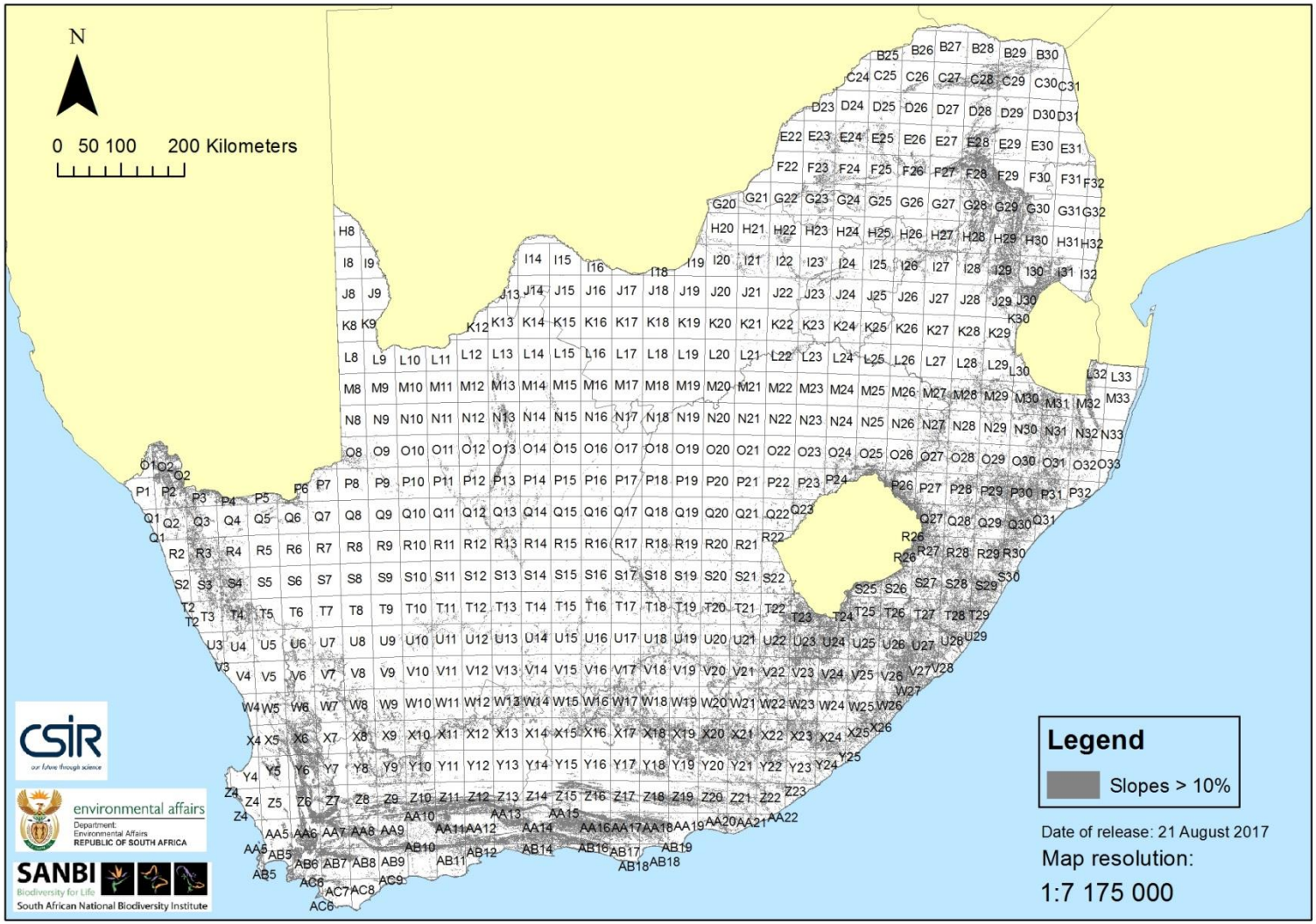
South African National Biodiversity Institute

6. Dolerites and hard-rock underlying formations



7. Slope > 10%


N
0 50 100 200 Kilometers
Legend
Slopes > 10%
Date of release: 21 August 2017
Map resolution:
1:7 175 000
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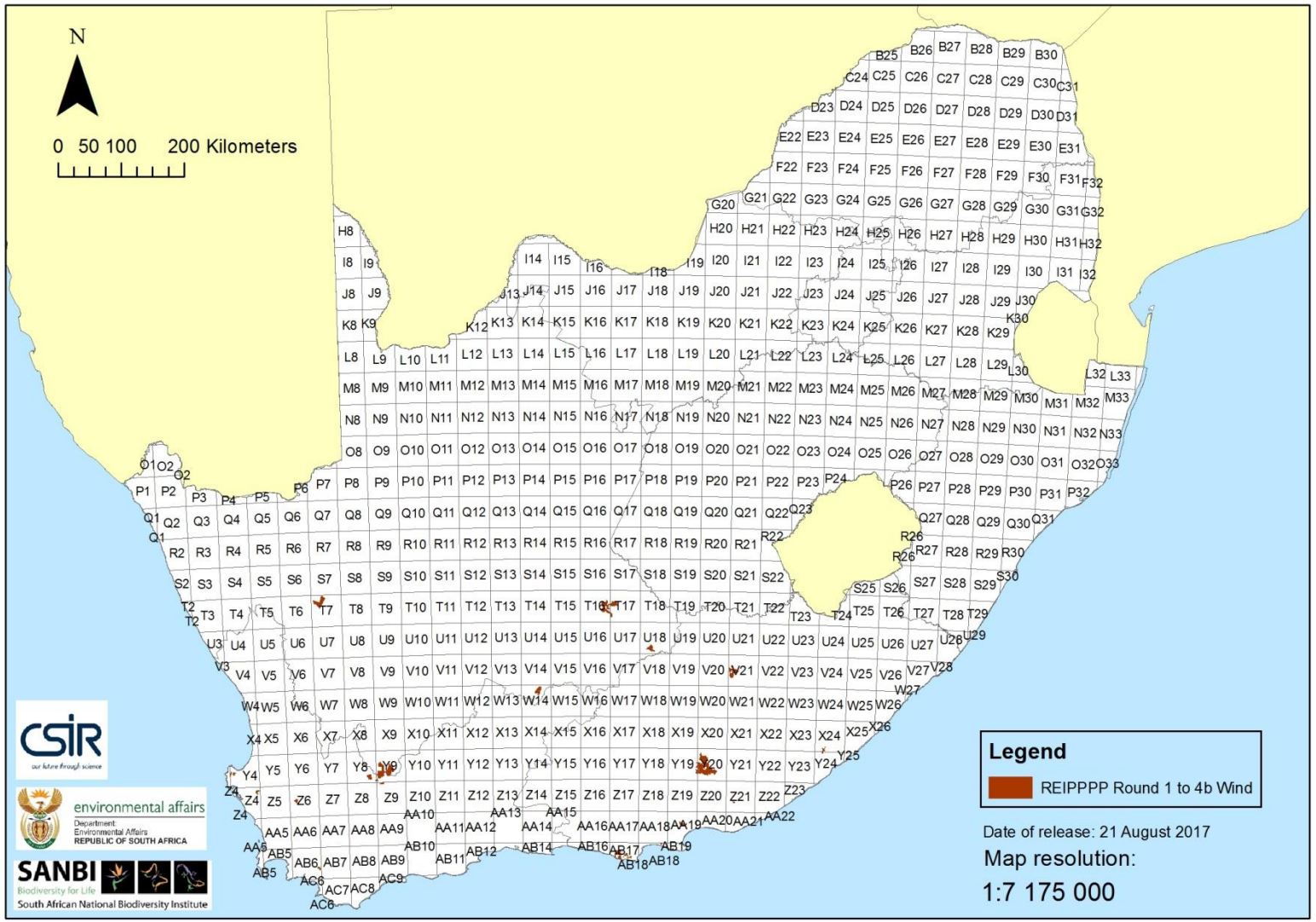
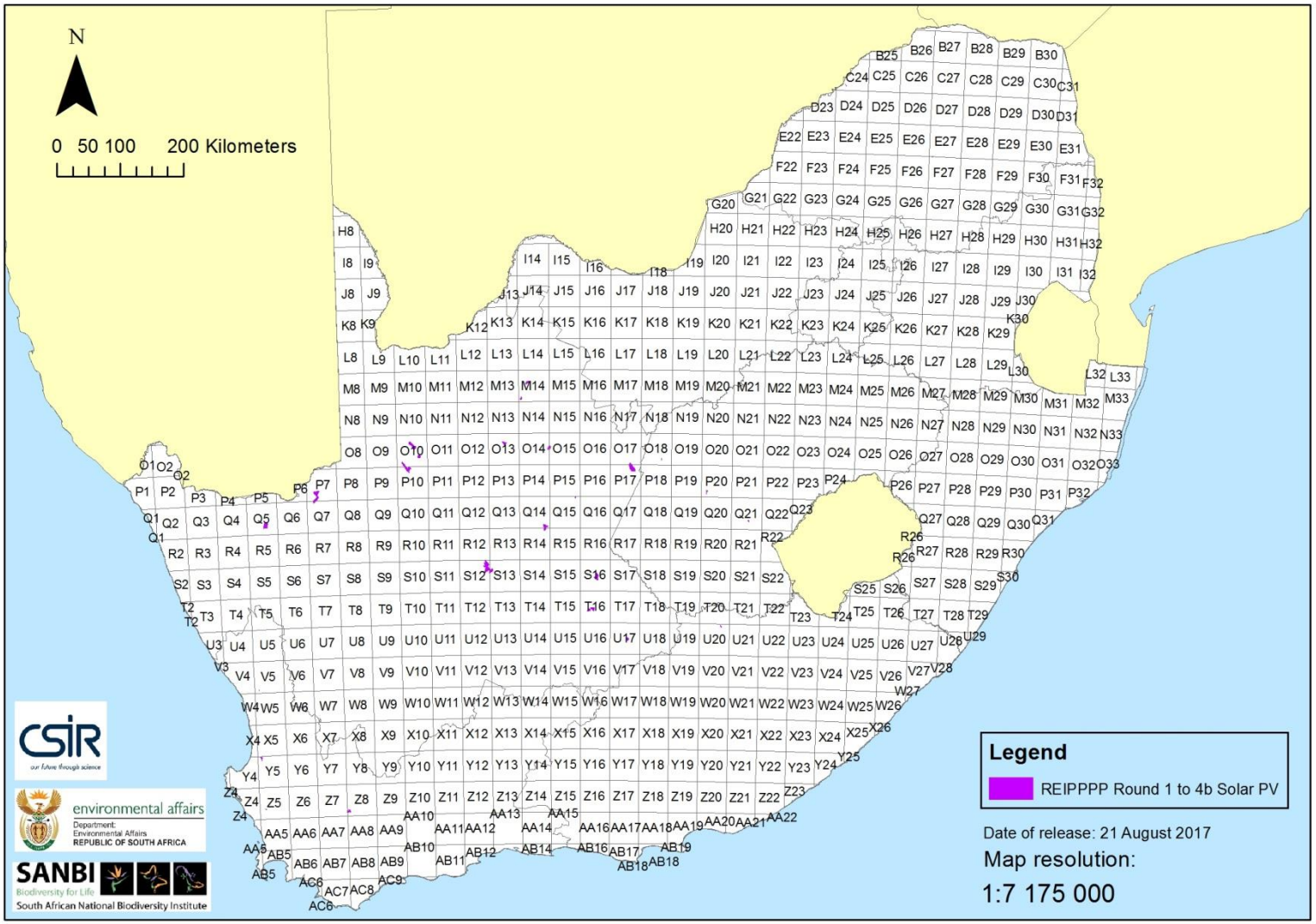
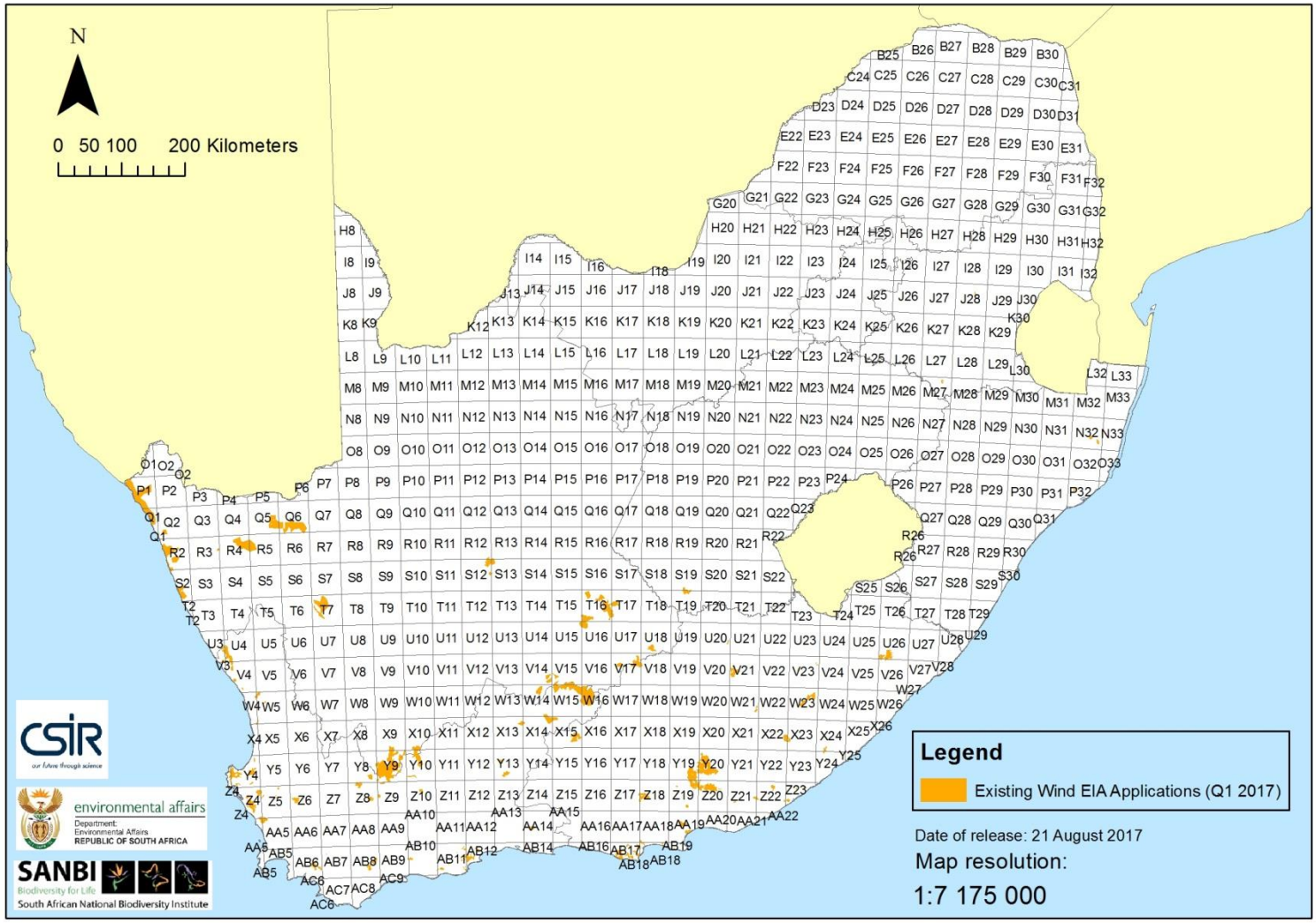
8. Wind energy REIPPPP round 1 to round 4b selected preferred bidders and solar PV REIPPPP round 1 to round 4b selected preferred bidders.



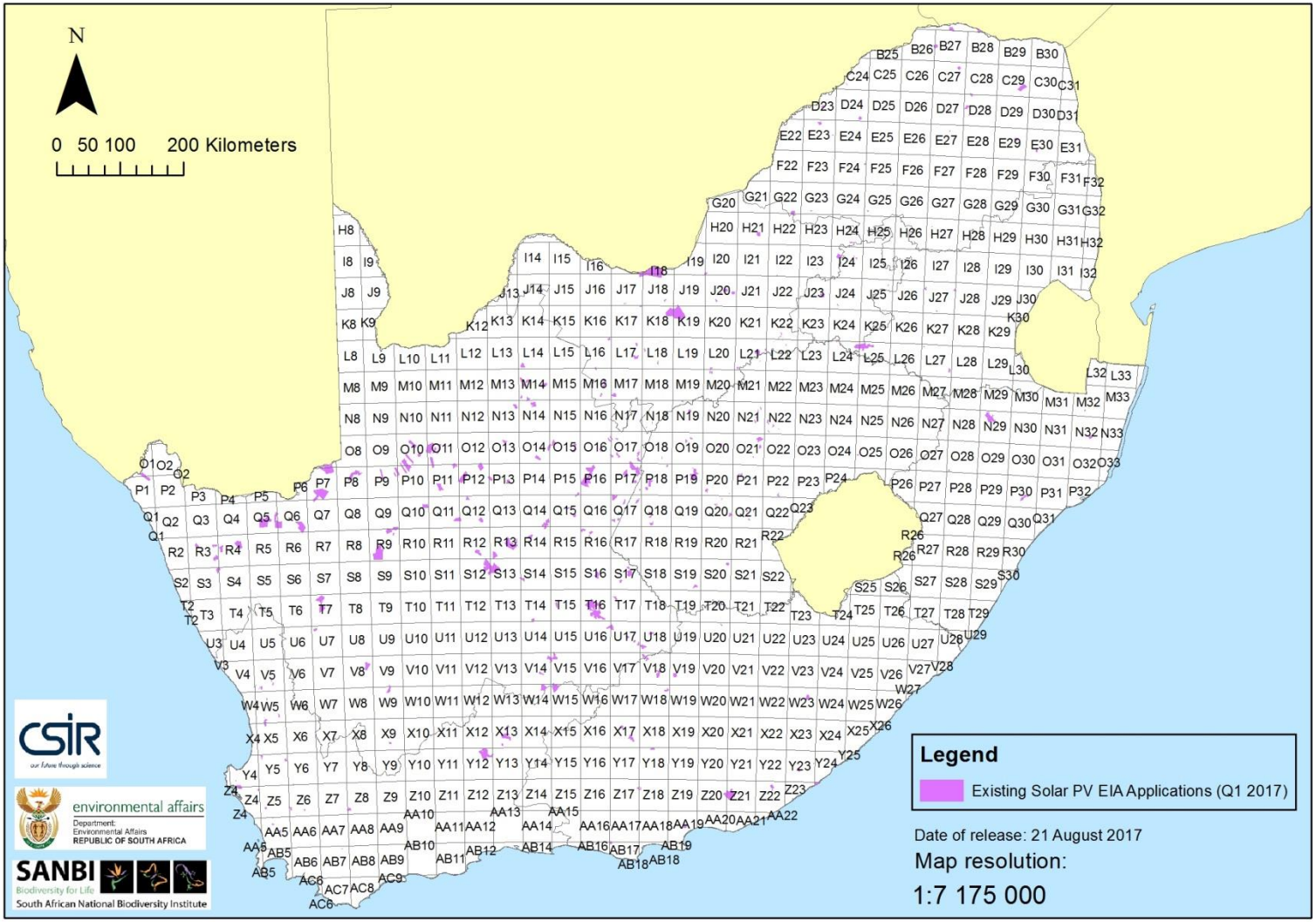
9. Solar PV energy REIPPPP round 1 to round 4b selected preferred bidders and solar PV REIPPPP round 1 to round 4b selected preferred bidders.



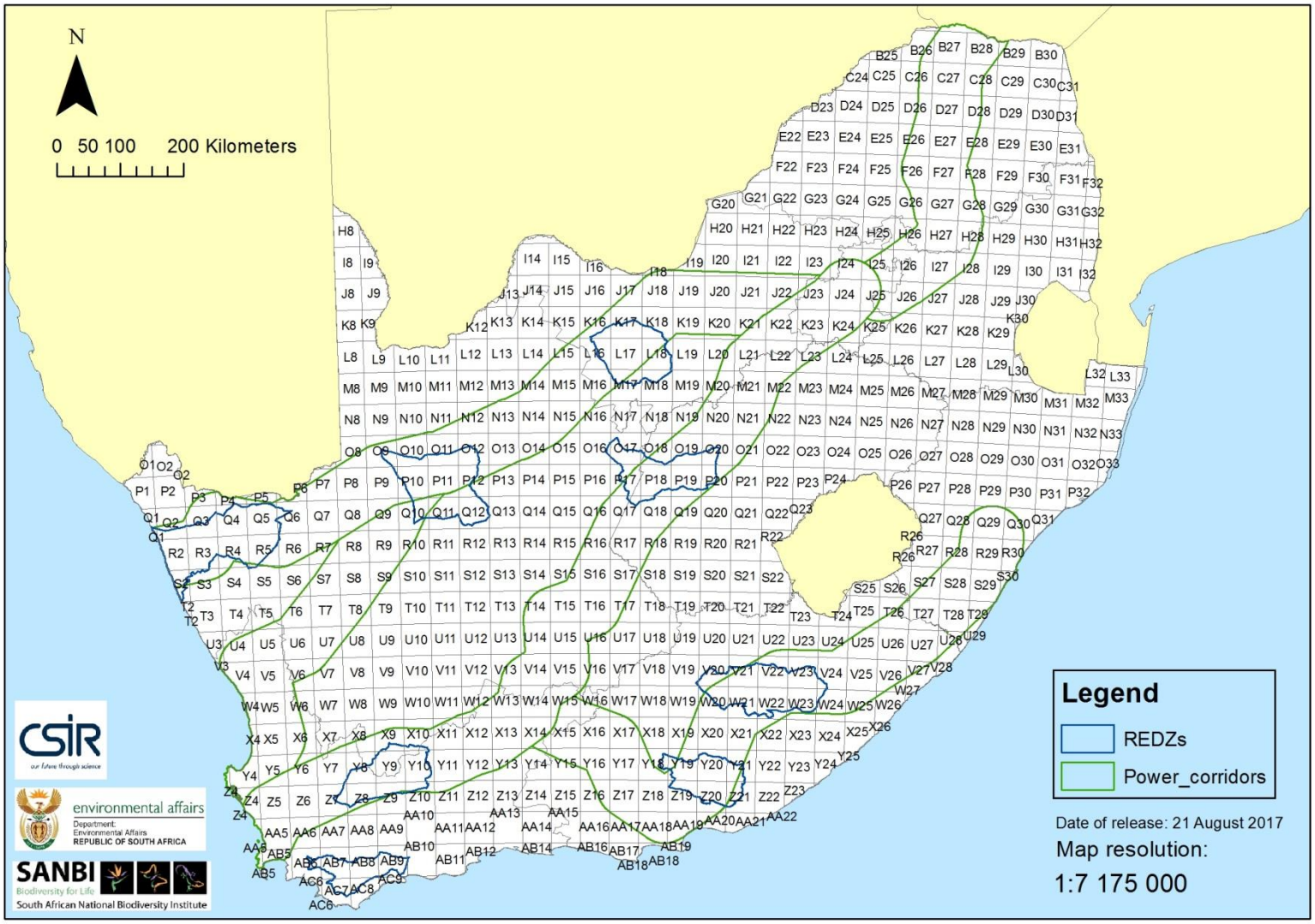
10. Approved or in progress EIA applications submitted to the Department of Environmental Affairs up to the first quarter of the 2017 calendar year for wind energy development respectively.



11. Approved or in progress EIA applications submitted to the Department of Environmental Affairs up to the first quarter of the 2017 calendar year for solar PV energy development respectively.



12. Renewable Energy Development Zones (REDZs) and Power corridors boundaries



Appendix 2:

Methodological Report for Socio-economic profiles to inform the identification of Renewable Energy Development Zones (REDZs) In support of the Phase 2 Wind and Solar Strategic Environmental Assessment

CSIR Report: CSIR/IU/021MH/IR/2017/0012/B

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1 Phase 1: Socio-economic activity intensity index for municipalities and towns

1.1 Introduction

A regional comparative analysis of socio-economic activity intensity was undertaken across municipalities in South Africa, to support the identification of Regional Economic Development Zones (REDZ).

The objective of Phase 1 of the socio-economic analyses was to develop a broad categorisation of regions in terms of the intensity of socio-economic activity, based on a comparison of areas in terms of the:

- Size of existing population and economic output; as well as
- Trends that would indicate growth or decline of population size and economic output.

Without conducting detailed energy demand analyses, nor industry specific demand or feasibility for green energy or feasibility, the above are regarded as very useful proxy indicators to provide a comparative indication energy demand.

The national **socio-economic activity index** provides a very useful national comparison of both the spatial distribution of population and economic activity. It provides a clear indication of areas with large and increasing population sizes and areas with high and increasing economic output.

The **socio-economic activity index** provides a spatial comparison of local municipal areas and cities and towns (above 1500 people) across South Africa, considering:

- Existing population size (which at LM and town scale correlates increasingly with socio-economic need and challenges) as well as recent population growth trends; and

- Existing formal economic activity (which in South Africa does not have a linear correlation with population size, but does provide an indication of areas likely to continue growing), as well as recent economic growth.

Given the differentiated nature of the South African settlement and space-economy landscapes the challenge in such indexes are usually to ensure that national and regional comparisons do also enable size and growth differentiation within, i.e.:

- Areas with low levels of activity (both in terms of population size and economic output, typically in large and sparsely populated areas); and
- Areas where the population growth is more than economic output growth (such as often found in high density rural areas and especially in former Homeland towns due to the Apartheid spatial legacies).

The index makes use of both size and weighted comparative growth in order to provide a comparative view.

It should be noted that the indicator does not provide an indication of location specific feasibility for Independent Power Producers, or of green energy demand per se. It also does not include planned projects and initiatives, nor regional economic and other linkages which could potentially have a major impact in project viability. The rest of the document provides:

- A national comparative overview of intensity of socio-economic activity using population and economic output indicated by Gross Value Added (GVA), providing a brief overview of the *Socio-economic activity intensity index*;
- More detail on the Comparative Municipal Level Classification Process; and
- More detail on the Comparative City and Town Classification Process

1.2 Socio-Economic Activity Intensity Index for Municipalities and Towns

The section provides a national comparative spatial overview of intensity of socio-economic activity in Figure 1. A more detailed description of the categories are provided below, providing a brief overview of the municipal (See Table 1.1) and town scale (See Table 1.2) *Socio-economic activity intensity index*.

The South-African settlement and socio-economic landscape can briefly be described as consisting of a number of metropolitan areas with strong linkages in four large city regions (housing about 40% of South Africa's population), big cities and metropolitan municipalities (with 3.8 million people living in the city and urban spaces alone), big regional service towns that are made up of large urban centres, as well as smaller towns that play a significant role in the large sparsely populated regions (about 41 towns housing 7.3 million people (about 11% of South Africa's population)). In addition to the large urban centres a range of medium and smaller towns (more than 600) play a significant role not only in housing about 10% of South African population but also provide services in vast rural regions.

Whilst it is acknowledge that more integrated quantitative and qualitative indicators and systems orientated understandings are crucial to understand regional and economic production, in the absence of recent refined economic data basic indicators of economic production and activity are still valuable in enabling comparative analyses, identifying lagging or growing regions and in pointing towards future activity (i.e. through identifying areas of high concentration existing economic

activity, agglomeration advantages and regional value chains and areas of natural resource or locational network potential).

The National Development Plan (NDP) has identified the need to target regional development according to regional dynamics in specific areas. In the functional economic region project (conducted by the Economic Development Department, the CSIR, Spatial Planning and Systems, and supported by the Department of Rural Development), it has been argued that to achieve job growth, sustainable regional development and address imbalances of the past, it is important to understand regional performance.

The REDZ Socio-Economic Intensity Indicator analysis follows from an analyses of regional performance and regional gateways (See Maritz et al, 2017), identified as crucial in order to:

- Maintain, expand and strengthen the existing network of gateways ports and corridors (with a specific emphasis on expanding inter-regional linkages) and regions that currently act as job engines;
- Establish new growth zones, develop rural growth points and district gate ways;
- Uplift lagging and declining regions, and strengthen existing export zones through strong regional and district gateways and networks;
- Open up rural economic opportunities by strengthening connectivity and linkages of the functional economic network - between the international focused growth points (global and regional gateways) to rural growth points (district gateways) and in turn to smaller rural towns and villages;
- Establish investor confidence and provide clear signals through a network of well-functioning, well maintained and functionally linked places, logistical networks and connections; and
- Support regional innovation, investment and job growth through high impact job drivers.

In comparing regions in terms of possible socio-economic value of REDZ, the existing level of socio-economic activity and growth rates associated with population and economic output were considered in the respective municipalities, for which current figures and growth rates are available for the 2011 to 2016 time periods.

For more detail on municipal categories to read in association with Figure 1.1 and Table 1.1 see Annexure 2-1. It is evident that a relative small number of municipalities actually serve as significant drivers of the formal economic output of the country, however with quite a large number of municipalities with high intensity of socio-economic activity, comparatively big populations and high levels of formal economic output. What is concerning is that numerous of the cities and metropolitan areas, with substantial economies, illustrate low economic growth. Evidence suggest that major breakthroughs are being made in moving towards a positive economic growth situation in several of the densely settled areas within the Eastern Cape, KwaZulu Natal and Mpumalanga – even though from a relative small base.

Where spatial location might be less significant in metropolitan municipalities and municipalities characterised by dense networks of settlements, location close to bigger towns might be a significant consideration in municipalities with moderate to small levels of socio-economic activity.

For more detail on town categories to read in association with Figure 1.1 and Table 1.2 see Shapefiles provided.

Figure 1.1 Socio-economic Intensity Index: Spatial Overview

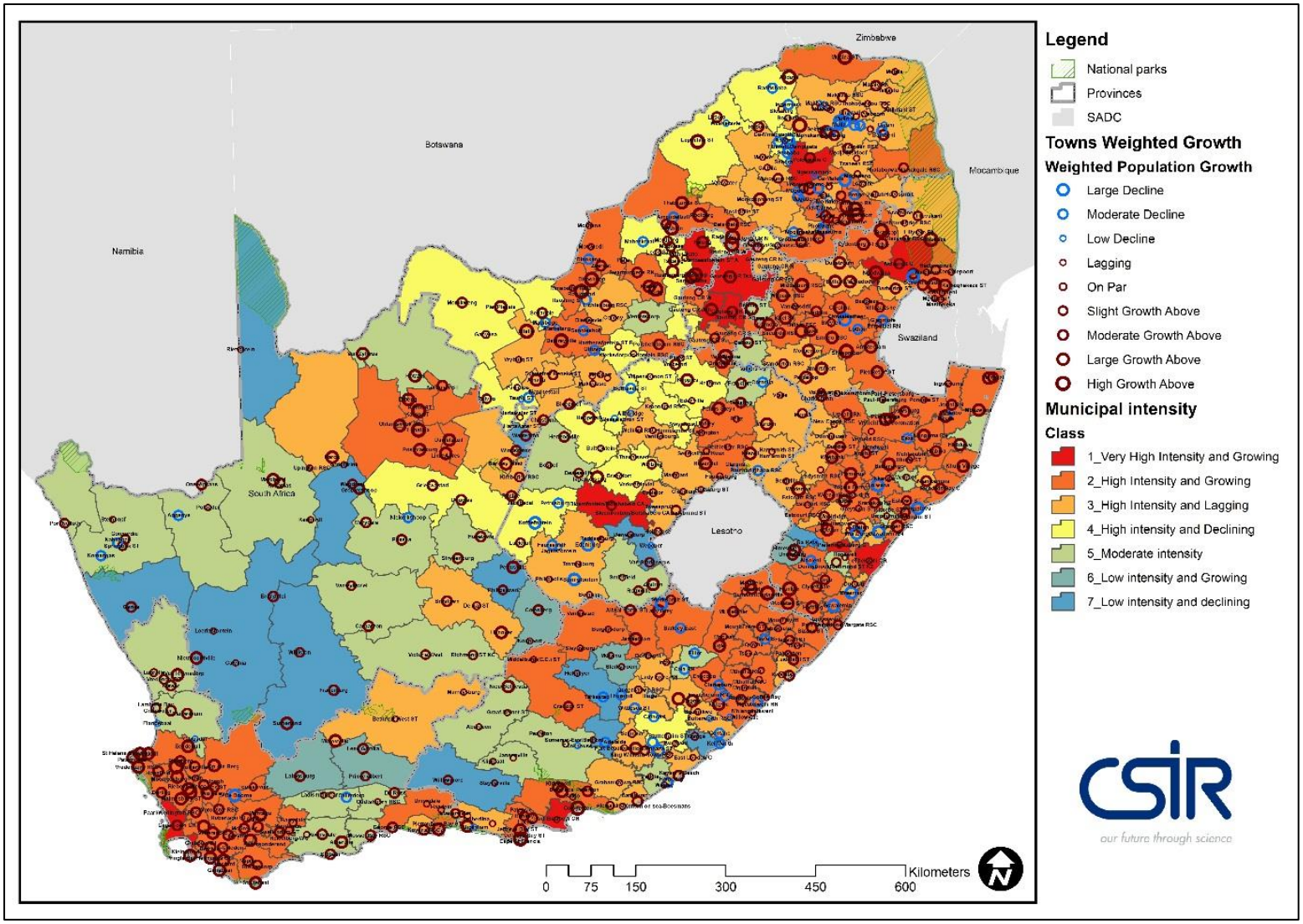

Table 1.1 Municipal Socio-economic Intensity Index Description

	Category	Description	Assumption
1 	Very High Intensity and Growing	Mainly Metropolitan regions and big cities characterised by very high intensity of socio-economic activity (population exceeding 500 000 and economic output in most municipalities is more than R50 Billion but no less than 28 billion), and where growth in population and economic output is higher than the national growth rates (growth exceeding the national 7.5% population growth rate and 7.8% growth in economic output)	High levels of existing domestic and other energy demand, most likely to grow due to natural growth and agglomeration advantages.
2 	High Intensity and Growing	Municipalities which have large secondary cities, big towns and densely populated areas that are characterised by high intensity of socio-economic activity (where population numbers exceed 50 000 and economic output generally exceeds R10 Billion), and where growth in economic output is higher than growth in population, and above national growth. Areas also include densely settled areas in Kwa-Zulu Natal and Mpumalanga and border areas in Limpopo that seem to be characterised with higher growth rates.	High levels of existing domestic and other energy demand, with demand most likely to grow due to natural growth and agglomeration advantages.
3 	High Intensity and Lagging	Municipalities that are characterised by relatively high intensity of socio-economic activity, typically with big towns in surrounding agricultural and resource economy hinterlands (where population numbers generally exceed 50 000 and economic output mostly exceeds R10 Billion), and where population and economic growth is low or on par with national growth, and where growth in economic output is lagging behind the national growth. A number of municipalities in this category are located in the Free-State, Limpopo, North-West and Eastern Cape in-land regions.	Relatively high levels of existing domestic and other energy demand, where existing growth rates might point towards stagnating or lagging future growth without intervention.
4 	High intensity and Declining	Municipalities that are characterised by relatively high intensity of socio-economic activity, typically with big towns in surrounding resource economy hinterlands (where population numbers exceed generally 50 000 and economic output exceeds generally R10 Billion). Municipalities in this category are areas where growth rates of population	Relatively high levels of existing domestic and other energy demand, where existing growth rates might point towards

	Category	Description	Assumption
		and economic output are low and declining, as well as areas where economic output is in decline but population growth rates relatively high compared to national growth. These areas typically include municipalities located in resource rich mining areas in Limpopo, Free State and North-west, areas to the north and west of Gauteng (including Madibeng), as well as the Northern Cape.	stagnating or declining growth in economic output, but also to the need for industrialisation, green economy and other interventions.
5 	Moderate intensity	Municipalities in this category are characterised by moderate and smaller population sizes (typically in the range between 20 000 and 100 000), and moderate levels of economic output (mostly between R1 Billion and R10 Billion), however where growth rates in economic output since 2011 exceeded national growth rates, as well as local population growth rates. A number of municipalities in this category are located in the sparsely populated areas of the Western and Northern Cape.	Relatively smaller population and economic demand for energy than in other municipalities, but typically with growth in specific locations and/sectors.
6 	Low intensity and Growing	Municipalities in this category are characterised by moderate and smaller population sizes (typically in the range between 10 000 to 50 000), and low levels of economic output (Less than R1 Billion), where growth rates in economic output since 2011 where on par or exceeded national growth rates.	Relatively small population and economic demand for energy than in other municipalities, but typically with growth in specific locations and/sectors.
7 	Low intensity and declining	Municipalities in this category are characterised by small population sizes (less than 10 000 people), and low levels of economic output (Less than R1Billion), where growth rates in bot economic output and population were lower than the national average, as well as areas where economic output since 2011 where lagging behind the national growth rate or declining in real terms. In the latter cases population growth varies but from a very small base.	Relatively small population and economic demand for energy compared with other municipalities, and characterised with slow growing or declining economic output. Areas with where demand for energy seems very low.

Table 1.2 Town scale weighted growth index and description

CATEGORY	Description of Population Growth, Compared to average national population growth and/or real population growth (Based on town growth trends for 2001-2011)
Large Decline	More than 15% decline in population
Moderate Decline	Between 5% to 15% decline in population
Low Decline	Between 0.05% and 5% decline in real population
Lagging	Real population growth of 0% - 14.32%, but weighted against the national average of 15.57%, lagging behind the national population growth rate.
On Par	More or less on par with the national population growth rate of 15.47%
Slight Growth Above	Growth of about 1%-5% above the weighted national population growth rate (Equated to real growth of about 17-21%)
Moderate Above	Growth of between 5%-15% above the weighted national population growth rate (Equated to real growth of about 21-33%)
Large Above	Growth of between 15%-50% above the weighted national population growth rate (Equated to real growth of about 33-73%)
High Above	Growth of more than 50% above the weighted national population growth rate (Equated to real growth of more than 73%)

1.3 Municipal Level Comparative Classification Process

1.3.1 Current population and economic output size and Classification

The data that is used as inputs for the municipal level analysis is:

- Population data was sourced from Statistics South Africa (StatsSA) population for the 2011 census and the 2016 community survey data.
- The economic output data used is Gross Value Added (GVA) from Quantec Easy-data for 2011 and 2016. This was Real GVA at basic prices, (in R millions) constant at 2010 prices. Having the prices constant, allows for temporal comparability.

The current population and GVA size per LM derived from StatsSA community survey data and Quantec Easy-data respectively for 2016. The Municipal population and GVA size was firstly classified into 6 classes this is shown in the below table.

Population Total 2016	***Population Category***	***Name***
>1 000 000	A	Extremely Large
500 000 - 1 000 000	B	Very Large
100 000 - 500 000	C	Large
50 000 - 100 000	D	Moderate
10 000 - 50 000	E	Low
<10 000	F	Very Low
GVA Total (R' 000 000) 2016	***GVA Category***	***Name***
> 1 00 000	A	Extremely Large
50 000 -100 000	B	Very Large
10 000 - 50 000	C	Large
1 000 - 10 000	D	Moderate
500 - 1000	E	Low
100 - 500	F	Very Low

The main differentiation between the A and B classes particularly for the population classification is that the category A is comprised of mainly the well-established metropolitan areas and category B is comprised of the more recently established metropolitan and highly populated municipalities. The GVA classification is based on similar principals.

1.3.2 Population and economic output growth calculation and Classification

The assumption is that the vast majority of the population growth for the country is natural growth. It is noted that the population growth is not only natural, as there are factors of immigration and emigration; however this number (in the grand scheme of things) is negligible.

This data was all aligned to the 2011 Local Municipality level as this is the common demarcation between the economic and population data. It is noted that the 2016 Community Survey data is available on the 2016 municipal demarcation, however for spatial consistency, the 2011 boundaries were utilised.

Bearing this in mind; national growth in population between 2011 and 2016 was 7.5%; and for GVA between the same periods was 7.8%, calculated by:

$$PG = \frac{Pa - Pb}{PB}$$

PG represents the population / economic growth. *Pb* represents the latest population / GVA figures (2016) and *Pa* representing previous population / GVA total figures (2011).

A Weighted Growth between 2011 and 2016 population; and 2011 and 2016 GVA was calculated. The weighted mean growth (for purposes of this analysis) will be used to analyse the population and economic growth in relation to other municipalities; controlling for the total population and economic growth.

To calculate which areas have been most significantly affected by growth trends an analysis of population and GVA growth of municipalities from 2011 to 2016 was conducted using a method by Geyer jr and Geyer (2016) that they undertook to indicate relative agglomeration and diffusion patterns over and above natural growth of migration subpopulations at municipal level.

In the analysis, a weighted population and GVA growth was calculated using the following equation:

$$NMj = \sum_{j=1}^{n} \frac{Pe_j \, (Pb_n / Pe_n)}{Pb_j - 1} \, ,$$

Where Geyer jr and Geyer (2016 p296) describe NMj is the net population [or GVA] growth/decline for municipality, j. $Pb\,and\,Pe$ are population [or GVA] sizes for municipality, j , or nationally, n, for the base- and end-years, respectively. The controlling weight, Pb_n/Pe_n, minimizes natural growth in the population in the municipality between the base year and the end year[i].

The results of the weighted growth (WG) calculation per LM where also classified. The classification is represented in the below table:

Population WG		
National Absolute Growth is 7.5% which would be Between -0.5% - .05% WG		
Growth %	***Population WG % Category***	***Name***
>10%	A	High growth above national
5% - 10%	B	Moderate growth above national
0.6% - 5%	C	growth slightly above national
-0.5% - 0.5%	D	on par with national growth
-0.6% - -7%	E	Growing but at a rate lower than national Growth
< -7%	F	Decline
Gross Value Added (GVA) WG		
National Absolute Growth is 7.8% which would be Between -0.5% - .05% WG		
Growth %	***GVA WG % Category***	***Name***
>10%	A	High growth above national
5.1% - 10%	B	Moderate growth above national
0.6% - 5%	C	growth slightly above national
-0.5% - 0.5%	D	on par with national growth
-0.6% - -7%	E	Growing but at a rate lower than national Growth
<-7%	F	Decline

The Number of classes where selected in order to have a consistent number of classes as the first classification.
It must be noted here that in both cases category E, does not represent negative growth or a decline, it represents an absolute growth however that growth is lower than the national growth, which could indicate only natural growth of population and a less intense economic growth.

1.3.3 Creating a Size and Growth classification

Following the categorisation and classification of the current population and GVA size and the calculation, categorisation and classification of the WG a Size and Growth classification was undertaken.
This method used a combination of the Size (population and GVA); as well as weighted growth (population and GVA) classes to develop a further classification of municipalities, which combined classes.
For example:

- With regards to the Size category; if in the size category you reflect an AA it would indicate that this municipality had an “Extremely Large” population and an “Extremely Large” GVA, and an AE would indicate that the population is “Extremely Large” however the GVA is “Low”.
- With regards to the Growth category; a classification of FF would indicate that the municipality has a declining population and declining economy, where a DF would indicate that the population growth for the municipality is “on par with national growth” however the Economy is in Decline.

These Categories where father classified as specified in the table below:

Size Classes	***Combined Classed***
Very Big	AA; AB BB; BB; BC and (Very Large areas in population and Economy)
Big	CC; CA: (With Large and Above Populations.)
Large	CD;CE ((Large populations with moderate economies (1 or 2 low economies but with still large populations))
Moderate	DD; ED; DE (Moderate populations and Moderate economies or Low population and Moderate economy)
Small	EE;FF;EF;FE (Low populations and low economies)
Growth Classes	***Combined Classed***
Growing	on Par or above National Growth
ok Area	EB; EC;ED; (Low population with economies Growing economies) OR FB;FC:FD(declining population but growing economies)
Lagging	EE (Low population growth and low economic Growth) OR DE; (Population growth on par with national growth but lagging economic growth)
At Risk	FE (Declining population and lagging Economy) OR (BF; CF) High Growth population with declining Economy; OR EF (Low growth population and declining Economy)

1.3.4 Creating a Combined Municipal Socio-Economic Size and Growth classification

Once the above classes where defined; a combined Size and Growth indicator was created using a combination of the Size and Growth classes.
The final classification produced a classification that had 7 classes. These are represented and described in the table below:

Class Number	*Classes Combined*	*Class Name*
1	Very big and growing	Very High Intensity and Growing
2	Very Big, Big Growing; Big OK; Large growing; Large ok; Moderate Growing;	High Intensity and Growing
3	Very Big Big Lagging, Large Lagging; Moderate Lagging	High Intensity and Lagging
4	Very Big and Big At Risk; ; Large At Risk; Moderate At Risk;	High intensity and Declining
5	Moderate OK; Small OK	Moderate intensity
6	Small Growing	Low intensity and Growing
7	Small At Risk, Small Lagging	Low intensity and declining

1.4 Town Level Classification Process

1.4.1 Introduction

A Sub-Municipal (town level) classification of growth was undertaken for the project to indicate the growth of cities, regional centres and towns (urban agglomerations) at a finer scale than the municipal level. It was intended that through this, town population could be compared to national growth which would then in turn highlight places of high / low / negative growth within the municipalities but also factoring in the growth nationally so as to compare the growth of towns across the country.
Due to the level of detail required for this process, the analysis period for the town growth could only be undertaken for the period between 2001 and 2011. It was agreed that due to limitations of data availability at this level, only population data would be analysed for the growth.
The data that is used as inputs for the town level analysis is:

- **CSIR's Meso-frame**. The meso-frame is a meso-scale "geoframe" for South Africa; it is a demarcation of South Africa into a "grid" of just less than 25 000 "mesozones", each approximately 50 km2 in size (GAP 2017). (For more information of this methodology please see https://www.gap.csir.co.za/techical-overview)
- **The Functional City, Town and Settlement Typology for SA**. This Typology was developed by CSIR in collaboration with the South African Cities Network (SACN), and provides a mechanism to profile (identify, calculate and analyse) a set of development information and trends pertaining to the towns and cities, as well as high density rural settlements across South Africa (StepSA 2017 and Van Huysteen et al 2015)

℘ (For more information of this Typology aqnd its development please see http://stepsa.org/settlement_typology.html)

- **Population Data**. Original population data was sourced from StatsSA for the censuses of 2001 and 2011. The data was then disaggregated into the CSIR meso-frame / Functional City, Town and Settlement Typology. (Mans 2012 A and B)

1.4.2 Population growth calculation and Classification

1.4.2.1 Data Preparation

Once the population data was packaged into the mesoframe that contained the settlement typology classification for each meso-zone, the data was dissolved and summed based on the:

- *SACN Type – The classification of each mesozone to what type / category of settlement it is*
- *SACN Town – The functional extent of each City, town or settlement [Note that the functional extent of each City/town which may cover of several mesozones. Please see above sources on the meso-frame and The Functional City, Town and Settlement Typology for more information]*

This process essentially allowed for the 2001 and 2011 population totals for each functional town area to be calculated per town.

1.4.2.2 Weighted Growth Calculation

Following the data preparation process, the method used in section 2.2 (weighted growth calculation) was undertaken, however, at this level, it was calculated for each of the cities, regional centres and towns. This produced a weighted growth for the period of between 2001 and 2011 for population per town across the country.

A actual growth calculation was also undertaken per town; this would allow for a comparison of the weighted growth and the real growth per functional area. The real population growth of South Africa between the periods was 15.47%

1.4.3 Creating a Comparative City and Town-based Growth classification

Once the calculations where complete both the real and weighted growth to create a classification of the growth for each town. Note that for decline, as decline is an absolute reduction of population the real growth was used, where for increased population the weighted growth was utilised in the classification process

The classification used the following ranges:

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Class Name	Description
Large Decline	More than 15% decline in real population growth OR a decline of more than 26.4%in the weighted Growth
Moderate Decline	More than 5% but less than 15% decline in real population OR Between a 17.7 - 26.4% decline in weighted Growth
Low Decline	More than 0.05% but less than 5% decline in real population OR Between a 13.4 - 17.6% decline in weighted Growth
Lagging	a growth of between 0.01 - 14.32% in population In real growth OR Values between -1% - -13.4% in weighted Growth
On Par	On par is an indication of being between -0.99% -0.99% in weighted growth which equates to a real growth of between 14.4 - 16.4% in population. note that national real growth is 15.47, therefore if a town grows at this rate it is considered to be on par with national Growth
Slight Growth Above	Growth of between 1%-5% in weighted growth; equating to a real growth of between 16.6% - 21.2%
Moderate Above	Growth of between 5%-15% in weighted growth; equating to a real growth of between 21.3% - 32.8%
Large Above	Growth of between 15%-50% in weighted growth; equating to a real growth of between 32.8% - 73%
High Above	Growth of more than 50% in weighted growth; equating to a real growth of more than 73%

1.5 Conclusion

The analyses provides a national comparative overview of intensity of socio-economic activity using population and economic output indicated by Gross Value Added (GVA), providing a brief overview of the *Socio-economic activity intensity index*. It also provides more detail on the methodology followed to conduct the comparative municipal level classification process and the comparative city and town classification process.

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Annexure 2-1:

1_Very High Intensity and Growing	2_High Intensity and Growing	3_High Intensity and Lagging	4_High intensity and Declining	6_Low intensity and Growing	7_Low intensity and declining
City of Cape Town	Abaqulusi	//Khara Hais	Aganang	Inkwanca	!Kheis
City of Johannesburg	Albert Luthuli	Beaufort West	Amahlathi	Kwa Sani	Baviaans
City of Tshwane	Ba-Phalaborwa	Buffalo City	Blouberg	Laingsburg	Great Kei
Ekurhuleni	Bela-Bela	Bushbuckridge	City of Matlosana	Prince Albert	Hantam
Ethekwini	Bergrivier	Dannhauser	Dr JS Moroka	Umsobomvu	Impendle
Madibeng	Bitou	Dikgatlong	Greater Taung		Kamiesberg
Mangaung	Breede Valley	Ditsobotla	Kagisano/Molopo		Karoo Hoogland
Mbombela	Cape Agulhas	Emakhazeni	Lephalale		Magareng
Nelson Mandela Bay	Dihlabeng	Emalahleni	Letsemeng		Mier
Polokwane	Drakenstein	Emfuleni	Masilonyana		Naledi
The Msunduzi	Elias Motsoaledi	Emnambithi/Ladysmith	Merafong City		Nxuba
	Elundini	Emthanjeni	Moqhaka		Renosterberg
	Emadlangeni	Ephraim Mogale	Moretele		Tsolwana
	Emalahleni	Fetakgomo	Moses Kotane		
	Endumeni	Greater Giyani	Nala		
	Engcobo	Greater Letaba	Ngwathe		
	Ezingoleni	Greater Tzaneen	Phokwane		
	Gamagara	Intsika Yethu	Ratlou		
	Gariep	Knysna	Rustenburg		
	Ga-Segonyana	Kopanong	Siyancuma		
	George	Kou-Kamma	Tswelopele		
	Govan Mbeki	Lekwa	Westonaria		
	Greater Kokstad	Lekwa-Teemane	**5_Moderate intensity**		
	Greater Tubatse	Lukanji	Blue Crane Route		
	Hibiscus Coast	Makana	Camdeboo		
	Hlabisa	Makhado	Cederberg		
	Imbabazane	Maluti a Phofung	Dipaleseng		
	Indaka	Mamusa	eDumbe		
	Ingwe	Mantsopa	Hessequa		

Inxuba Yethemba	Maquassi Hills	Ikwezi
Jozini	Maruleng	Joe Morolong
Kgatelopele	Matjhabeng	Kai !Garib
Kgetlengrivier	Mnquma	Kannaland
King Sabata Dalindyebo	Modimolle	Kareeberg
Kouga	Mogalakwena	Kh ǂói-Ma
KwaDukuza	Molemole	Mafube
Langeberg	Mookgopong	Maphumulo
Lepele-Nkumpi	Mpofana	Matzikama
Lesedi	Mutale	Mohokare
Mafikeng	Naledi	Mossel Bay
Makhuduthamaga	Ndlambe	Mthonjaneni
Maletswai	Ndwedwe	Nama Khoi
Mandeni	Newcastle	Ngqushwa
Matatiele	Nkonkobe	Oudtshoorn
Mbhashe	Ntambanana	Richmond
Mbizana	Okhahlamba	Richtersveld
Metsimaholo	Phumelela	Sakhisizwe
Mfolozi	Pixley Ka Seme	Siyathemba
Mhlontlo	Port St Johns	The Big 5 False Bay
Midvaal	Randfontein	Thembelihle
Mkhambathini	Setsoto	Tokologo
Mkhondo	Sol Plaatjie	Ubuntu
Mogale City	Thembisile	Ventersdorp
Msinga	Thulamela	Victor Khanye
Msukaligwa	Umjindi	
Mtubatuba	uMshwathi	
Musina	Vulamehlo	
Ngquza Hill		
Nkandla		
Nketoana		
Nkomazi		

Nongoma
Nqutu
Ntabankulu
Nyandeni
Overstrand
Ramotshere Moiloa
Saldanha Bay
Senqu
Stellenbosch
Steve Tshwete
Sundays River Valley
Swartland
Swellendam
Thaba Chweu
Thabazimbi
Theewaterskloof
Tlokwe City Council
Tsantsabane
Tswaing
Ubuhlebezwe
Ulundi
Umdoni
Umhlabuyalingana
uMhlathuze
uMlalazi
uMngeni
Umtshezi
UMuziwabantu
Umvoti
Umzimkhulu
Umzimvubu
Umzumbe

UPhongolo
Witzenberg

[i] This method can also be used as an indication of spatial agglomeration (+ results) and diffusion (-results) in areas, however negative results do not always indicate total absolute decline, as this method tries to compensate for natural national growth, negative results may indicate diffusion.

For purposes of this project, the above analysis focused on the municipal gains and losses compared to the national change in population between the 2 periods of 2011 and 2016, this would indicate which areas had accelerated growth beyond the national growth. In this case the product of the analysis (NMj) per municipality will represent and quantify the rate of growth in the municipalities where they grew faster or slower than the national growth between the periods. Simply; since the proportion of growth between the two periods is calculated first Pb_n/Pe_n, this will show that in 2011 there was (for example) 93% of the population in 2016. The 2016 population is then multiplied by this weight / factor, the product of that is then divided by the population in 2011 and converted into a percentage indicating growth. It is this weighted growth that will be classified and used as an input to for the indicator.