Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

December 2019

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Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

FINAL SEA REPORT

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Note from the Council for Scientific and Industrial Research (CSIR):

The SEA was commissioned in April 2017 by the National Department of Environmental Affairs (DEA), National Department of Energy (DoE) and National Department of Public Enterprises (DPE), as well as iGas, Eskom and Transnet. These aforementioned National Departments changed during the Cabinet restructuring that took place in May 2019. Since the SEA was commissioned by the National DEA, DoE and DPE, these abbreviations have been retained in the Final SEA Report. However, the table below has been provided to indicate the Ministries that have been mentioned in this Final SEA Report prior to and subsequent to the May 2019 Cabinet restructuring to ensure relevance when referring to the report. Therefore, where the Final SEA Report mentions the Department of Environmental Affairs, for example, kindly note that this refers to the Department of Environment, Forestry and Fisheries.

Ministry prior to May 2019 Restructuring	Ministry subsequent to the May 2019 Restructuring
Department of Environmental Affairs (DEA)	Department of Environment, Forestry and Fisheries (DEFF)
Department of Energy (DoE)	Department of Mineral Resources and Energy (DMRE)
Department of Public Enterprises (DPE)	Department of Public Enterprises (DPE)* (**No change*)
Department of Water and Sanitation (DWS)	Department of Human Settlements, Water and Sanitation (DHSWS)
Department of Agriculture, Forestry and Fisheries (DAFF)	Department of Agriculture, Land Reform and Rural Development (DALRRD)
Department of Rural Development and Land Reform (DRDLR)	Department of Agriculture, Land Reform and Rural Development (DALRRD)
Department of Defence (DoD)	Department of Defence and Military Veterans (DDMV)
Department of Labour (DoL)	Department of Employment and Labour (DoEL)
Department of Planning, Monitoring and Evaluation (DPME)	Department of Planning, Monitoring and Evaluation (DPME)* (**No change*)
Department of Co-operative Governance and Traditional Affairs (DCOGTA)	Department of Co-operative Governance and Traditional Affairs (DCOGTA)* (**No change*)
Department of Trade and Industry (DTI)	Department of Trade and Industry (DTI)* (**No change*)

PREFACE

The final Electricity Grid Infrastructure (EGI) Power Corridors assessed as part of the 2016 EGI Strategic Environmental Assessment (SEA) were gazetted for implementation on 16 February 2018 in Government Gazette 41445, Government Notice 113. The Gazette documented notice, given by the Minister of Environmental Affairs, of alternative procedures to be followed when applying for Environmental Authorisation for large scale electricity transmission and distribution development activities, identified in terms of section 24(2)(a) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) in the identified Strategic Transmission Corridors (i.e. areas declared as geographical areas of strategic importance).

Developers proposing to submit applications for Environmental Authorisations for large scale electricity transmission infrastructure within any of the five gazetted Strategic Transmission Corridors, that trigger Listed Activity 9 of Listing Notice 2 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), or any other listed and specified activities that are necessary for the realisation of such infrastructure and facilities, would need to follow a Basic Assessment (BA) Process in terms of the 2014 EIA Regulations (as amended), as opposed to a full Scoping and EIA Process, which is required for all activities listed in Listing Notice 2.

Therefore, the outcome of the 2016 EGI SEA was the streamlining of the Environmental Authorisation process for EGI related development within any of the five gazetted Strategic Transmission Corridors.

Linked to the above, to support the objectives of the Strategic Integrated Project (SIP) 10, to accelerate the planning for EGI as part of the Integrated Resource Plan (IRP), and to ensure that when required, Environmental Authorisations are not a cause for delay, the Department of Environmental Affairs (DEA), Department of Energy (DoE), and Department of Public Enterprises (DPE), as well as iGas, Eskom and Transnet, have commissioned the Council for Scientific and Industrial Research (CSIR) to undertake a SEA to expand the Gazetted EGI corridors. The CSIR was appointed in April 2017 and undertook the SEA in collaboration with the South African National Biodiversity Institute (SANBI).

Eskom wishes to expand two of the Gazetted EGI corridors in order to support potential business cases extending to Mozambique and Namibia, as well as to facilitate potential import and export of power in these regions. Specifically, the **Expanded Eastern EGI Corridor** is required for interconnecting with Mozambique for possible imports due to anticipated high gas generation. In addition, the **Expanded Western EGI Corridor** is required for interconnection with Namibia for possible gas to power generation, as well as the facilitation of Renewable Energy integration.

The design of the future transmission grid in South Africa is undergoing a major shift to cater for significant spatial changes to South Africa's future energy generation footprint. Currently the electricity generation is dominated by coal in a centralised power pool in the north-east of the country. However the Government of South Africa has made an international commitment to reduce the carbon footprint of the country and adopted a generation policy requiring large scale renewable energy and other generation sources in order to achieve this. This is embodied in the IRP for the country, which specifies the future energy mix until 2030. In August 2018, the DoE published an updated Draft IRP for public comment. The 2018 Draft IRP (DoE, 2018[3]) called for the generation capacity of a total of 19 400 Megawatts (MW) from renewable energy sources (i.e. Solar Photovoltaic (PV) and Wind only (excluding Hydropower, Storage Schemes and

[3] Department of Energy (August 2018). Integrated Resource Plan 2018 (Draft). Pretoria.

Concentrated Solar Power (CSP)) by 2030. On 17 October 2019, the IRP was promulgated for implementation (DoE, 2019[4]). The 2019 IRP takes into account various capacity developments that have taken place since the promulgation of the 2010 – 2030 IRP, as well as a number of changes in assumptions, including electricity demand projection, Eskom's existing plant performance, and new technology costs. The 2019 IRP has resulted in an increase in Wind and Solar Energy capacity, equating to a total of 26 030 MW of total installed capacity (excluding Hydropower, Storage Schemes and CSP) by 2030. Of this, Solar PV and Wind respectively have a current installed capacity (i.e. as at 2019) of 1474 MW and 1980 MW. Gas/Diesel has a 3 830 MW installed capacity as at 2019, with an additional capacity of 3 000 MW by 2030 (equating to 6 830 MW capacity by 2030) (DoE, 2019). In terms of the future total installed capacity mix (as a percentage), coal represents the highest percentage, followed in descending order by Wind, Solar PV, Gas/Diesel, Pumped Storage, Hydro, Nuclear, and CSP and Other.

One of the challenges facing the expansion of the grid (outside of the five gazetted Strategic Transmission Corridors noted above) is obtaining the necessary environmental approvals and authorisations to construct the new power lines and substations. As a result, new EGI projects (outside of the five gazetted Strategic Transmission Corridors) can take between five and ten years to complete. However, for new power generation, particularly renewable energy where allocation is determined through a competitive bidding process, new power plants can be operational within two to three years. Therefore, in the instance where new transmission infrastructure is required to connect this renewable energy to the grid, there is the risk that the required grid infrastructure will not be ready in time. Thus, a strategic approach to planning and obtaining Environmental Authorisations for the future transmission grid in the Northern Cape, Western Cape and KwaZulu-Natal (i.e. the proposed Expanded Western and Eastern EGI Corridors) is needed.

In addition, strategic planning for servitudes needs to be undertaken well in advance of the final planning of power lines. It would therefore be beneficial for the applicant to submit a pre-negotiated route, where the upfront approval of landowners has been obtained. The current EIA Process (outside of the five gazetted Strategic Transmission Corridors) does not allow for the submission of applications on a pre-determined route.

From the perspective of the National DEA, every effort needs to be made to ensure that the requirements for Environmental Authorisation are streamlined, they follow an efficient and effective assessment and review process, and achieve the objectives of sustainable development. Therefore, in order to overcome the constraints listed above, and to support the SIP 10 and IRP, this SEA Process was commissioned with a vision to ensure that strategic development of EGI is undertaken in an environmentally responsible and efficient manner that responds effectively to the economic and social development needs of the country. With this vision in mind, the following objectives were developed to guide the study:

- Ensuring sustainable development;
- Enhancing consultation with and participation of stakeholders;
- Ensuring coordination with relevant national, provincial and local plans and policies;
- Developing a streamlined Environmental Authorisation process, including integration with relevant Competent Authorities, as applicable; and
- Facilitating strategic investment.

The SEA Process was undertaken in the following phases:

- Inception and Eskom Preliminary Corridors;
- Phase 1: Constraints Mapping;
- Phase 2: Utilisation Mapping;
- Phase 3: Pinch Point Analysis (Corridor Refinement);
- Phase 4: Scoping Level Pre-Assessment (i.e. Environmental Assessment of the Corridors); and
- Phase 5: Gazetting and Decision- Making Framework.

[4] Department of Energy (October 2019). Integrated Resource Plan 2019. Pretoria.

Figure A provides an illustration of the SEA Process and Stakeholder Engagement undertaken. A series of focus group and sector specific meetings and workshops with key authorities and stakeholders were held during the SEA Process in order to gather information from major power users, and important business and government stakeholders. In addition, two rounds of Authority and Public Outreach Road Shows were undertaken to seek feedback on the Preliminary Corridors, Draft Refined Corridors and Specialist Assessments, as well as to provide feedback on the progress of the SEA. In this regard, the first Authority and Public outreach was undertaken in November 2017 at strategic locations across the country, i.e. Cape Town, George, East London, Durban, Johannesburg and Springbok. A second Authority Public Outreach was undertaken towards the end of Phase 2, in October 2018. The same locations visited during Round 1 of the outreach were visited during Round 2, with Upington and Port Elizabeth added as additional locations. Four Expert Reference Group (ERG) and Project Steering Committee (PSC) meetings were also undertaken during the SEA Process.

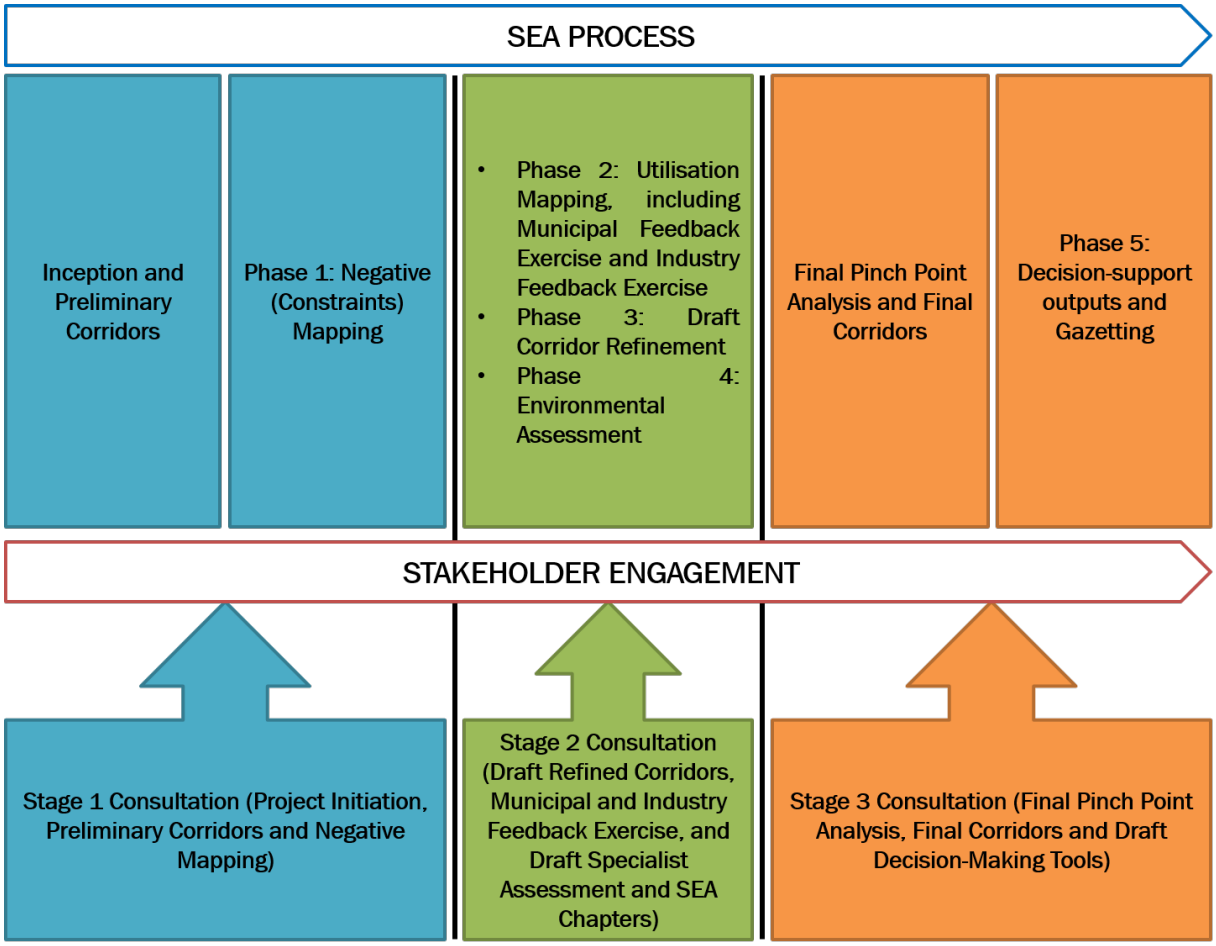

Figure A: SEA Process and Stakeholder Engagement

During the **Inception Phase**, the project team convened the ERG and PSC, as well as established the dedicated project website (https://gasnetwork.csir.co.za/) and project email address (gasnetwork@csir.co.za).

The PSC comprised of authorities with a legislated decision-making mandate for EGI development in South Africa, as well as Provincial Government Departments and District Municipalities. The ERG consisted of, but not limited to, all PSC members, as well as representatives from environmental and conservation bodies, Non-Government Organizations, research institutions and industry. The ERG provided assistance and technical knowledge, as well as insights with respect to the issues relevant to specific sectors.

The project website and email address were created to serve as a dedicated platform for stakeholders and Interested and Affected Parties (I&APs) to obtain project information and to submit their comments on the SEA Process.

Also during the **Inception Phase**, two 100 km wide preliminary corridors were used as the starting point of the SEA. The preliminary corridors were identified by Eskom and were based on the results of a detailed Eskom Strategic Grid Plan Study.

Phase 1 included negative or constraints mapping, and involved identifying key environmental sensitivities and engineering constraints in terms of EGI development. Environmental sensitivities were regarded as environmentally sensitive features that may be negatively impacted by EGI development (e.g. wetlands, birds and Protected Areas, etc.). Engineering constraints were considered as environmental features that are likely to impact upon the development of EGI (e.g. mining areas, steep slopes, coastal areas, and forestry areas, etc.). Dedicated national scale, wall-to-wall environmental sensitivity and engineering constraints maps were developed, highlighting areas of sensitivity and constraints across four tiers (Very High, High, Medium and Low).

Phase 2 involved identifying areas both inside and adjacent to the preliminary corridor boundaries where transmission infrastructure development might be best utilised. Utilisation was considered from both a bulk load and bulk generation perspective. Information was gathered from a range of sources including national, provincial and local government spatial planning documentation. This was supplemented with information gathered through consultation with government and industry on spatial plans for load and generation activities. A Provincial and Municipal Feedback Exercise, as well as an Industry Feedback Exercise was undertaken in order to seek feedback on the potential need for energy to inform the final corridor alignment. A review of Provincial and Municipal Spatial Development Framework Plans, and Integrated Development Plans were also reviewed in order to seek feedback on future energy intensive developments that may require power. These components were combined into a Spatial Energy Demand Layer as part of the Demand Mapping process. A Spatial Energy Generation Layer was also developed based on the industry consultation, renewable energy EIA projects that are planned and approved, as well as the Renewable Energy Development Zones (REDZ).

The output maps from **Phase 2** were used to refine the draft refined corridors (**at the end of Phase 4**) with the aim to maximise overlap with areas of highest utilisation potential, and to ensure that the corridors are aligned with areas that best represent where transmission infrastructure might be best utilised in the future, without compromising environmental sensitivities, engineering constraints and linkages to critical anchor points.

Phase 3 included a Corridor Refinement process, which entailed a Draft Pinch Point Analysis that was undertaken based on the wall-to-wall negative mapping and utilisation mapping, and feedback received from the authorities, specialists and the public. This process entailed shifting the corridors slightly, where possible, to obtain as many areas of low sensitivity within the corridors. The national, wall-to-wall, environmental sensitivities and engineering constraints maps from Phase 1 were then reduced to the extent of the Draft Refined Corridors to produce a draft environmental and engineering constraints map. This map was carried through to Phase 4.

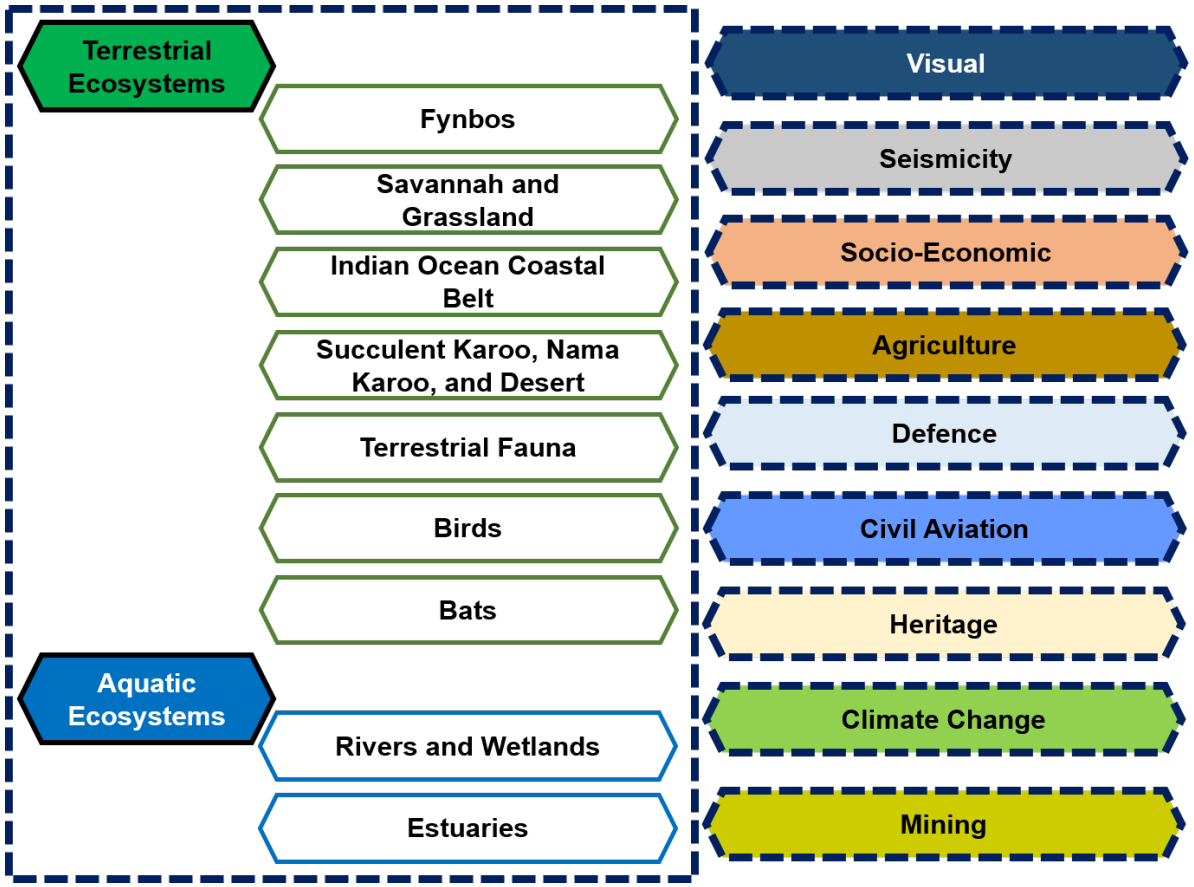

Figure B: Specialist Assessments and Additional Impact Chapters forming part of the EGI Expansion SEA.

Phase 4 included an Environmental Assessment of the corridors. The specialist team was appointed in December 2017 to assess the Draft Refined Corridors. Specialists were required to review, validate and enhance the draft environmental constraints/sensitivities map for a range of environmental aspects, as indicated in Figure B. Some of the environmental aspects were addressed by the SEA Project Team (i.e. Defence, Civil Aviation, Heritage, Climate Change and Mining). The Draft Specialist Assessments were presented during the second round of the Public and Authority Outreach. In addition, the Specialist Assessment chapters, and Parts 1 and 2 of the SEA Report, were released for comment from 25 April 2019 to 24 June 2019 via the project website. The comments received from the public and stakeholders were then taken into consideration, where applicable.

The final pinch point analysis was thereafter undertaken in order to determine the Final Expanded EGI Corridors. The findings of the Demand Mapping undertaken in Phase 2 (i.e. Spatial Energy Demand Layer and the Spatial Energy Generation Layer); the findings of the Specialist Assessments, updated Engineering and Environmental Constraints data, and comments from stakeholders were taken into consideration during the Final Pinch Point Analysis. The 100 km wide Corridors were first designed based on the Opportunities Mapping resulting in the 100 km wide Demand Mapping Corridors. The 100 km wide Demand Mapping Corridors were then refined in terms of updated environmental and engineering data and only moved if there was still a pinch point.

For illustrative purposes, Figure C shows the key mapping outputs of each phase of the SEA Process.

Phase 5 is the Decision-support Outputs and Gazetting. This phase translates the outputs from Phase 4 into environmental management measures and planning interventions for inclusion in the relevant legal environmental framework and local government planning tools, including Municipal Spatial Development

Frameworks, to ensure that long term energy planning is secured. The Final SEA Report and final outputs will be presented by the DEA to Cabinet for approval.

The final outputs of the SEA include the Final Expanded EGI Corridors, Final Corridor Environmental Sensitivities and Engineering Constraints Map, Standard and Development Protocols. The Standard documents the process that needs to be followed to enable exemption from Environmental Authorisation for EGI development within the gazetted EGI corridors, as well as the two expanded EGI corridors (once gazetted). The Standard also provides specifications to guide the routing of the EGI during the project specific phase, and will result in a registration process and no Environmental Authorisation or decision-making. A Heritage and Palaeontology Protocol was compiled as part of the SEA Process in consultation with relevant authorities in order to capture assessment and minimum report content requirements for environmental impacts on heritage and palaeontological resources. The protocols specify the additional project level assessment requirements that need to be met by the Project Applicant when applying for Environmental Authorisation.

Once the Standard and Protocols are finalised and undergo vetting processes within the DEA, the final outputs of the SEA will be put forward for public comment through publication in the Government Gazette. Following this, the final outputs of the SEA will be gazetted for implementation. The gazetting process is envisaged to take place in 2020.

Based on the findings of the SEA Process, it is proposed that EGI projects planned within the Expanded EGI Corridors (once gazetted), as well as the five gazetted EGI corridors, will be exempted from obtaining an Environmental Authorisation in terms of the NEMA EIA Regulations, provided that there is compliance with the Standard (once gazetted). This is in line with the provisions of Section 24 (2) (d) of the NEMA. This will ensure that EGI development within the corridors (once gazetted) are fast-tracked, whilst still maintaining a high level of environmental rigour.

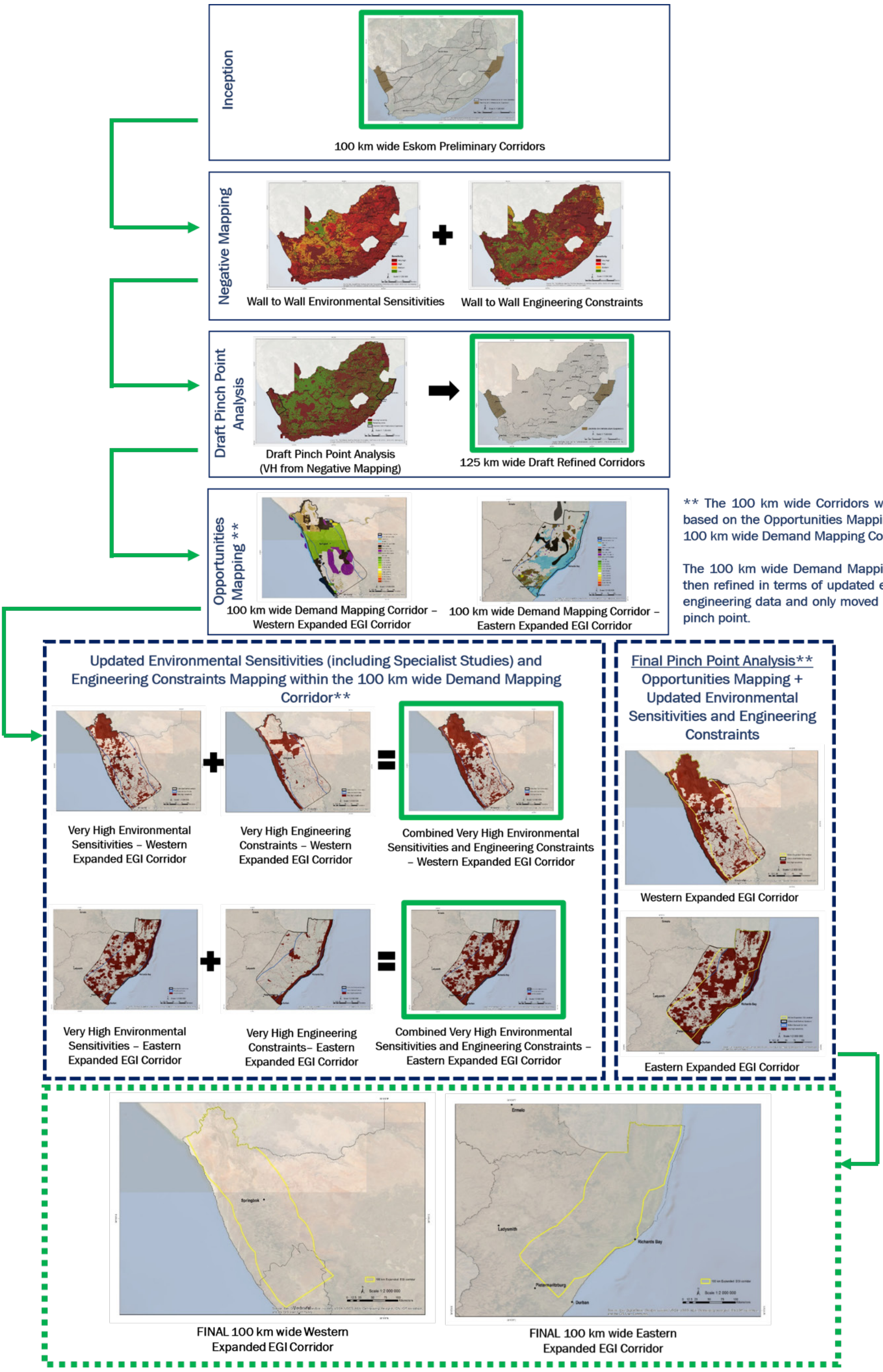

Figure C: Key Mapping Outputs for each Phase of the EGI Expansion SEA.

CONTENTS

APPENDICES

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 1

Background to the Electricity Grid Infrastructure Strategic Environmental Assessment

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ABBREVIATIONS

BA	Basic Assessment
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DOE	Department of Energy
DPE	Department of Public Enterprises
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
IRP	Integrated Resource Plan
MW	Megawatt
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SIP	Strategic Infrastructure Project
SPLUMA	Spatial Planning and Land Use Management Act (Act 16 of 2013)

PART 1. BACKGROUND TO THE ELECTRICITY GRID INFRASTRUCTURE EXPANSION STRATEGIC ENVIRONMENTAL ASSESSMENT

1.1 Introduction and Background

The Eskom 2040 Strategic Grid Plan Study was undertaken to determine the requirements of the future transmission grid to accommodate the expected demand needs and the potential impact of future generation scenarios. Three generation scenarios were considered, including:

- 2010-2030 Integrated Resource Plan (IRP) base scenario (extended to 2040);
- Increased renewable energy scenario; and
- Increased imports scenario.

To provide for the above, five Strategic Transmission Corridors were assessed as part of the 2016 Electricity Grid Infrastructure (EGI) Strategic Environmental Assessment (SEA) (Figure 1). These corridors were gazetted for implementation on 16 February 2018 in Government Gazette 41445, Government Notice 113. The Gazette documented notice given by the Minister of Environmental Affairs of alternative procedures to be followed when applying for Environmental Authorisation for large scale electricity transmission and distribution development activities, identified in terms of section 24(2)(a) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) in the identified Strategic Transmission Corridors (i.e. areas declared as geographical areas of strategic importance).

Developers proposing to submit Applications for Environmental Authorisation for large scale electricity transmission infrastructure within any of the five Strategic Transmission Corridors, that trigger Listed Activity 9 of Listing Notice 2 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), or any other listed and specified activities that are necessary for the realisation of such infrastructure and facilities, would need to:

- Submit a pre-negotiated route to the Department of Environmental Affairs (DEA); and
- Follow a Basic Assessment (BA) Process in terms of the 2014 EIA Regulations (as amended), as opposed to a full Scoping and EIA Process, which is required for all activities listed in Listing Notice 2.

The submission of a pre-negotiated route will enable the developers the flexibility to consider a range of route alternatives within the pre-assessed corridors to avoid land negotiation issues. This fairly recent streamlined Environmental Assessment process also includes a reduced decision-making timeframe for the Competent Authority (i.e. 57 days as opposed to 107 days). Several factors served as motivation for the abovementioned streamlining of the Environmental Assessment Process, including the fact that the development of linear EGI is a well-known type of development, and the DEA has previously considered and issued Environmental Authorisation for numerous applications in this regard. Therefore, the type of issues and impacts linked to a proposed EGI development is well understood and would apply across many EGI development applications.

Therefore, the outcome of the 2016 EGI SEA was the streamlining of the Environmental Authorisation process for EGI related development within any of the five Strategic Transmission Corridors (Figure 1).

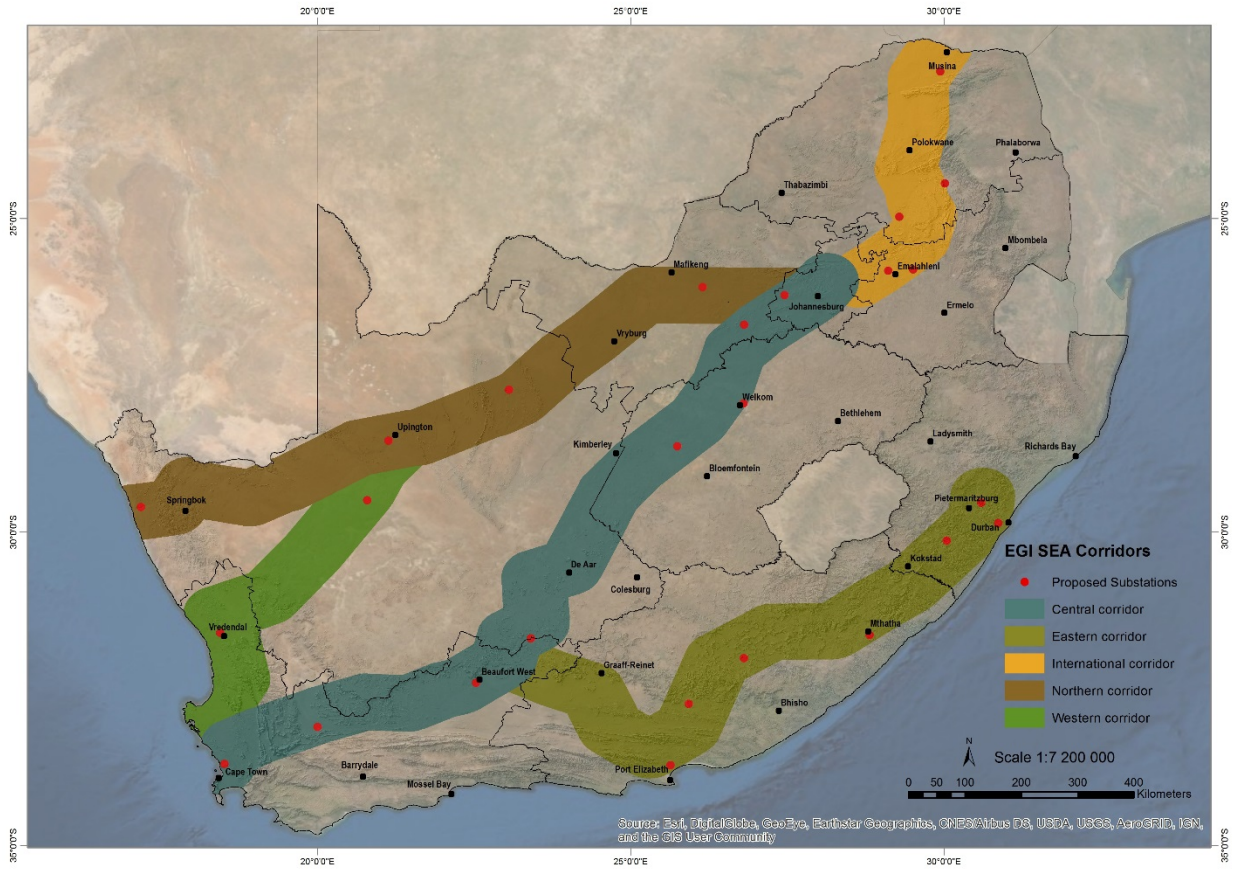

Figure 1: Gazetted EGI Corridors as an outcome of the 2016 EGI SEA (DEA, 2016[1])

Following the completion of the 2016 EGI SEA and to support the objectives of the Strategic Infrastructure Project (SIP) 10, various additional long term studies were conducted by Eskom to determine the likely future transmission network that will be adequate to cater for Renewable Energy and gas generation, as well as future load. These studies indicated that there is a need to augment the final gazetted EGI Corridors and to increase the number of corridors (interconnectors) leading to neighbouring countries for the purposes of importing or exporting power. Specifically, an expansion of the Eastern EGI Gazetted Corridor is required for interconnecting with Mozambique for possible imports due to anticipated high gas generation. In addition, an expansion of the Western EGI Corridor is required for interconnection with Namibia for possible gas to power generation, as well as the facilitation of Renewable Energy integration.

Linked to the above, and to ensure that when required, Environmental Authorisations are not a cause for delay, the DEA, Department of Energy (DoE), and Department of Public Enterprises (DPE), as well as iGas, Eskom and Transnet, have commissioned the Council for Scientific and Industrial Research (CSIR) to undertake a SEA to expand the Gazetted EGI corridors. The CSIR was appointed in April 2017 and undertook the SEA in collaboration with the South African National Biodiversity Institute (SANBI). Refer to Figure 3 for a breakdown of the SEA Project Team.

The current SEA therefore builds onto the previous 2016 EGI SEA Report, cited as DEA (2016[1]). **For purposes of consistency and continuity, a similar process and methodology to that adopted in the 2016 EGI SEA Process was followed in this EGI Expansion SEA (which is the subject of this report)**. For detailed information on the EGI SEA rationale, study objectives, legal framework, project information and approach

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

adopted during this SEA, refer to the 2016 EGI SEA Report (DEA, 2016)[2]. Only where the process has been slightly amended for this EGI Expansion SEA, has the relevant updated information been provided in this report.

For context, the SEA Process was undertaken in the following phases:

- Inception and Eskom Preliminary Corridors;
- Phase 1: Constraints Mapping;
- Phase 2: Utilisation Mapping;
- Phase 3: Pinch Point Analysis (Corridor Refinement);
- Phase 4: Scoping Level Pre-Assessment (i.e. Environmental Assessment of the Corridors); and
- Phase 5: Gazetting and Decision- Making Framework.

[2] The 2016 EGI SEA Report (DEA, 2016) is available on the following website: https://egi.csir.co.za/?page_id=1375

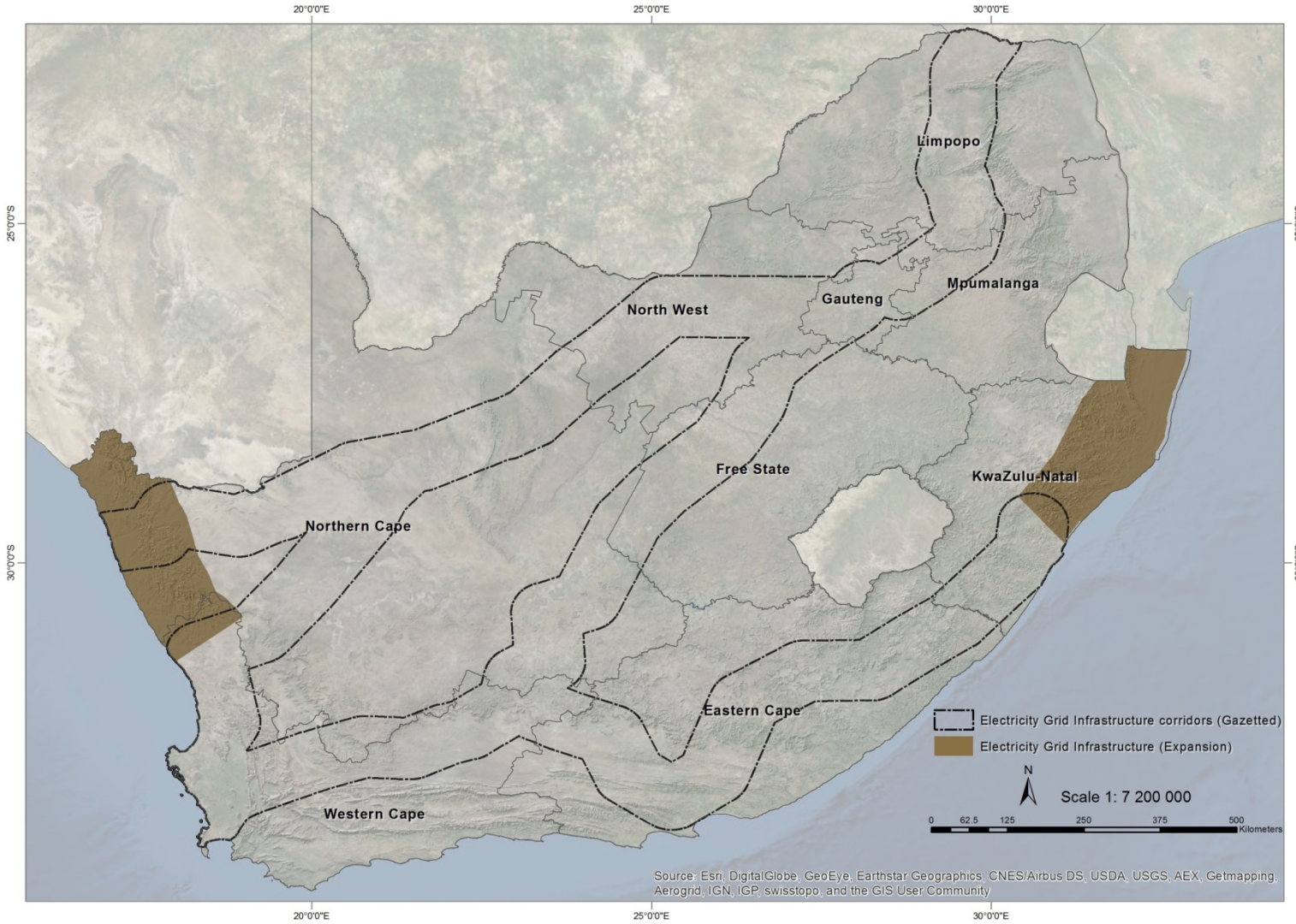

Figure 2: 2016 EGI SEA Gazetted Power Corridors (i.e. Strategic Transmission Corridors) and the Expanded Western and Eastern EGI Corridors (the subject of this current SEA).

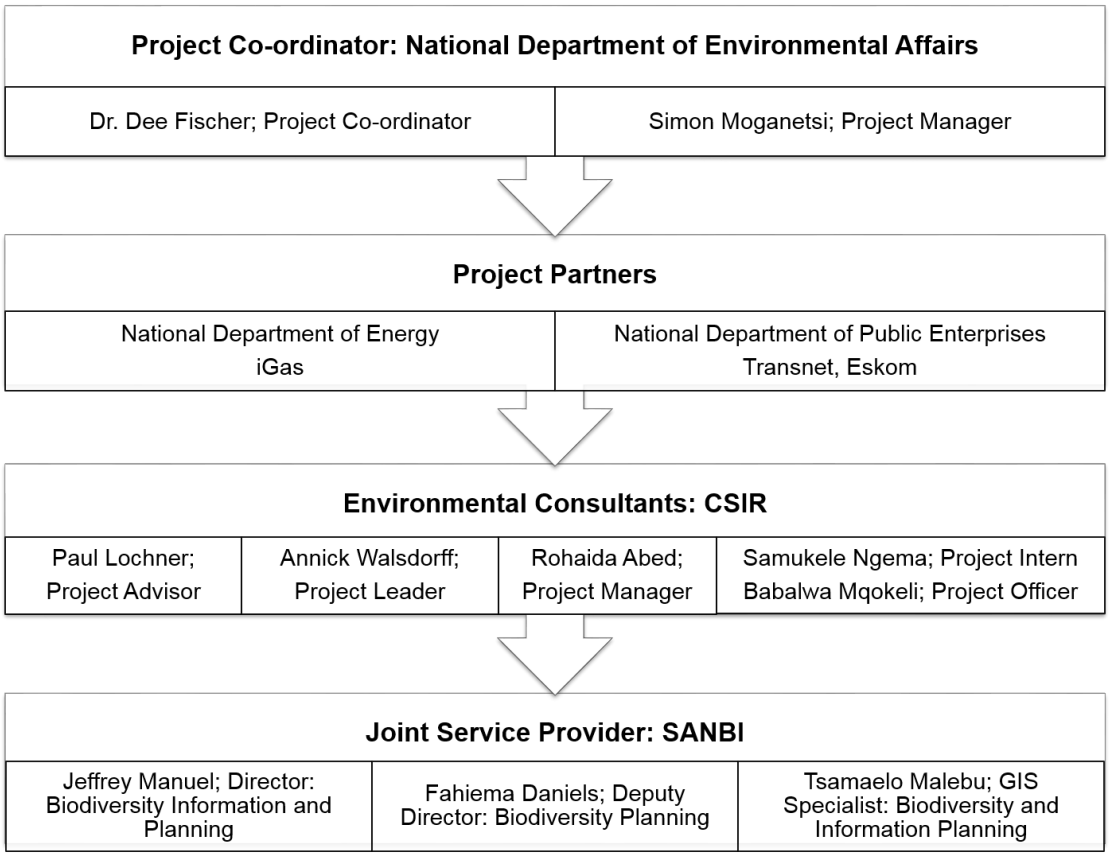

Figure 3: SEA Project Team

1.2 Legal Framework

The key pieces of legislation that enable the identification and implementation of the Power Corridors include the NEMA, National Water Act (Act 36 of 1998), Infrastructure Development Act (Act 23 of 2014), and the Spatial Planning and Land Use Management Act (Act 16 of 2013) (SPLUMA). The applicability and description of these pieces of legislation are captured in the 2016 EGI SEA Report (DEA, 2016). However, it is also important to capture the importance and relevance of the IRP. Key relevant legislation is also described in the Specialist Studies in Part 4 of this SEA Report.

1.2.1 Integrated Resource Plan

The IRP 2010-30 was promulgated in March 2011, and at the time, it was considered a "living plan" to be updated frequently by the DoE. Since the promulgation of the IRP 2010-30, there have been a number of developments in the energy sector in South and Southern Africa, and the electricity demand outlook changed from that projected in 2010. As an update to the 2010-30 IRP, the DoE published Assumptions and Base Case documents for public comment in 2016. According to these documents, there is a significance placed on pursuing a diversified energy mix in South Africa, which "reduces reliance on a single or a few primary energy sources" (DoE, 2016[3]).

[3] Department of Energy (November 2016). Integrated Resource Plan Update Assumptions, Base Case Results and Observations Revision 1. Pretoria.

In August 2018, the DoE published an updated Draft IRP for public comment. The updated report was focused on ensuring security of supply, as well as reduction in the cost of electricity, negative environmental impact (emissions) and water usage (DoE, 2018[4]). One of the main implications of the Draft IRP 2018 was that the progression and level of new capacity developments needed up to 2030 should be reduced compared to that noted in the 2010-30 IRP (DoE, 2018). It was also concluded that additional detailed studies be undertaken to inform the update of the IRP, and this includes, but is not limited to, undertaking a detailed analysis of the options for gas supply to identify the technical and financial risks and mitigation measures needed for an energy mix that is dominated by Renewable Energy and Gas post 2030 (DoE, 2018).

The above was echoed in the Final IRP, which was promulgated on 17 October 2019 for implementation (DoE, 2019[5]). The 2019 IRP takes into account various capacity developments that have taken place since the promulgation of the 2010 – 2030 IRP, as well as a number of changes in assumptions, including electricity demand projection, Eskom's existing plant performance, and new technology costs.

Table 1: Final IRP 2019: Plan for the Period Ending 2030 (Source: DoE, 2019)

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400 1000	1600			
2023	750	-555				1000	1600			500
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	**43**		**2.36**	**5.84**	**6.35**	**10.52**	**22.53**	**0.76**	**8.1**	
% Annual Energy Contribution (% of MWh)	**58.8**		**4.5**	**8.4**	**1.2***	**6.3**	**17.8**	**0.6**	**1.3**	

Installed Capacity
Committed / Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030
- Koeberg power station rated / installed capacity will revert to 1926 MW (original design capacity) following design life extension work.
- Other / Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility
- Short term capacity gap is estimated at 2000 MW

[4] Department of Energy (August 2018). Integrated Resource Plan 2018 (Draft). Pretoria.
[5] Department of Energy (October 2019). Integrated Resource Plan 2019. Pretoria.

The 2018 Draft IRP (DoE, 2018) stipulated a total generation capacity of 19 400 Megawatts (MW) from Solar Photovoltaic (PV) and Wind Energy (excluding Hydropower, Storage Schemes and Concentrated Solar Power (CSP)) by 2030. However, the Final 2019 IRP has stated an increase in Wind and Solar Energy capacity, equating to 26 030 MW of total installed capacity (excluding Hydropower, Storage Schemes and CSP) by 2030 (DoE, 2019). This value includes 1 474 MW and 1 980 MW of currently installed capacity for Solar PV and Wind, respectively.

In addition, the current installed capacity for Gas / Diesel is 3 830 MW. The 2018 Draft IRP (DoE, 2018) proposed an additional capacity of 8 100 MW for Gas / Diesel by 2030; however based on various reasons, this has decreased to 3 000 MW additional capacity in the promulgated Final 2019 IRP (DoE, 2019) (equating to 6 830 MW capacity by 2030) (DoE, 2019).

As indicated in Figure 4 and Table 1, in terms of the future total installed capacity mix, coal represents the highest percentage, followed in descending order by Wind, Solar PV, Gas/Diesel, Pumped Storage, Hydro, Nuclear, and CSP (excluding Other).

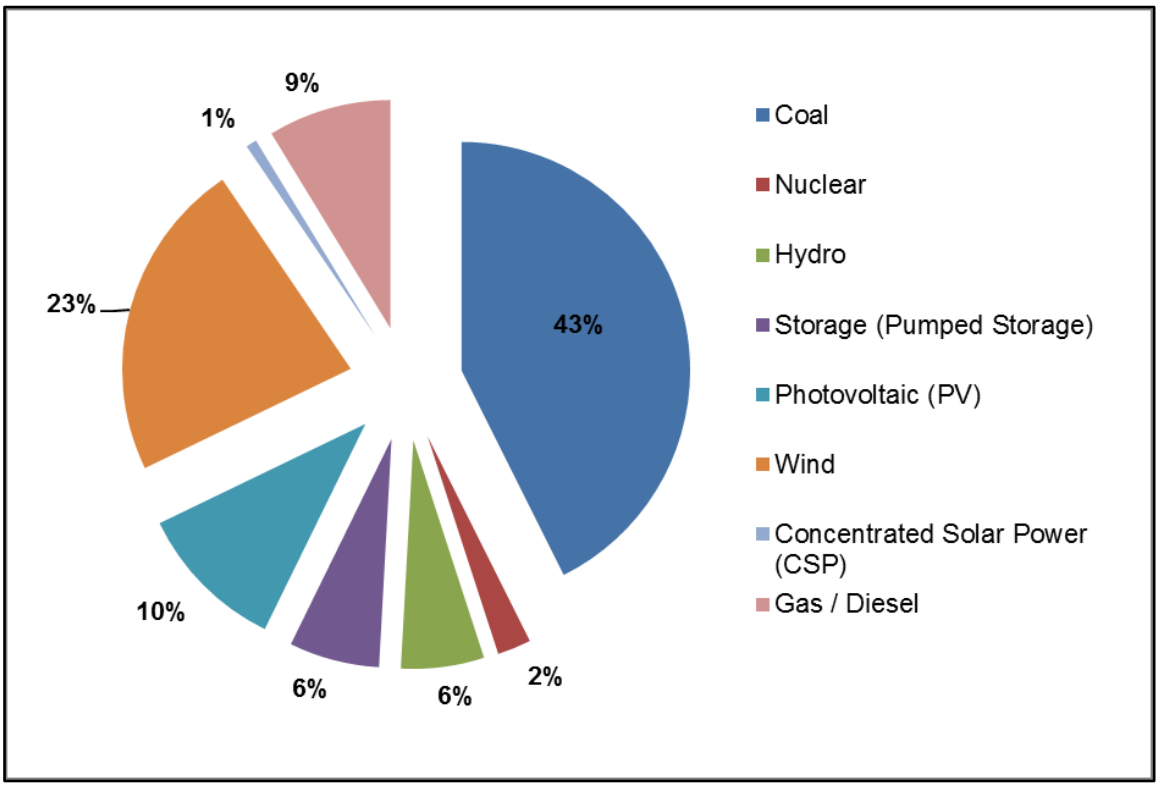

Figure 4: Graph indicating percentages of the future installed capacity mix (taking into consideration Installed Capacity as at 2019; Committed/Already Contracted Capacity; Capacity Decommissioned; and New Additional Capacity) based on the Final 2019 IRP (DoE, 2019).

1.3 Procedure of Environmental Assessment within the EGI Corridors: Objectives and Vision

One of the key points that the DEA has realised over time is that unless developers plan with the environment in mind, it is not really considered as a priority. This SEA is ensuring that the environment is brought to the forefront as a priority in planning. One of the outcomes of this SEA is therefore to ensure that environmental approvals for such infrastructure within the corridors are not a cause for delay towards development, whilst still maintaining and ensuring the highest levels of environmental rigour.

To ensure that EGI development within the Expanded EGI Corridors are not a cause for delay, the following two options were considered during the SEA Process to achieve streamlining of the Environmental Authorisation process:

- Option 1: Allow for exemption from the need to obtain Environmental Authorisation in terms of the NEMA provided that there is compliance with a Norm or Standard; or
- Option 2: Allow for a streamlined Environmental Authorisation process in terms of NEMA (i.e. undertake a streamlined Environmental Assessment (such as a Basic Assessment) instead of an EIA) provided that there is compliance with Minimum Information Requirements.

In the first option, complete exemption from the Environmental Authorisation process can only be achieved if there is compliance with prescribed Norms or Standards. This is allowed for in terms of Section 24(2)(d) of the NEMA. Although no Environmental Authorisation would be issued, the Standard would, as a fundamental minimum, require site verification to be conducted prior to development, followed by a Concluding Statement confirming that, where applicable, impacts have been avoided/engineered out or as a minimum, that the proposed mitigation results in acceptable residual impacts. The Standard also proposes to allow for complete Public Participation as required in the 2014 EIA Regulations (as amended). The main difference from traditional Environmental Assessment is that the Standard would not entail any decision-making component, but would rather include a registration process. The latter would potentially include the submission of a Registration Form and supporting documents (such as an Environmental Sensitivity Report that includes Specialist inputs) by an Environmental Assessment Practitioner to the Competent Authority. The Competent Authority would then need to issue a registration number to officially register the use of the Standard.

In the second option, streamlining would be achieved by undertaking a streamlined Environmental Assessment (such as a Basic Assessment) instead of an EIA with adherence to Minimum Information Requirements. The Minimum Information Requirements revert to the 2014 NEMA EIA Regulations (as amended), with additional detail in terms of providing a clear and structured process and regulatory framework for environmental monitoring, assessment and decision-making related to EGI development. The Minimum Information Requirements will enable the Competent Authority to make decisions on the applications in a streamlined and responsible manner.

These options were considered and discussed with various SEA Project Team members, Authorities and key Stakeholders. Both options are considered viable, as they are allowed for in NEMA, and pre-assessment work has been undertaken as part of this SEA and mandatory compliance would be required with either the Standards or Minimum Information Requirements. These instruments would ensure that potential negative impacts are avoided or mitigated and that best practice measures are adopted. Option 1, to allow exemption from Environmental Authorisation for EGI development within the Expanded EGI Corridors (once gazetted), as well as the five gazetted EGI Corridors, has been recommended and will be taken into Phase 5 of the SEA Process, which is the Decision-Support Outputs and Gazetting.

1.4 SEA Report Structure

The Final SEA Report comprises five parts. Part 1 (i.e. this chapter) provides a background of the SEA Process, as well as a description of key applicable legislation. Part 2 provides a description of the EGI that has been assessed and considered in this SEA. Part 3 provides an overall description of the process followed and methodology adopted for the SEA. Part 4 describes the outputs of the Specialist Assessments and other studies conducted as part of the EGI Expansion SEA Process; and Part 5 explains the process undertaken to identify the Final EGI Corridors. Figure 5 illustrates the structure of the Final SEA Report.

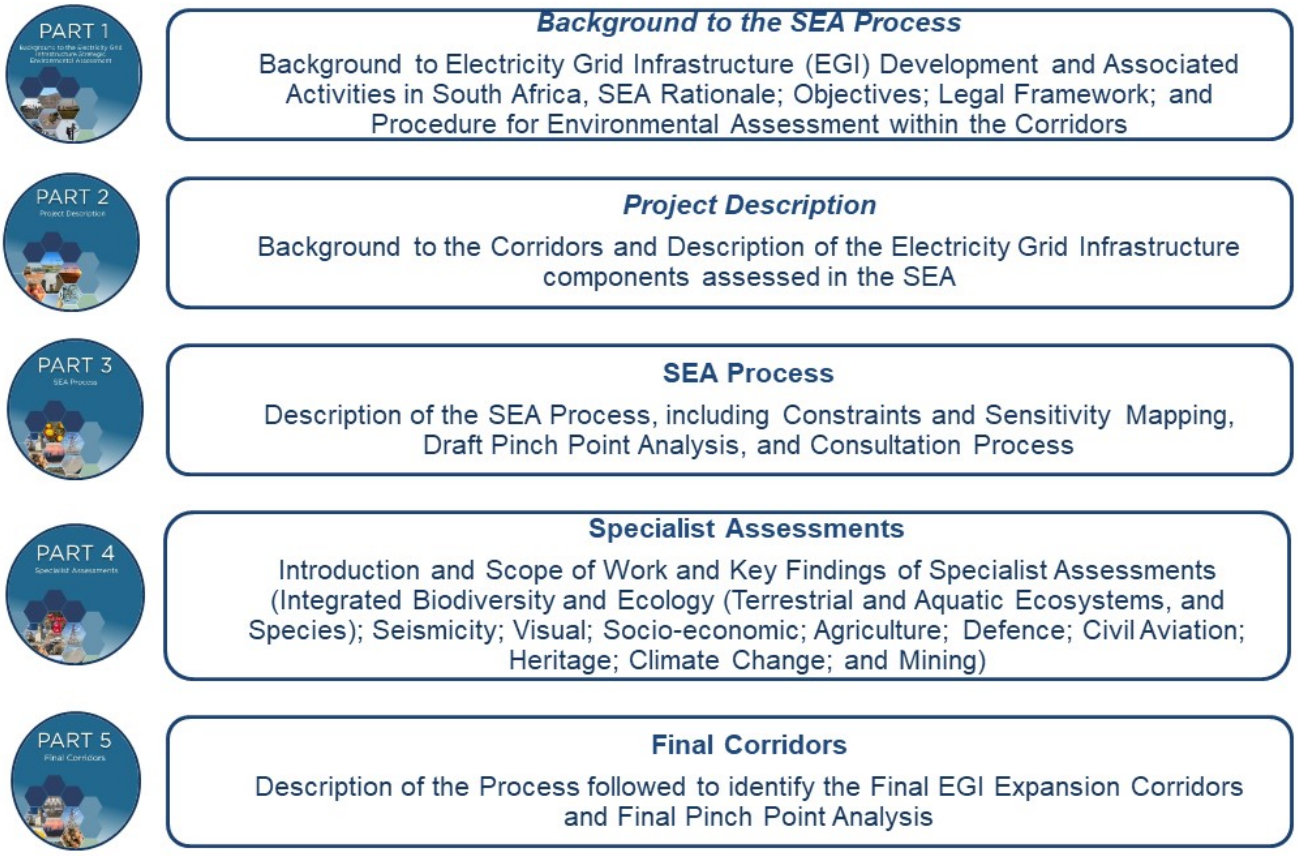

Figure 5: EGI Expansion SEA Report Structure

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 2

Project Description

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ABBREVIATIONS

DEA	Department of Environmental Affairs
EGI	Electricity Grid Infrastructure
MVCD	Minimum Vegetation Clearance Distance
SEA	Strategic Environmental Assessment

PART 2. PROJECT DESCRIPTION

2.1 Introduction

This section of the report describes the process undertaken to identify the Preliminary Electricity Grid Infrastructure (EGI) Corridors, as well as a description of the key project components. As noted in Part 1 of the Strategic Environmental Assessment (SEA) report, Eskom identified the need to expand the EGI corridors that were assessed as part of the 2016 EGI SEA (Department of Environmental Affairs (DEA), 2016[1]) and recently gazetted. The EGI Corridors assessed in this SEA are founded on a set of two expanded corridors, referred to as the Eskom Preliminary Corridors in this report. The approach undertaken for refining the corridors was developed in line with the context and study objectives described in Part 1 of the Final SEA Report.

2.2 Project Description

This section describes the key components of the EGI and typical construction activities.

2.2.1 Transmission and Distribution Power Lines and Vegetation Clearing

Based on the 2016 EGI SEA Report, Eskom anticipates that a number of new transmission lines, with a capacity greater than or equal to 400 kV will be required within each of the Expanded EGI Corridors. The precise number of lines will be dependent on which generation scenario unfolds. Figure 1 shows a route profile in the context of a servitude and Development Envelope for a typical 765 kV power line, i.e. 40 m on either side of the power line (an 80 m wide project footprint) and 50 m on either side of the project footprint. A 765 kV servitude is 80 m wide and any line parallel to that must be 80 m away from the centre line of the first 765 kV line; 55 m away from the centre line of any 400 kV line, etc. The width of a servitude is thus the distance away from any line that additional lines can be installed, always using the biggest line servitude as reference.

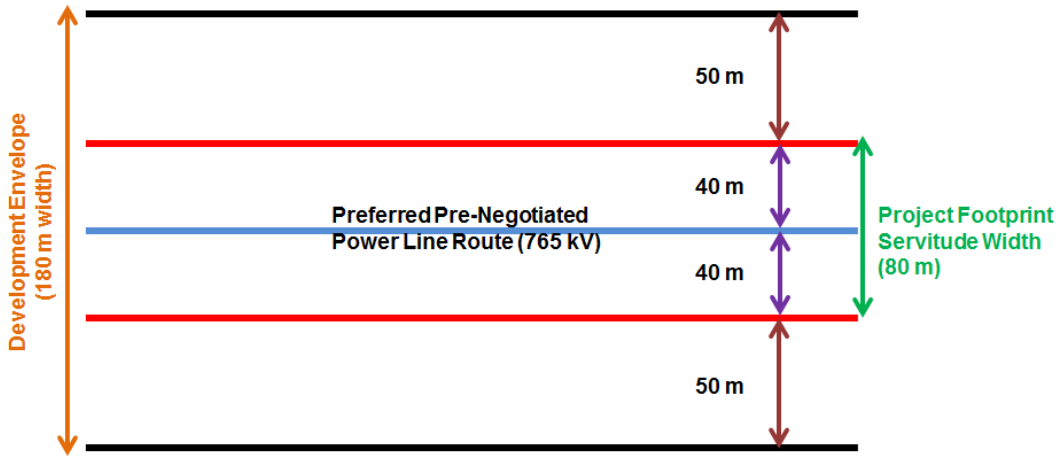

Figure 1: Route Profile: Servitude and Development Envelope for a typical 765 kV power line (DEA, 2016)

Where clearing for access purposes is essential, the maximum width to be cleared within the servitude shall be in accordance the specifications in Table 1 below.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

Table 1: Maximum servitude clearance distances

Nominal Voltage	Servitude Building Restriction Widths[2]	Maximum Vegetation Clearance
11 kV	9 m	4m on either side of the centre line
22 kV	11 m	4m on either side of the centre line
88 kV	11 m	5 m on either side of the centre line
132 kV	15.5 m	8 m on either side of the centre line
220 to 765 kV	22 m to 40 m	Clear from the centre of the power line up to the outer conductor, plus an additional 10 metres on either side.
533 kV DC	15 m	8 m either side of the centre line

During maintenance, vegetation trimming will be undertaken where it is likely to intrude on the minimum vegetation clearance distance (MVCD) or where it will intrude on this distance before the next scheduled clearance. MVCD is determined by SANS 10280 (refer to Table 2).

Table 2: Minimum vegetation clearance distances

System nominal r.m.s. voltage kV	Minimum Vertical Clearances (m)	Minimum Horizontal Clearances (m)
>1 up to and including 44	3	3
66	3.2	3
88	3.4	3
132	3.8	3
220	4.4	3
275	4.9	3
400	5.6	3.2
765	8.5	5.5

2.2.2 Pylons

Each pylon will have a footprint of up 1 ha that is disturbed during the construction phase. This is required in order to excavate and fill the foundations of the pylon, as well as to assemble and then raise the pylon on-site. This translates to a footprint of approximately 166 ha per 100 km of 765 kV power line. Excavations for pylons generally extend to about 3.5 m deep.

2.2.3 Access Roads

An access road is required for construction as well as maintenance of a power line. The road is generally around 4 m wide during construction and may become a simple two-track during operation of the power line. The initial disturbance footprint of such roads is approximately 40 ha per 100 km of power line, but is sensitive to the exact width of the road as well as the habitat as roads on steep or uneven terrain create more disturbances due to the cut and fill that is usually required in order to make the site accessible for heavy vehicles. In some cases, such as specifically within agricultural fields, service roads parallel to the power line are generally not required.

2.2.4 Substations

Transmission and distribution substations are also required. These may extend up to 70 ha in extent and usually also require borrow pits, construction camps, temporary laydown areas etc. during construction. Excavations for substations generally extend between 3 m and 3.5 m in depth.

[2] Measured from the centre line of the power line

2.2.5 Construction Activities

Tables 3 and 4, below, respectively, show the typical activities in power line and substation construction (following the receipt of all necessary Environmental Approvals).

Further details on the project description can be found in the 2016 EGI SEA (DEA, 2016).

Table 3: Typical Activities in Power Line Construction

Activity
• Erection of camp sites for the Contractor's workforce.
• Servitude gate installation to facilitate access to the servitude.
• Vegetation clearing to facilitate access, construction and the safe operation of the line.
• Establishing of access roads on the servitude where required
• Pegging of tower positions for construction
• Transportation of equipment, materials and personnel to site and stores.
• Installation of foundations for the towers.
• Tower assembly and erection.
• Conductor stringing and regulation.
• Transfer of the line from the Contractor for commissioning.
• Final inspection of the line, commissioning and transfer to the Grid Line and Servitude Manager for operation.
• Rehabilitation of disturbed areas.
• Signing off of all Landowners upon completion of the construction and rehabilitation.
• Transfer of the servitude by the Grid Environmental Manager.
• Operation and maintenance of the line

Table 4: Typical Activities in Substation Construction

Activity
• Transportation of equipment, materials and personnel to site and stores (ongoing)
• Vegetation clearing to facilitate access, construction and the safe operation of the substation.
• Site establishment
• Level substation area and excavate for cut and fill requirements (terracing)
• Gate and fence installation
• Construction of access roads
• Foundation excavation
• Steelwork assembly and erection.
• Equipment installation
• Stringing operations
• Dismantling and removal of old equipment (where required)
• Testing and commissioning
• Rehabilitation of disturbed areas
• Transfer of works

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 3

SEA Process

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ABBREVIATIONS

BA	Basic Assessment
BS	Baseline Scenario
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ERG	Expert Reference Group
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NDP	National Development Plan
PSC	Project Steering Committee
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SKA	Square Kilometre Array

PART 3. SEA PROCESS

3.1 Introduction

This section of the report describes the process undertaken and methodology adopted for the Electricity Grid Infrastructure (EGI) Expansion Strategic Environmental Assessment (SEA). The SEA undertook to identify the Preliminary Corridors and refine them to ensure optimal placement in support of sustainable development, as well as the consideration of environmental and engineering constraints, together with the needs of authorities and key stakeholders. The approach is broadly based on an integrated spatial analysis of the best available data at the time.

3.2 SEA Process Overview

3.2.1 Context

As noted in the 2016 EGI SEA Report (Department of Environmental Affairs (DEA), 2016[1]), the SEA Process attempts to add spatial context to national level policies, plans and programmes. In particular, it can be considered as a link between the objectives of the National Development Plan (NDP) 2030 and the primary EGI projects required to make this plan a reality. The SEA will allow for proactive investment as well as faster and more coordinated permitting procedures. This will ensure that priority grid infrastructure projects are implemented more effectively, whilst maintaining the highest level of environmental protection. Transmission and distribution lines are being considered in this assessment.

It should be noted that the SEA Process is undertaken at a strategic level and cannot replace the requirements for project level environmental studies. The high-level environmental, social and economic data utilised to identify the 100 km wide corridors and to undertake environmental pre-assessment of the corridors, is not sufficient for project-level decision making. The SEA should therefore be considered as a scoping level exercise used to identify key potential impacts. Additional environmental studies will be necessary at a project level, together with effective public participation, to determine the significance of impacts. These requirements will be stipulated in the Decision-Making Tools.

As illustrated in Figure 1, the SEA Process consists of the following five phases:

- Inception and Eskom Preliminary Corridors;
- Phase 1: Constraints Mapping;
- Phase 2: Utilisation Mapping;
- Phase 3: Pinch Point Analysis (Corridor Refinement);
- Phase 4: Scoping Level Pre-Assessment (i.e. Environmental Assessment of the Corridors); and
- Phase 5: Gazetting and Decision- Making Framework.

[1] DEA. 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

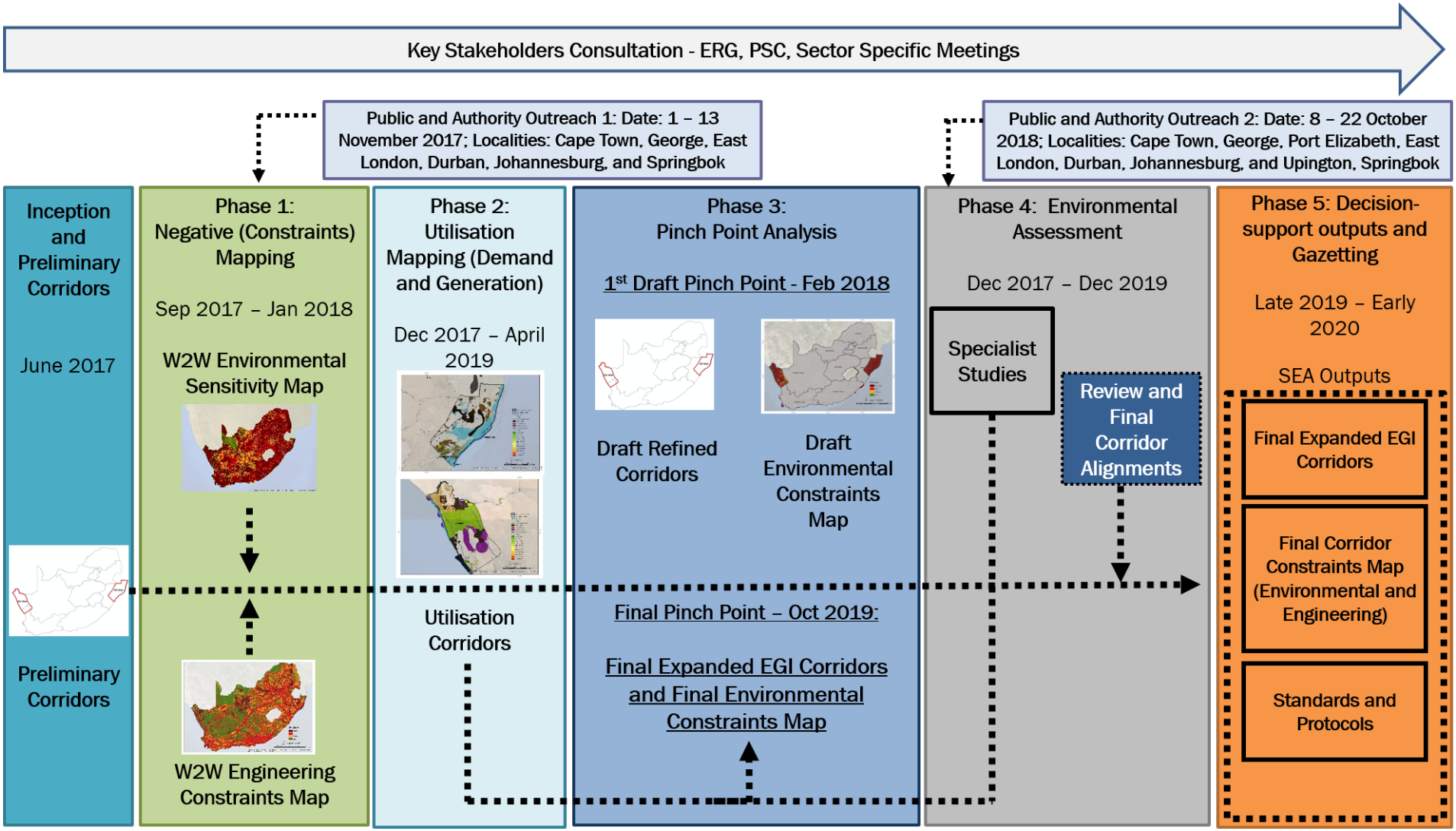


Figure 1: EGI Expansion SEA Process

3.2.2 Inception and Eskom Preliminary Corridors

3.2.2.1 Inception

The SEA Process began in April 2017 and a dedicated project specific website (https://gasnetwork.csir.co.za) and email address (gasnetwork@csir.co.za) were created to ensure that stakeholders are able to access project specific information and download reports available for comment. The project email address served as the main mechanism of communicating with stakeholders.

An Expert Reference Group (ERG) and Project Steering Committee (PSC) were also convened during the Inception Phase, with assistance from the DEA. The PSC comprises authorities with a legislated decision-making mandate for EGI development in South Africa, as well as relevant National and Provincial Government Departments, as well as District Municipalities. The ERG consists of, but is not limited to, all PSC members, as well as representatives from environmental and conservation bodies, Non-Government Organizations, research institutions and industry. The ERG provides assistance and technical knowledge, as well as insights with respect to the issues relevant to specific sectors. Additional information on the composition of the ERG and PSC, as well as a description of the meetings held and notes of the ERG meetings are included in Appendix A of the EGI Expansion SEA Report.

3.2.2.2 Eskom Preliminary Corridors

Based on the results of a detailed Eskom Strategic Grid Plan Study, Eskom identified the need to expand two of the Gazetted EGI Power Corridors. As such, two 100 km wide preliminary corridors were used as the starting point of the SEA. The study considered a number of possible future generation and load scenarios, and in so doing, identified the need for an additional two national transmission infrastructure corridors to facilitate the balancing of South Africa's electricity supply and demand needs up to 2040.

The corridors are illustrated in Figure 2 and referred to as:

- The Expanded Eastern EGI Corridor; and
- The Expanded Western EGI Corridor.

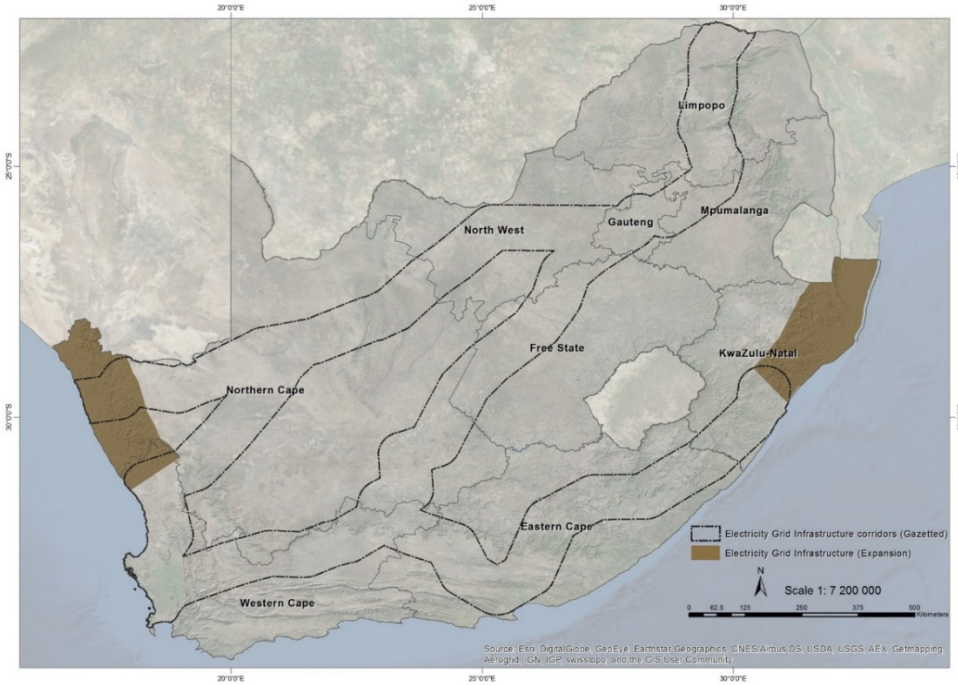


Figure 2: 2016 EGI SEA Gazetted Power Corridors (i.e. Strategic Transmission Corridors) and the Expanded Western and Eastern EGI Corridors

3.2.3 Phase 1: Constraints Mapping

Phase 1 involved negative mapping to identify key environmental sensitivities and engineering constraints in terms of EGI development. Environmental sensitivities in the context of this process were regarded as environmentally sensitive features which may be negatively impacted by EGI development, such as Protected Areas, known bird habitats or wetlands. Engineering constraints are environmental features which are likely to impact upon the development of EGI. These are features, which developers preferably avoid when planning an EGI development due to the increased cost of constructing and/or maintaining the infrastructure in these areas, such as, but not limited to, seismicity, steep slopes and geology.

Where applicable, additional and updated environmental data layers have been incorporated in the wall to wall environmental sensitivity and engineering constraints maps developed as part of the 2016 EGI SEA (DEA, 2016).

The outputs of Phase 1 included updated national wall to wall environmental sensitivity and engineering constraints maps, highlighting areas of sensitivity and constraints across four tiers (i.e. Very High, High, Medium and Low).

In terms of consultation, an initial Authority and Public Outreach was undertaken during this Phase in November 2017, to present the SEA Process, Preliminary Corridors and findings of the constraints mapping. The outreach included areas such as Cape Town, George, East London, Durban, Johannesburg and Springbok.

Additional detail on and the results of the Negative/Constraints Mapping Task is described in Section 3.4 of this chapter.

3.2.4 Phase 2: Utilisation Corridors

Phase 2 entailed Utilisation Mapping which aimed at refining the corridors to maximise overlap with areas of highest utilisation potential (i.e. areas where transmission grid expansion might support the unlocking of future development). It involved identifying areas both inside and adjacent to (within a 25 km buffer either side of (except on the coastal extremity)) the preliminary corridor boundaries where transmission infrastructure development might be best utilised in the future. Utilisation was considered from both a bulk load and bulk generation perspective. Information was gathered from a range of documentation including national, provincial and local government spatial planning plans, including information gathered through consultation with government and industry on spatial plans for load and generation activities.

The outputs of this exercise were used in the identification and refinement of the Final Refined Corridors.

Details on the process followed for this mapping exercise can be found in the 2016 EGI SEA Report (Part 2, Section 2.4) (DEA, 2016). Additional detail on the Utilisation Mapping exercise is described in Part 5 of this SEA Report.

3.2.5 Phase 3: Pinch Point Analysis (Corridor Refinement)

Phase 3 is referred to as the Corridor Refinement (Pinch Point Analysis) phase. The Pinch Point Analysis checked whether any pinch points (significantly constrained areas) exist at any position within the corridors and accordingly refined the corridors. This phase involved aggregating the spatial information captured in Phases 1 and 2 to determine optimal placement of the corridors from both an ‘opportunities’ and ‘constraints’ perspective, i.e. where opportunities are maximized whilst ensuring suitable transmission routing alternatives are available from a constraints and sensitivities (both environmental and engineering) perspective.

Two Pinch Point Analyses were undertaken as part of this SEA Process, as described below:

- First Draft Pinch Point Analysis: A first draft Pinch Point Analysis was undertaken to refine the preliminary corridors based on the outputs of Phase 1 (i.e. the Sensitivity and Constraints Maps). The national wall to wall environmental sensitivities and engineering constraints maps from Phase 1 were then reduced to the extent of the Draft Refined Corridors to produce a draft environmental and engineering constraints corridor map. This map was carried through to Phase 4 and assessed by the Specialists. Refer to Section 3.5 of this chapter for additional detail on the Draft Refined Corridors; and
- Final Pinch Point Analysis: Based on the outputs of Phase 2 (i.e. Utilisation Mapping), Phase 4 (Scoping Level Pre-Assessment i.e. the specialist studies), as well as the inputs from stakeholders following the review of the specialist studies, a Final Pinch Point Analysis was carried out to determine the Final Refined Corridors for consideration by Cabinet. Refer to Part 5 of the EGI Expansion SEA Report for additional information on the Final Pinch Point Analysis.

3.2.6 Phase 4: Environmental Assessment

Phase 4 included Specialist Assessments which involved scoping level pre-assessments (as referenced in the 2016 EGI SEA Report) and sensitivity mapping within the two Draft Refined Expanded EGI Corridors. Specialists were required to review, validate and enhance the draft environmental constraints/sensitivities map for a range of environmental aspects (as described below).

The following Specialist Assessment Studies have been commissioned as part of the SEA:

- Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species, including Bats and Avifauna);
- Visual Impacts;
- Impacts of seismicity; and
- Socio-Economic Impacts.

The spatial sensitivity and associated potential EGI impacts of further aspects including agriculture, defence, civil aviation, heritage, and mining, were also considered. Consideration was also given on the effect of climate change on EGI.

In terms of consultation, a second Authority and Public Outreach was undertaken towards the end of Phase 4, in October 2018, to present the findings of the specialist studies and draft refined corridors. The same locations visited during Round 1 of the outreach were visited during Round 2, with Upington (for an Authority Meeting only) and Port Elizabeth added as additional locations. The opportunity was used to identify additional information and potential concerns from stakeholders and provincial departments that needed to be taken into consideration in the SEA Process.

The Specialist Assessment Studies were also released to stakeholders for a comment period extending from 25 April 2019 to 24 June 2019 via the project website.

3.2.7 Phase 5: Gazetting and Decision- Making Framework

Phase 5 translated the outputs from Phase 4 into decision making tools (i.e. Final Expanded EGI Corridors, Standards and Development Protocols). These outputs will be released for public comment through publication in the Government Gazette. The gazetting process is envisaged to take place in the second quarter of 2020.

As part of the 2016 EGI SEA (DEA, 2016), the CSIR compiled the following Environmental Management Programmes (EMPr) to guide the construction of the EGI:

- A generic EMPr for the Development and Expansion for Overhead Electricity Transmission and Distribution Infrastructure; and
- A generic EMPr for the Development and Expansion of Substation Infrastructure for the Transmission and Distribution of Electricity.

On 2 May 2018, the Minister of Environmental Affairs respectively published the abovementioned EMPrs in Government Notices 162 and 163 for public comment in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA), and Regulations 19(4) and 23(4) and Appendix 4 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended). On 22 March 2019, these two Generic EMPrs were gazetted for implementation in Government Gazette 42323, Government Notice 435.

As part of this SEA, the project team, including the specialists, provided formal comments on the abovementioned EMPrs (in Government Notices 162 and 163) for consideration by the DEA. These comments were considered in the Gazetted EMPrs, as applicable. It is planned that the Gazetted EMPrs will also be applied to EGI development within the Expanded EGI Corridors.

Figure 3 illustrates the process of the SEA since inception until the project specific Environmental Authorisation process.

Figure 3/…

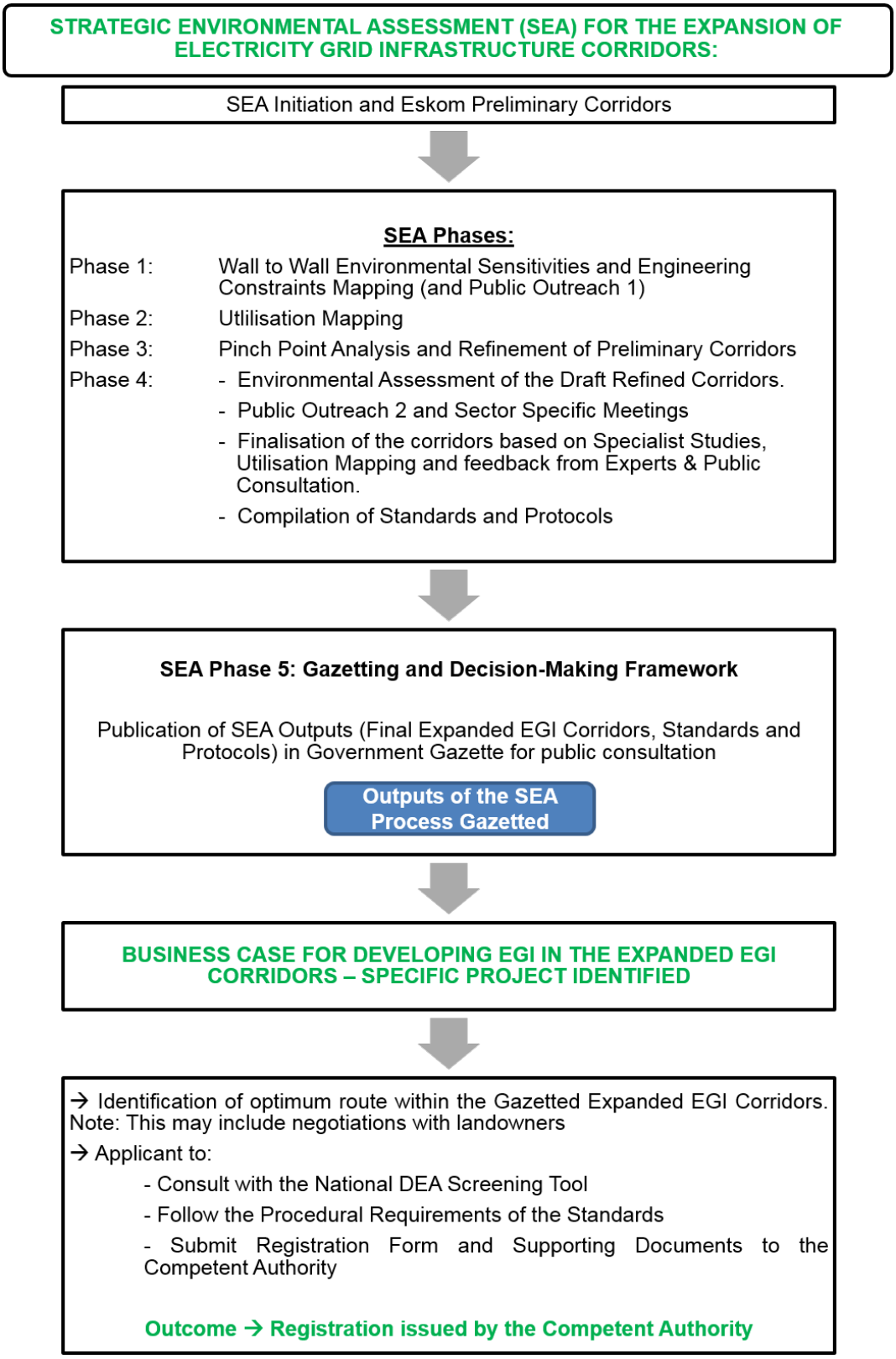


Figure 3: Expanded EGI SEA Process from Initiation to Project Specific Environmental Assessment Process

3.3 Consultation with Stakeholders

In addition to consulting with key stakeholder groups through the ERG and PSC, as well as engagement with key and sector specific stakeholders, public consultation was conducted throughout the duration of the SEA through the exchange of information and data via the project website (https://gasnetwork.csir.co.za/). Additional public engagement was undertaken through newspaper advertisements at key stages of project delivery, as well as two Public Outreach programmes. Table 1 below lists the various mechanisms used to engage the public as part of this SEA.

Consultation was undertaken in order to gather information from major electricity users, and important business and government stakeholders, and to seek feedback on the constraints mapping, location of the corridors, SEA Process and specialist assessment findings. Additional detail regarding the stakeholder engagement is discussed in the following sub-sections and in Appendix A of the EGI Expansion SEA Report.

Table 1: Summary of Public Engagement undertaken during the SEA

Date	Mechanism
July 2017	• Advertisements placed in newspapers to inform stakeholders of the SEA (as part of the Project Initiation)
October 2017	• Advertisements placed in newspapers to notify stakeholders of the planned Public Outreach – Round 1
1 November 2017 to 13 November 2017	• Public Outreach – Round 1
6 July 2018	• Article published online in Engineering News provide a progress update on the SEA
August 2018	• Advertisements placed in newspapers to provide an update on SEA Process
September 2018 and October 2018	• Advertisements placed in newspapers to notify stakeholders of the planned Public Outreach – Round 2
8 October 2018 to 22 October 2018	• Public Outreach – Round 2
May 2019	• Advertisements placed in local and provincial newspapers to notify stakeholders of the additional Public Information Sharing Session held in Durban
13 June 2019	• Additional Public Information Sharing Session held
July 2019	• Engagement with recommended communities within KwaZulu-Natal

3.4 Phase 1: Constraints and Sensitivities Mapping

Details on the process followed for the identification of environmental sensitivities and engineering constraints can be found in the 2016 EGI SEA Report (Part 2, Section 2.3) (DEA, 2016).

3.4.1 Environmental Sensitivities

The mapping exercise was undertaken for the entire country and involved identifying high level environmental sensitivities for EGI development based on the best available data at a national scale. The identification of sensitive features, applicable buffers and datasets was undertaken in consultation with the relevant authorities and key stakeholders. In instances where data for certain environmental aspects was not available, indicative sensitive areas were provided by relevant key stakeholders in consultation with the specialist fraternity. Also included were existing and future conflicting planned land uses such as mining activities and the Square Kilometre Array (SKA). Projects which encroach upon these features are considered more likely to encounter delays, appeals or a negative decision for Environmental Authorisation. The output of this exercise is a map indicating areas to be avoided (Very High sensitivity), areas which are sensitive for various reasons (High-Medium sensitivity), and areas which demonstrate no or low sensitivity (Low sensitivity).

3.4.2 Engineering Constraints

Engineering constraints in the context of the SEA refers to technical challenges posed by the landscape and surrounding environment on the construction and operation of EGI. The mapping exercise was undertaken for the entire country and based on the best available data at a national scale. The identification of features and delineation of constraint level (sensitivity) for each engineering feature was done in consultation with engineering representatives from Eskom, as well as iGas and Transnet.

Typical engineering related features include steep slopes, coastal areas and deep river gorges. The level of constraint attributed to each feature (f_n) was determined according to a crude cost assessment. The cost assessment considered the impact of each feature on an optimal cost effective Baseline Scenario (BS) (x). The BS in this instance was the construction and maintenance of a 1 km of 400 kV power line in optimal conditions for construction. Level of constraint (c) associated with a feature in the context of the BS (x) was therefore represented as (c) = (x)*(f_n).

3.4.3 Constraints Criteria

Based on feedback from the consultation process and expert inputs, the list of features, buffers and associated level of constraint (Very High, High, Medium and Low) as well as the originating datasets used during the 2016 EGI SEA were reviewed and, where available, updated datasets were used (refer to Tables 2 and 3, and Maps 1 and 2).

In addition, from an engineering constraints perspective, the following parameters will also need to be considered during the project specific stage, when the power line routes are determined:

- Rock outcrops in order to gauge the risk in terms of excavations considering the local changes in geology and topography. This will have an implication on associated costs in terms of excavation and importing bedding material. Rock outcrops or shallow rock is often associated with steep slopes; and
- Slope stability, which is considered to be localised and can be engineered to eliminate or avoid based on severity.

These factors are mainly related to the highly variable nature of expected geological conditions and associated constraints, which may change over short distances and would require detailed mapping and planning of routes.

Table 2: Features and datasets used to prepare a high level Environmental Sensitivities Map

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
Protected Areas	South African Protected Areas Database (SAPAD) - Q4, 2018, South African National Parks (SANParks) and Provincial	Marine Protected Areas	Very high	feature	Protected Areas are meant to stay in a natural or near natural state for biodiversity conservation purposes, hence the Very High sensitivity allocation. In some cases, such as the Mountain Catchment Areas and Protected Environments categories, the reason for the designation of protection is very specific and they may have mixed landscapes within the boundaries of the Protected Area i.e. they may have agricultural land, etc. In these cases, the sensitivity is lower. The proposed construction would require excavation of soils, potentially affecting flora, fauna and microbes. The maintenance of a linear servitude for EGI may also have impacts in the post construction phases.
		National Parks	Very high	feature	
		Nature Reserves	Very high	feature	
		World Heritage Sites (Core)	Very high	feature	
		Mountain Catchment Areas	Medium	feature	
		Protected Environments	Medium	feature	
		Forest Nature Reserve	Very high	feature	
		Forest Wilderness Area	Very high	feature	
		Special Nature Reserve	Very high	feature	
Protected Areas Buffers	SAPAD - Q4, 2018 and South African Conservation Areas Database (SACAD) - Q1,2017	10 KM buffer around National Parks or buffers received from SANPARKS	Medium	feature	Areas in the legislated buffers around National Parks and Nature Reserves need to be kept as natural or semi-natural as possible. For National Parks, delineated SANParks buffers were used. The 2014 Environmental Impact Assessment (EIA) Regulations Listing Notice 3 was used to guide the allocations for the remaining Protected Areas. EGI has impacts in both construction and post construction phases as they have a visual impact during the operational phase. A “Medium” sensitivity has been allocated because of the proximity to a National Park or nature reserve, but the potential biodiversity impact is lower.
		5KM buffer around Provincial Nature Reserves	Medium	feature	
		1KM buffer around Local Nature Reserves	Medium	feature	Minimal impact in areas around Local Nature Reserves. Most Local Nature Reserves are already close to or within urban areas, so the impact is minimal.
		1KM buffer around Special Nature Reserves	Medium	feature	Areas in the legislated buffers around National Parks and Nature Reserves need to be kept as natural or semi-natural as possible. For National Parks, delineated SANParks buffers were used. The 2014 EIA Regulations Listing Notice 3 was used to guide the allocations for the remaining Protected Areas. EGI has impacts in both construction and post construction phases as they have a visual impact during the

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					operational phase. A "Medium" sensitivity has been allocated because of the proximity to a National Park or nature reserve, but the potential biodiversity impact is lower.
		Buffer around World Heritage Sites (Buffers are Site Specific)	Medium	feature	World Heritage Sites are of international importance. However, the buffers are often large and in some cases may not have important biodiversity. It has been allocated a medium sensitivity because of the nature of the landscape that can accommodate development. The core areas of these World Heritage Sites are often Protected Areas, which have been allocated a Very High sensitivity. Some World Heritage Sites have palaeontological features, which could be affected by linear EGI that requires excavation.
		5 km buffer around protected forests	Medium	feature	The buffer areas around forest reserves have been allocated a medium sensitivity, as they are not the actual forests themselves. EGI construction and maintenance is more compatible with these areas.
Conservation Areas	South African Conservation Areas Database (SACAD) - Q1,2017 (DEA)	Biosphere reserves (Buffer area of the biosphere reserve, core areas are already protected)	Medium	feature	The buffers around biosphere reserves is assessed as having Medium sensitivity as these areas are often large and are transition zones areas that have non-natural landscapes within in them. Hence, there are many options and potential to not impact on biodiversity.
		Botanical gardens	Medium	feature	Botanical gardens are often in urban centres. They have been allocated a Medium sensitivity because they have largely landscaped areas and some natural or semi natural parts.
		Ramsar Sites (not already protected)	Very high	feature	Ramsar sites are of international importance. Most are already protected. Where they are not protected, they still are of Very High sensitivity because of their nature. The proposed EGI routes would need either to avoid these areas or implement engineering solutions to ensure that the power lines can traverse these areas. Ideally building in/near Ramsar sites should be avoided as they are important wetland features, and are important for aquatic fauna and flora at an international scale.

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
		1 km Buffer around National Botanical gardens	Medium	feature	Botanical gardens are often in urban centres. They have been allocated a Medium sensitivity because even though they are botanical gardens they have largely landscaped areas and some natural or semi natural parts. Their buffer areas only need consider a visual impact as a result of the EGI.
		5km Buffer around Ramsar Sites	Medium	feature	Ramsar sites are of international importance. Most are already protected. Buffers around these international sites have been allocated medium sensitivity because of the visual impact and lower sensitivity of biodiversity features in the buffer zones.
	UNESCO Website / SAHRA	UNESCO tentative sites	Very high	1km	The proposed EGI routes will try to avoid these areas of international heritage importance.
National Protected Areas Expansion Strategy	Priority Areas for Protected Area Expansion, 2017 (including updated Northern Cape Priorities) (DEA)	Protected areas expansion priority areas (Primary)	High	feature	There areas have been allocated a High sensitivity because they are fine scale areas, identified as priority areas for Protected Area expansion. They are small focused areas that provinces are looking to secure as part of the Protected Area network. If the areas are not yet Protected Areas then they can be assessed as Medium sensitivity with the correct mitigation measures in place for EGI particularly for maintenance required during the post construction phase.
Natural Forests	National Forest Inventory (NFI), sourced 2016, Department of Agriculture, Forestry and Fisheries (DAFF)	National Forest Inventory	Very high	1km (Medium)	Natural forests are protected in terms of the National Forestry Act (Act 84 of 1998), and are highly sensitive environmental features. For the development of proposed EGI, a servitude would need to be cleared (width will depend on the voltage), therefore a Very High sensitivity has been allocated and will be avoided.
Critical Biodiversity Areas (CBAs)	Provincial datasets (GP-2011 (with an update to the report in 2014), EC-2018, FS-2016, KZN-2012, Limp- 2013, MP-2013, NW- 2014, WC-2017, NC- 2016)	CBA	Very high	feature	By definition, CBAs are "an area that must be maintained in a natural or semi-natural state" in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for ecosystem types, species of conservation concern and ecological processes. These areas are of Very High sensitivity and often have sensitive ecosystem types and species. They are the minimum areas required for biodiversity persistence. EGI development would have a

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					significant impact on the species and ecosystems that CBAs help conserve if not routed correctly. Micro-siting could help minimise the impact.
		ESA	Medium	feature	An ESA is an area that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or Protected Area, or to generate or deliver ecosystem services. ESAs are assessed as Medium sensitivity because only ecosystem functioning needs to be maintained and some types of development such as EGI are compatible with ESAs.
Threatened Ecosystems	DEA and the South African National Biodiversity Institute (SANBI) 2010	CR	Very high	feature	A CR ecosystem type has very little of its historical extent (measured as area, length or volume) left in a natural or near natural state. Thus, any loss of remaining habitat will have a highly significant impact on the ecosystem type, therefore these areas are assessed as Very Highly sensitive and EGI development within them should be carefully planned to either avoid or minimise impact.
		EN	High	feature	An EN ecosystem type is one that is close to becoming Critically Endangered i.e. that has little of its historical extent left in a natural or near natural state. Thus any loss of remaining habitat will have a highly significant impact on the ecosystem, thus these areas are assessed as sensitive. EGI development would have a significant impact on the species and ecosystems that ESAs help conserve if not routed correctly. Micro-siting could help minimise the impact. Management plans should advise clearly on the maintenance of the servitude during the post construction stage.
		VU	Medium	feature	A VU ecosystem type still has the majority of its historical extent in a natural or near natural state. EGI development would need to be done in a sustainable manner, one in which impacts on key features and species of conservation concern are minimised.
Thicket	Thicket Vegetation, SANBI Vegetation Map, 2012 and the STEP Remnant Layer, 2003	Thicket Vegetation Types	Very high	N/A	Thicket vegetation types are often dense and shrubby. Some thicket vegetation is already highly degraded. For EGI construction, thicket vegetation types will

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					need to be removed from the construction servitude during the construction phase. Thicket takes a very long time to recover, and grow back, therefore it has been assessed as very highly sensitive. Ideally, these areas should be avoided.
Species of Conservation Concern	Endangered Wildlife Trust (EWT), SANBI and BirdLife South Africa (2017)	Critical Habitat for highly restricted Species Global Extent of Occurrence < 10 km^2	Very high	feature	This is the only remaining habitat for highly restricted or threatened species, and loss of these areas could result in extinction. At the time of this SEA, this dataset was only available for plants (with fauna to be rolled out soon). These areas are seen as a fatal flaw and should be avoided as far as possible. These areas are often very small, so micro-siting and design of the EGI can limit impact on these species.
		Confirmed occurrences of rare and threatened species	High	feature	These are areas known to have threatened species, as they have recent confirmed records of species. These areas are highly sensitive and mitigation measures will need to be employed to avoid impacting these species. At the time of this SEA, this dataset was only available for plants. Route design should try to avoid or minimise impact on these areas.
		Suitable unsurveyed habitat for threatened, rare and data deficient species.	Medium	feature	These areas may contain threatened or rare species, which need to be verified during the project specific phase; hence, a Medium sensitivity has been allocated. If species are present then the area becomes highly sensitive, and if nothing is present it becomes a low sensitivity.
		No known or expected threatened or rare species.	Low	feature	Rationale not required.
Bats	Roost dataset from the South African Bat Assessment Advisory Panel (SABAAP), 2017	Colony of 1 – 50 Least Concern bats + colony of 1 – 50 Low Risk Conservation Important bats	Very high	3km	Bat colonies are highly sensitive and these areas need to be avoided as far as possible for the routing of the EGI. EGI needs to be at least 3km away from the actual roost site because of the potential collision or electrocution risk of the power lines.
		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	3km	
		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	3km	
		Colony of 500 - 2000 Med-High Risk Conservation	Very high	3km	

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
		Important bats			
	Ecoregions (for bats), SABAAP, 2017	KwaZulu-Cape coastal forest mosaic	Medium	feature	These broad ecoregions are known to house habitat for bat species. Verification for presence of roosts need to be undertaken as applicable during the project specific phase. These have been allocated a Medium sensitivity because the sensitive areas within these broad areas need to be verified.
		Maputaland-Pondoland bushland and thickets	Medium	feature	
		Maputaland coastal forest mosaic	Medium	feature	
		Zambezian and Mopane woodlands	Medium	feature	
	Dolomite and Limestone, 2013, CSIR (Phase 1 REDZ)	Dolomite and Limestone	Medium	32m Buffer	Dolomite and limestone areas have a high probability of having bat roosts. They are of medium sensitivity because the potential presence of bats needs to be verified if any EGI construction is to take place.
Birds	BirdlifeSA exclusions Phase 1 SEA	Priority colonies	High	3km	Theses colonies are at high risk of collision with power lines. Ideally, areas close to colonies must be avoided for EGI routing in order to reduce collision risk. The location of priority bird species colonies should be avoided and are of high sensitivity.
		Transkei vulture IBA	High	3km	The location of targeted bird species are of High sensitivity. The risk of collision with power lines is high. Measures to mitigate, minimise and avoid collision and electrocution should be taken. Construction of the EGI can therefore affect populations, and these areas need to be avoided or appropriate mitigation measures applied in order to minimise the impact on populations.
		Amur nests	High	3km	
		Bearded vulture nest	High	3km	
		Verloernvlei Flyway	High	3km	
		Lesser Kestrel	High	3km	
		Potberg Cape Vulture	High	3km	
		Saldanha Flyway	High	3km	
	Vulture Data, 2017, VULPRO	VULPRO Cape Vulture colonies	High	3km	
		VULPRO Cape Vulture roosts	High	3km	
		VULPRO Cape Vulture restaurants	High	3km	
	Vulture Roost Sites, 2017, NMMU	NMMU Cape Vulture roost sites	High	3km	
	Bearded Vulture Risk Model, 2017, KZN wildlife	Bearded Vulture collision risk model	High	3km	Areas identified as high or very high risk for bearded vultures must be mitigated. These are areas with high probability of having vultures, so mitigation is key to ensure lower sensitivity in the post construction phase.
	Important Bird areas for South	Important Birds Areas (Formally protected)	Very high	none	These areas have been identified as priority areas for

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
	Africa, Bird Life, 2016				bird conservation and are already existing Protected Areas. They are thus Very High sensitivity and to be avoided. All EGI development is to have appropriate mitigation to reduce risk and sensitivity.
		Partially protected	High	feature	These IBAs are not formally protected, however they are still of High sensitivity because of their importance as bird areas. Appropriate avoidance and mitigation needs to be taken in the construction phase to reduce the risk of collision and electrocution of bird species.
		Unprotected	High	feature	
Estuaries	Estuaries, including flood plains, 2011, National Biodiversity Assessment, SANBI	All estuaries	Very high	feature	Estuaries are very highly sensitive and dynamic ecosystems, with significant scouring potential. For EGI construction, where the estuary is less than 500 m wide, the estuary can be traversed. However, where it is wider than 500 m, EGI development needs to avoid estuaries because they are ecologically sensitive, and would result in cascading environmental impacts if developed within. Ideally, they should be avoided as far as possible.
Freshwater Features	Rivers - 1:50 000 scale river lines from the Department of Water Affairs, 2015; Wetlands, updated National Biodiversity Assessment wetland layer, SANBI, 2017	Wetlands	Very high	feature	Natural wetlands are very highly sensitive ecosystems. For EGI construction, where the wetland is less than 500 m wide, it can be traversed. However, where it is wider than 500 m, EGI development needs to avoid wetlands by routing around them because they are ecologically sensitive, and would require diversion or infilling for construction in wetlands. Ideally, they should be avoided as far as possible.
		Rivers	Very high	feature	Rivers are very highly sensitive ecosystems. For EGI construction, where the river is less than 500 m wide, it can be traversed. However, where it is wider than 500 m, EGI development needs to avoid rivers by routing around them because they are ecologically sensitive, and would require diversion or infilling for construction within. Ideally, they should be avoided as far as possible.
Freshwater Feature buffers	Buffered Rivers and Wetlands	32 m buffer around Rivers	High	32m buffer and feature	Riparian areas are highly sensitive ecosystems. For EGI construction, where the area is less than 500 m wide, it can be traversed. However, where it is wider than 500 m, EGI development needs to avoid rivers by routing around them because they are ecologically

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					sensitive, and would require diversion or infilling for construction within. Ideally, they should be avoided as far as possible.
Strategic Water Source Areas (SWSAs) - Surface and Groundwater	Council for Scientific and Industrial Research (CSIR). April 2018	SWSAs (Natural areas)	High	feature	The natural area in the SWSA need to be maintained in a natural or semi-natural condition because these areas are the water factories of the country and construction/ development within them should be kept at a minimum. The run off from these areas that make up 10% of the country, supplies 50% of the country's water. Appropriate mitigation measures to avoid degradation and limit pollution could reduce the risk.
Land Cover	National Land Cover 2013/2014, DEA Habitat Modification Layer (improved land cover), SANBI 2017	Natural areas	Low	feature	These are the other natural areas, available for sustainable EGI development.
		Modified areas	Low	feature	These modified areas are not priority for the natural environment, and are thus preferred for EGI development.
		Old fields (mapped from imagery)	Low	feature	These are formerly ploughed areas that are degraded, which are more favourable than natural areas for sustainable EGI development.
Agricultural Land Capability	Land Capability Layer, 2016, DAFF	Land capability features with values ranging from 11-15	Very high	feature	These are areas with very high agricultural potential, and are earmarked for agricultural expansion. These areas are Very high Sensitivity from an agricultural point of view and should be reserved for agricultural activities to ensure food security. EGI construction should aim to apply appropriate measures to minimise the impact on these areas, and avoid agricultural areas with fixed infrastructure.
		Land capability features with values ranging from 8-10	High	feature	These are areas that are of high agricultural potential, and are earmarked for agricultural expansion. These areas are High Sensitivity from an agricultural point of view and should be reserved for agricultural activities to ensure food security. EGI construction should aim to apply appropriate measures to minimise the impact on these areas, and avoid agricultural areas with fixed infrastructure.
		Land capability features class 6 to 7	Medium	feature	These are areas that are of Medium agricultural potential. These areas are Medium Sensitivity from an

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					agricultural point of view. EGI construction should aim to apply appropriate measures to minimise the impact on these areas.
		Land capability features class 1 to 5	Low	feature	These are areas that are of low agricultural potential. EGI construction is favoured in these areas.
Field Crop Boundaries	Field crop boundaries, 2017, DAFF	Irrigated Areas (pivot agriculture)	Very high	N/A	Irrigated pivots have fixed infrastructure that would need to be moved permanently for EGI development. Ideally, EGI routes should be minimised in pivot agriculture areas.
		Shadenet	Very high	feature	Shadenet crops have fixed infrastructure that would need to be moved for EGI development. Ideally, EGI routes should be minimised in shadenet areas.
		Viticulture	Very High	feature	Viticulture represents high value agricultural crops that support the Gross Domestic Product. Ideally, EGI routes should be minimised in viticulture areas or should be placed between vines.
		Horticulture	Very High	feature	Horticulture represents high value agricultural crops that support the Gross Domestic Product. Ideally, EGI routes should be minimised in horticultural areas.
		Other cultivated areas	High	feature	Ideally, high value agricultural areas should be avoided where possible to prevent loss of income/economic impact.
Coastline	Coastline, 2015, SANBI and Department of Rural Development and Land Reform	Buffered coastline (1km)	Very high	1km	Coastal areas are particularly sensitive to development that may cause coastal erosion and often have human settlements. Additionally, the coastline is dynamic. This is very highly sensitive to EGI development as these ecosystems are sensitive and changes in the coast often has cascading effects.
Karoo Central Astronomy Advantage Area (KCAAA)	KCAAA Footprint, obtained via CSIR (2017)	Karoo Central Astronomy Advantage Area	Medium	feature	This area is assessed as Medium sensitivity and is used as a flag for the KCAAA. The appropriate mitigation needs to be taken into account when constructing EGI in this area.
Square Kilometre Array (SKA) Area	SKA Core Area, 2017, from SKA via CSIR	SKA study area	Very high	feature	The SKA study area serves as a flag for the SKA telescopes. EGI development needs to be avoided where the SKA telescopes are placed due to potential electro-magnetic impacts.
		SKA telescopes with 20km buffer	Very high	20km	The SKA study area serves as a flag for the SKA telescopes. EGI development needs to be avoided

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					where the SKA telescopes are placed and their 20km buffer due to potential electro-magnetic impacts.
Defence	Defence Data, 2017, South African National Defence Force	Forward Airfield	Very high	1km	These areas have airfields that are important for the Military. Access is limited and therefore the EGI route identification in these areas need to be limited, as these areas cannot be compromised for such construction.
			Medium	10km	This serves as a flag for areas that are 10 km form military airfields. The EGI route identification process must make a note of this and take the location of the military airfield into account in design.
		Air Force Bases	Very high	8km	These areas have Air Force Bases that are important for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited, as these areas cannot be compromised for such construction. EGI also needs to be compliant with Air Force Base requirements and designed in accordance with it
			Medium	28 km	
		High Sites	Very high	1km	These High Sites are important for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited. Specific design of pylons may be required.
		Operational Military Bases	Very high	1km	These Operational Military Bases are important for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited. Specific design of pylons may be required.
		Military Training Areas	Very high	1km	These Military Training Areas sites are important for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited. Specific design of pylons may be required.
		Bombing Ranges	Very high	28km	These areas have Bombing Ranges that are important for the Defence Force. Access here is limited, and EGI routes should not coincide with bombing ranges because of the high risk of explosions and damage to the infrastructure.
			High	28 - 56km	This serves as a flag for areas within the buffer area from a Defence Force Bombing Range. The location of the bombing range must be taken into account in
			Medium	56-111km	

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					design and identification of EGI routes.
		Shooting ranges	Very high	1 km	These areas have Shooting Ranges that are important for the Defence Force and are of Very High sensitivity. Access here is limited, and EGI routes should not coincide with shooting ranges because of the potential risk of explosions.
		Border Posts	Very high	1km	These Border Posts are important for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited, as these areas cannot be compromised for such construction.
		Ammunition Depots	Very high	10 km	These areas have ammunition deposits that are important for the Defence Force and are of Very High sensitivity. Access here is limited and EGI routes should not coincide with these areas.
		All Other DoD features (Including Naval Bases, Housing, Offices etc.)	Very high	1km	These are important areas for the Defence Force. Access is limited and therefore the EGI route identification in these areas need to be limited, as these areas cannot be compromised for such construction.
Airports (Major, Landing Strips, Small Aerodromes)	REDZs 1 SEA dataset and EGI SEA dataset, 2017	Major Airports	Very high	8km	This serves as a flag for a buffer area around the feature. The EGI route identification process must make a note of this. This feature is allocated a Very High sensitivity. Ideally, EGI should not be too close to airports, or it need to be designed to be lower to facilitate landing.
			Medium	15 km	This serves as a flag for a buffer area around the feature. The EGI route identification process must make a note of this. This feature is allocated a Medium sensitivity. Ideally, EGI should not be too close to airports, or it need to be designed to be lower to facilitate landing.
		Landing strips	Very high	2km	EGI should not to be constructed close to landing areas as they pose a collision risk with aircrafts.
		Other civil aviation aerodromes (small aerodromes)	Medium	8km	This serves as a flag for a buffer area around the feature. The EGI route identification process must make a note of this. This feature is allocated a Medium sensitivity.

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
	SACAA	Civil Aviation Radars	High	4.6 km	Civil aviation radars are of high sensitivity for EGI development. The EGI can interfere with aviation radars and should ideally not be constructed close to them.
			Medium	15 km	This serves as a flag for a buffer area around the feature. The EGI can interfere with aviation radars and should ideally not be constructed close to them.
	ATNS	Air Traffic Control and Navigation Sites	Medium	5 km	Air traffic control sites are of Medium sensitivity as their antenna may need to be factored into the design of EGI.
	SACAA	Danger and Restricted Airspace	High	As demarcated on the sensitivity maps	EGI must be restricted from danger and restricted airspace, as these are often air space for military testing. These areas should be avoided.
Paleontological heritage resources	Geological Features and Substrates of Palaeontological Importance, Geology Layer, 2014, Council for Geosciences	High sensitivity areas (*) - refer to below Adelaide, Asbestos Hills, Boegoeberg Dam, Bothaville, Brulsand, Campbell Rand, Clarens, Drakensberg, Dwyka, Ecca, Elliot, Enon, Ghaap, Kameeldoorns, Koegas, Kuibis, Matsap, Molteno, Prince Albert, Rietgat, Schmidtsdrif, Schwarzrand, Stalhoek, Sultanaoord, Tarkastad, Vryburg, Whitehill, Witteberg	High	feature	This layer identifies substrates with a high probability of containing palaeontological items/features. For EGI construction, this is of importance during the construction phase. Areas with High and Very High sensitivity should be avoided as best as possible in order to minimise impact.
		Medium sensitivity areas (**) - refer to below Achab, Allanridge, Bidouw, Bredasdorp, Ceres, Kookfontein, Korridor, Mesklip Gneiss, Modderfontein, Granite/Gneiss	Medium	feature	This layer identifies substrates with a medium probability of containing palaeontological items/features. For EGI construction, this is of importance during the construction phase. Areas with significant palaeontological sensitivity should be avoided as best as possible in order to minimise impact.

Feature Category/Factor	Source/Dataset	Features		Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
		Concordia Granite Dwyka Fort Brown Geselskapbank Gladkop Grahamstown Hartebeest Pan Granite Hoogoor Kalahari Kamieskroon Gneiss Karoo Dolerite Khurisberg Konkyp Gneiss	Naab Nababeep Gneiss Nakanas Nardouw Nuwefontein Granite Rietberg Granite Skoorsteenberg Stinkfontein Styger Kraal Syenite Table Mountain Tierberg Volksrust Waterford			
Heritage	Mapped Heritage Features, SAHRA, 2018	World Heritage Sites (Core)		Very high	feature	Protected Areas are meant to stay in a natural or near natural state for biodiversity conservation purposes, hence the Very High sensitivity allocation. The proposed construction would require excavation of soils, potentially affecting flora, fauna and microbes.
		World Heritage Sites (Buffer)		Medium	feature	World Heritage Sites are of international importance. However, the buffers are often large and in some cases may not have important biodiversity. The core areas of these World Heritage Sites are often Protected Areas, which have been allocated a Very High sensitivity. Some World Heritage Sites have palaeontological features, which could be affected by linear EGI that requires excavation; hence, a High Sensitivity has been allocate here.
		Grade I sites		Very high	2km	These mapped heritage features are of Very High sensitivity, and ideally, these areas should be avoided by the EGI. The EGI would require excavation, therefore the risk of finding significant finds are very high.
		Grade II sites		Very high	1km	
		Grade IIIa sites		High	150m	These mapped heritage features are of High sensitivity, and ideally, these areas should be avoided by the EGI. The EGI would require excavation, therefore the risk of finding significant finds are high.
		Grade IIIb sites		High	100m	
		Grade IIIc sites		High	50m	

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
		Ungraded	Very high	100m	These mapped heritage features are of Very High sensitivity, and ideally these areas should be avoided by the EGI. The EGI would require excavation, therefore the risk of finding significant finds are very high.
		Battlefields (Grade IIIb)	Very high	5 km	
Visual	Modelled from Digital Elevation Model, 2015, NGI	Slopes > 25% or 1:4	Very high	feature	Areas with high slope/angle to be avoided as they can affect the stability of the EGI during and after construction, and may present an access constraint.
	NFEPA, 2011	Major River	High	32-500 m	EGI can affect the sense of place if placed close to rivers.
	NGI, 2016	Coastal zones	Medium	1-4 km	EGI can affect the sense of place if placed close to the coast.
	Provincial data sets on Game Farms and Private Reserves (2014-2017) SACAD Q2, 2017, DEA	Private reserves and game farms	Very high	0-2.5 km	Game farms within this distance are visually sensitive towards EGI. EGI can be seen as visually obtrusive. EGI can affect sense of place if they are located close to game farms. The proximity to the game farm means it is more sensitive. Game/ private reserve farmers general prefer to have their background as natural as possible.
			High	2.5-5 km	
			Medium	5-10 km	EGI can affect sense of place if they are located close to game farms. These buffered distances are not as close to game/private reserve farmers, however there is still some potential for EGI to be seen as visually obtrusive.
			Low	>10 km	Far enough to not have any impact on game farms from a visual perspective, hence the low sensitivity allocation.
	Location of the South African Large Telescope (SALT), sourced from the CSIR, 2017	SALT	Very high	0-25 km	This is not compatible with the construction and operation of EGI due to potential electro-magnetic interference on the telescope due to the EGI. The location of the SALT must be avoided due to its sensitivity.
	Mapped Heritage Features, SAHRA, 2015	Heritage feature: Grade I sites	Medium	feature- 1.5 km	Visually sensitive for areas around heritage sites as EGI has an operational component and is visible.
		Heritage feature: Grade II sites	Medium	1- 1.5 km	
		Heritage feature: Grade IIIa sites	Medium	150 m - 1.5 km	

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
		Heritage feature: Grade IIIb sites	Medium	50 m - 1.5 km	
		Heritage feature: Grade IIIc sites	Medium	30 m - 1.5 km	
	Location of Towns, AfriGIS Towns – 2017	Town, villages and settlements outside large urban areas	Very high	0-500 m	These areas need to be avoided for safety reasons (especially with regards to potential accidents and collapse), as well as to avoid re-settlement concerns. In addition, vandalism concerns contribute to this sensitivity allocation.
			High	500 m - 1 km	
			Medium	1 km - 2 km	Far enough to not impact any people or towns, but still in walking distance for the slight risk, hence it has been allocated a medium sensitivity.
	NGI, Coastline 2016	National Roads and Scenic Routes	Very high	0-500m	EGI can run alongside but not over roads due to height clearance and risk of power line collapse. The proximity of the road determines the sensitivity (i.e. the closer EGI is to the road, the higher the sensitivity).
			High	500m-1km	
			Medium	1 km-2 km	
	Western Cape Department of Transport, 2013, Sourced from the CSIR	Western Cape Routes	Very high	1km	
Major Towns	Location of towns, AfriGIS Towns – 2017	Towns, villages and settlements and urban areas	Very high	N/A	These areas need to be avoided for safety reasons (especially with regards to potential accidents and collapse), as well as to avoid re-settlement concerns. In addition, vandalism concerns contribute to this sensitivity allocation.

Table 3: Features and datasets used to prepare a high level Draft Engineering Constraints Map

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
Coastline (including Estuaries)	SANBI 2004	Coastline & Estuaries	Very high	10 km	The atmosphere in the vicinity of the coastline has corrosive properties. This means that increased cost would be needed if power lines are routed within these areas as the EGI would need to be reinforced with an engineering solution address the corrosion risks.
Slope	25m NGI DEM	>45◦	Very High	feature	Expensive engineering solutions may be required in order to route the power lines up very steep slopes. These areas are therefore rated with a Very High sensitivity.

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
Access/Roads	Eskom - NGI Roads Layer 2016	Roads	Low (nearest mapped road >2 km from site)	feature	Access to power lines is important, as the servitude beneath the power line often needs to be cleared in some areas and well maintained.
Geology	Council for Geoscience, 1997	Dolomite (and other rock types)	High	feature	Additional reinforcement may be required in areas that are prone to erosion. In addition, geology that may pose a subsidence risk should also be avoided as best as possible.
		Dolomite restricted to Gauteng and Mpumalanga	High	feature	
Gully Erosion	DAFF Gully Erosion Datasets	Footprint of erosion/gully > 500 m^2	High	feature	Areas with deep gully erosion should be avoided, as there is a risk that the EGI may be exposed in areas prone to such erosion. Areas with existing gullies may result in further erosion that may cause instability for the EGI and may require reinforcement for the pylons.
Soil Erodibility	DAFF Soil Erosion Hazard Classes - South Africa and Lesotho, 2010	Hazard Class - High	High	feature	Areas with high soil erodibility do pose a risk to the EGI stability and reinforcement of the pylons will be needed. The data is too coarse scale to weigh it higher.
Settlements	AfriGIS Towns Layer	Towns, villages and settlement spatial footprints	Very high	feature	These areas need to be avoided for safety reasons (especially with regards to potential accidents and collapse), as well as to avoid re-settlement concerns and increased cost in this regard. In addition, vandalism concerns contribute to this sensitivity allocation.
Railway Lines (All Railways)	DRDLR Topo, 2006 - Transnet	All Railway Lines	Medium	1 km	Avoid crossing railway lines as far as possible. Ideally try to route the power line parallel within a safe distance away from the railway lines.
Industrial Areas	DEA 2013/2014 land cover	Existing industrial areas	Low	feature	These areas are considered suitable for EGI development.
Industrial Expansion	SDFs, IDPs, consultation with authorities	Planned industrial activities	Low	feature	
Mining	DMR, 2018 (SAMRAD Mining Applications)	Retention Permit, Reconnaissance Permission/Permit, Prospecting Right, Prospecting Right Renewal, Mining Right, Mining Permit, Exploration Right, Burrow Pit, Amending An Existing Right	Very high	feature	Ideally, all areas with existing and abandoned mining areas should be avoided as they pose a risk to the EGI, especially for underground mines. Subsidence and instability caused by mining is unfavourable for the EGI.
Major dams	DWA Dams Data	Dams	Very high	feature	Avoid these areas because of the cost of engineering measures that would be needed to traverse dams. Dams wider than 500 m should be avoided.
Estuaries	National Biodiversity Assessment (NBA) 2017/18	All Estuaries	Very high	feature	Avoid these areas because of the cost of engineering measures that would be needed to traverse estuaries, including aspects to address corrosion. Estuaries wider than 500 m should be avoided.

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
Wetlands	Wetland Data 2017	All Wetlands	Very high	feature	Avoid these areas because of the cost of engineering measures that would be needed to traverse wetlands.
Rivers	NFEPA River Data 2010 and NGI Mapped River Footprint	Drainage Lines	Very high (Order 6-7)	1000m buffer around feature	Rivers wider than 500 m should be avoided. They are not advised to be traversed.
			High (Order 4-5)	500m buffer around feature	Avoid these areas because of the cost of engineering measures that would be needed to traverse rivers wider than 500 m.
			Medium (Order 1-3)	10m buffer around feature	Smaller rivers could be traversed easier than wider rivers; hence it has been allocated a Medium Sensitivity.
	NBA 2018 (South African Inventory of Inland Aquatic Ecosystems)	Valley Bottom include Stream (Exclude Northern Cape)	Very High	feature	Avoid these areas because of the cost of engineering measures that would be needed to traverse wetlands. Often these are too wide to be crossed.
WULA Agreements	NFEPA River and Wetland Data 2010	Rivers and wetlands buffered by 500 m	High	500 m buffer around feature	Additional cost associated with having to apply for a Water Use Licence.
Forestry Potential (EC)	EC Parks and Tourism Agency 2014	Potential Areas for Forestry	Medium	feature	These areas should be avoided because of the height clearance and servitude clearance requirements. There is potential future conflict.
Thicket	Albany Thicket, SANBI Vegetation Map, 2017	National	High	feature	This has been rated a High sensitivity because of the additional cost associated with clearing of the Thicket during the construction phase, as the thicket is dense and potentially deep-rooted.
Sugar Cane	KZN Land Cover 2011 [Sugar cane farming and emerging farming data]	Sugar Cane Farm Boundaries	High	feature	This has been rated a High sensitivity because of the potential safety risk that applies due to burning operations, as well as the need to raise the power line to avoid this impact.
Commercial Forestry	Data on Commercial Forestry provided by DAFF in June 2016	DAFF Commercial Forests	High	feature	These areas should be avoided because of the height clearance and servitude clearance requirements. There is also additional cost associated with purchasing servitudes on highly productive land.
Field Crop Boundaries (Pivot >500 m radius)	Agriculture Field Crop Boundary Data 2016	All	Very high	feature	Try to avoid these areas because of the cost associated with having to move fixed centre pivot infrastructure if power lines need to traverse areas where the pivots are

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/ Buffer	Rationale for Mapping Sensitivity
					greater than 500 m in diameter.
Field Crop Boundaries (vineyards and orchards)	Agriculture Field Crop Boundary Data 2016	All	Very high	feature	The pylon footprint may take up space on agricultural land, therefore servitude negotiation will expensive, and the area under the EGI will need to be maintained.
High incidence for lightning strikes	Eskom, July 2014	Highest 10% risk areas	Medium	feature	Reinforcement will be required on the cables for additional lightning resistance. This has an increased cost.
High incidence for fire	Eskom, November 2016 (2002-2017)	Highest 10% risk areas	Medium	feature	The pylons need to be raised (hence increased cost) to avoid the risk of catching alight or tripping during fires.
High incidence for wind	Eskom, July 2014	Highest 10% risk areas	Medium	feature	Reinforcement will be required on the EGI for additional strong wind resistance. This has an increased cost.
High incidence for flooding	Eskom, 2015 (sourced in 2018)	Highest 10% risk areas	Medium	feature	Reinforcement of the pylon bases will be required for additional flooding resistance. This has an increased cost.
High incidence for snow conditions	Eskom, July 2014	Highest 10% risk areas	High	feature	Reinforcement will be required on the cables for additional snow/additional weight associated with snow. This has an increased cost.
High incidence for pollution	Eskom, July 2014	Highest 10% risk areas	High	feature	Reinforcement will be required on the cables for additional pollution resistance. This has an increased cost.

3.4.4 Wall to Wall Constraints Maps

Based on the updated list of features and sensitivities, the constraints mapping outputs were developed at a national scale for both environmental sensitivities and engineering constraints:

- The four tiered wall to wall draft environmental sensitivities map and the interpretation of each tier of constraint is illustrated in Map 1a (excluding Rivers), Map 1b (including Rivers) and Table 4, respectively.
- The four tiered wall to wall draft engineering constraints map and the interpretation of each tier of constraint is illustrated in Map 2 and Table 5, respectively.

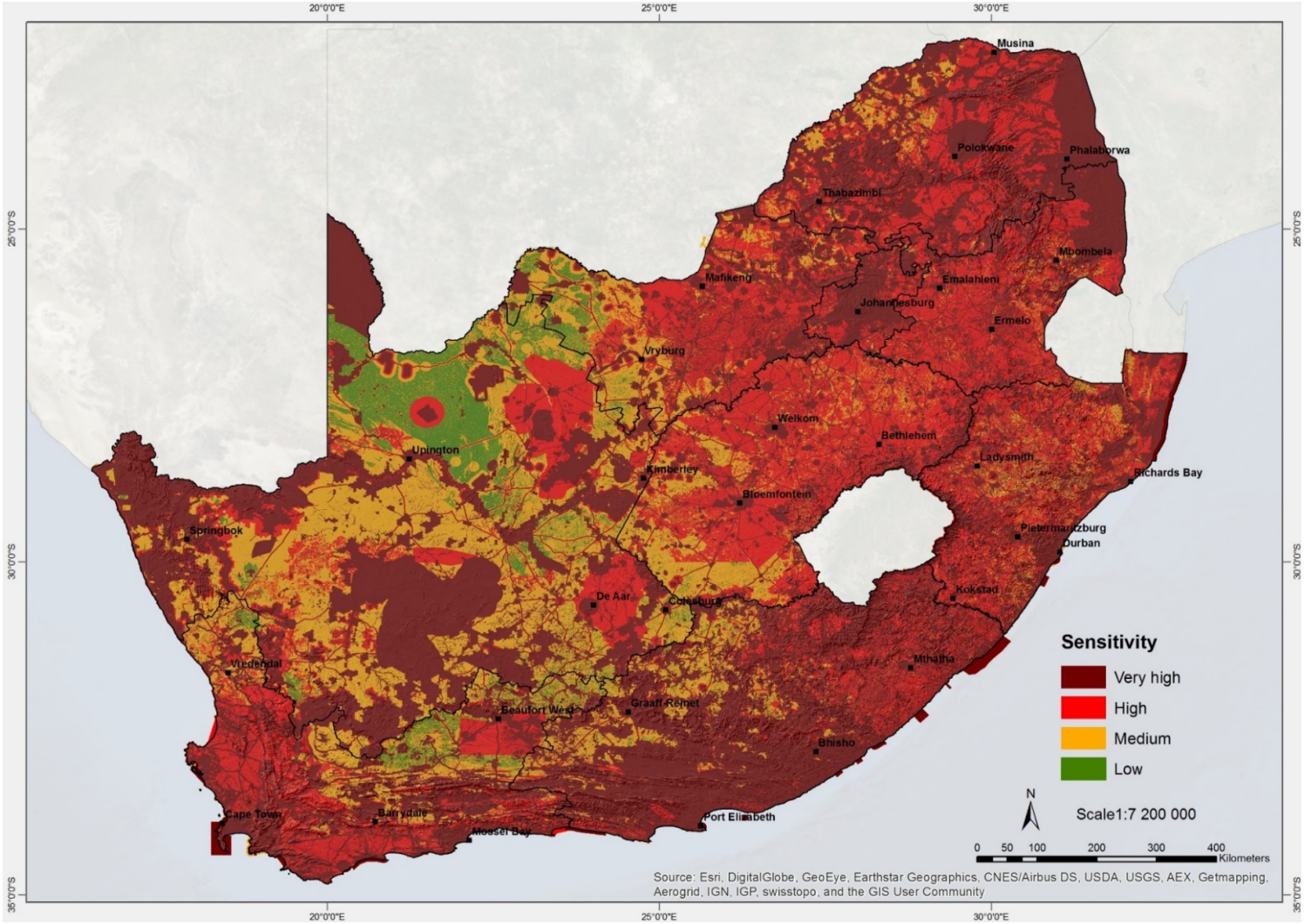
Note that sensitivities for Mining Areas, Towns, Villages and Settlements as well as Visual Sensitivities have not been displayed in relevant maps due to scale.

Table 4: Environmental sensitivities interpretation

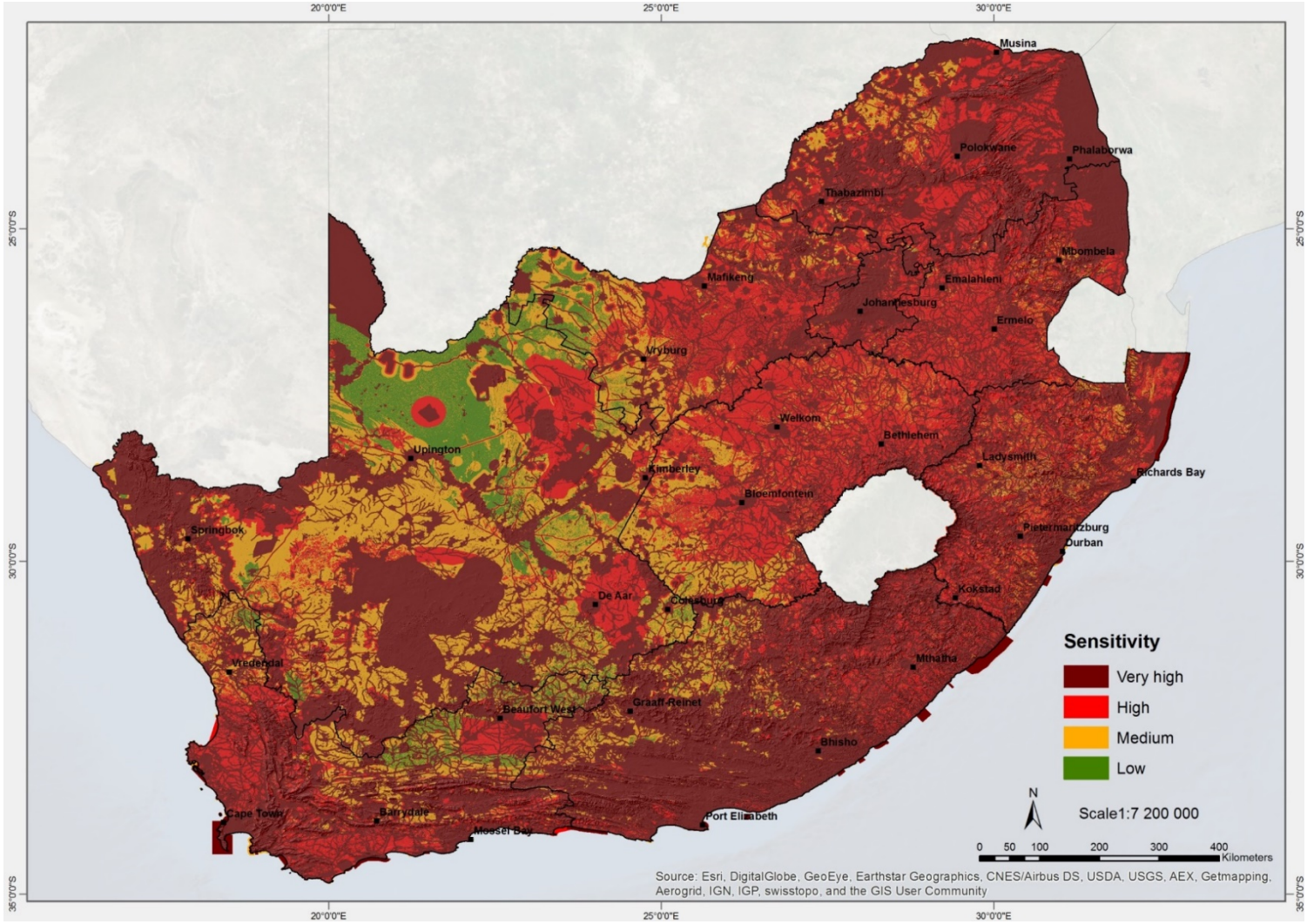
Environmental Sensitivities	
Constraint	**Description**
Very High	The area is rated as extremely sensitive to the negative impact of EGI development. As a result, the area will either have very high conservation value, very high existing/ potential socio-economic value or hold legal protection status.
High	The area is rated as being of high sensitivity to the negative impact of EGI development. As a result, the area will either have high conservation value and or existing/potential socio-economic value.
Medium	The area is rated as being of medium sensitivity to the negative impact of EGI development. As a result the area will either have medium levels of conservation value and/or medium levels of existing/potential socio-economic value.
Low	Area is considered to have low levels of sensitivity in the context of EGI development.

Table 5: Engineering constraints interpretation

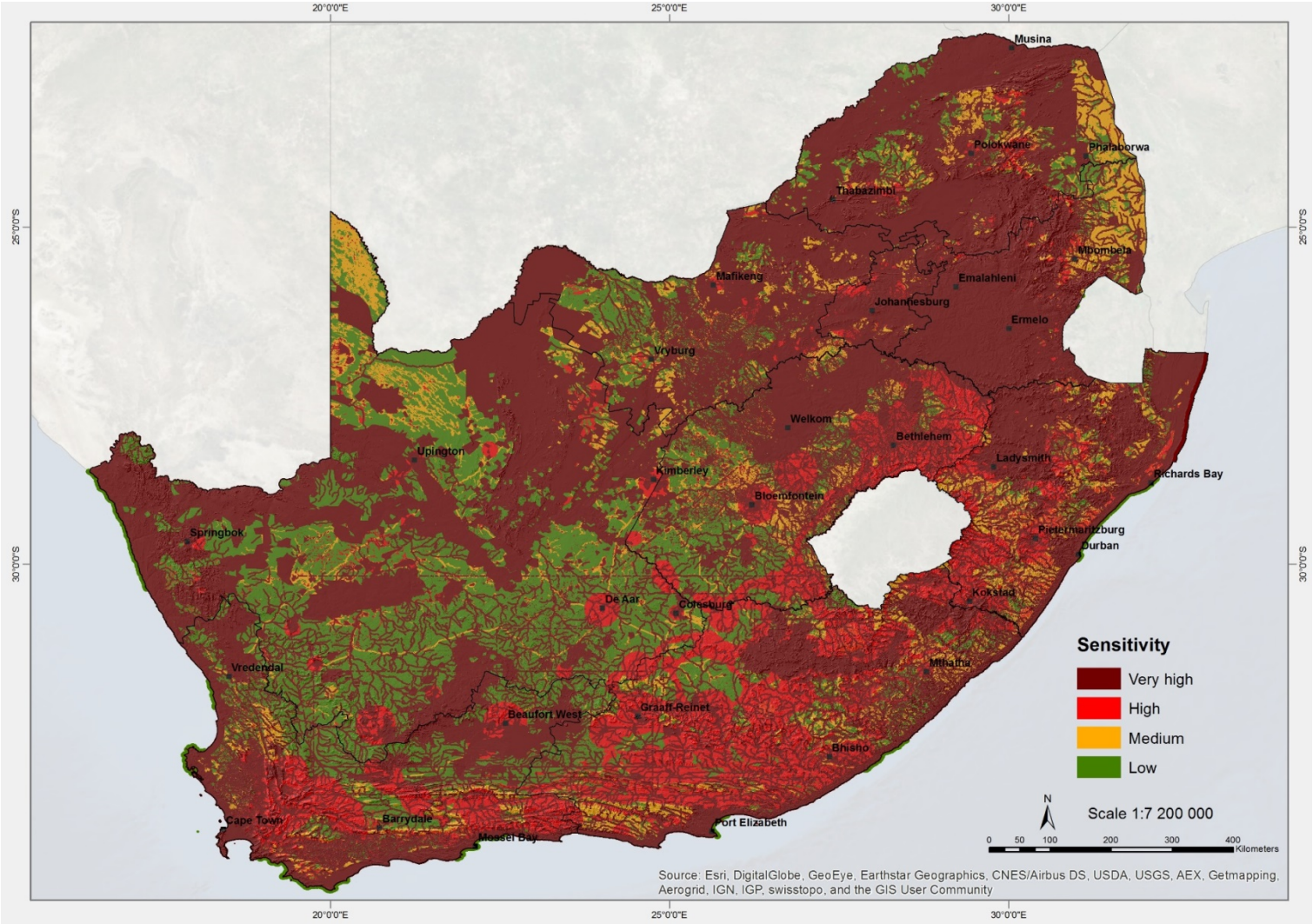
Engineering Constraints		
Constraint	**Description**	**Feature Cost**
Very High	The lifetime cost associated with development in this area is greater than 175% the baseline lifetime cost index.	c=>1.75x
High	The lifetime cost associated with development in this area is between 150% and 175% the baseline lifetime cost index.	c=>1.5x and ≤1.75x
Medium	The lifetime cost associated with development in this area is between 120% and 150% the baseline lifetime cost index.	c=1.2x and ≤ 1.5x
Low	The lifetime costs associated with development in this area is less than 120% times the baseline lifetime cost index.	c =<1.2x



Map 1a: Draft Wall to Wall Environmental Constraints Map (Rivers have been **excluded** from this map).



Map 1b: Draft Wall to Wall Environmental Constraints Map (Rivers have been **included** in this map).



Map 2: Draft Wall to Wall Engineering Constraints Map

3.5 Phase 3: Draft Pinch Point Analysis

The draft Pinch Point Analysis was undertaken at the end of Phase 1 to guide and inform the location of the corridors to be assessed by the specialists in Phase 4. This analysis involved synthesising and overlaying the various mapping outputs to determine whether available routing options exists end to end for each of the corridors assessed. Based on the wall to wall constraints maps, a single layer of all **Very High** sensitive areas was created at a national scale (Map 3). The remaining sensitivity layers were consolidated and referred to as available routing space in the analysis. Due to their sensitivity, these **Very High** sensitive areas potentially impact the design of the EGI, and consequently the location of the corridors. Some examples of features rated with a Very High sensitivity includes Protected Areas, mountainous areas, Critical Biodiversity Areas (CBAs), threatened ecosystems and water related features.

A complete pinch point was defined as a point within a corridor where no clear power line routing opportunities exist without having to traverse an area delineated as Very High sensitivity from either an environmental or engineering perspective. Partial pinch points, instances where fewer than five unique routes through different land parcels without having to traverse an area delineated as Very High sensitivity, were also identified.

In the event of a complete or partial pinch point, the area outside and immediately adjacent to that point in the corridor was considered from an environmental and engineering constraints perspective. Where relief (less sensitive area) was shown to be present, and without compromising the intersection of the corridors with the key anchor points (as best as possible), the corridor boundary was shifted in the direction of relief. Where no obvious relief was shown to be present, the position of the corridor remained unchanged. The output from this process was a draft refined set of corridor positions i.e. the Power Corridors, which represents areas of highest demand for grid infrastructure without compromising on the environment.

Refer to the 2016 EGI SEA Report (DEA, 2016) for further details on the Pinch Point Analysis methodology.

3.5.1 Identification of Pinch Points

Expanded Western EGI Corridor

The Pinch Point Analysis for the preliminary Expanded Western EGI Corridor showed very little relief (Maps 3 and 4) within the 100 km wide corridor. The main features representing the areas of very high sensitivity within the corridor included:

- Diamond mining areas close to the coast within the Northern Cape, which pose a threat to potential EGI development, mainly from a stability and safety perspective. Additional detail on the impact of mining areas on EGI and vice versa is captured in Part 4.2.10 of this EGI Expansion SEA Report;
- The Richtersveld National Park and World Heritage Site, and CBAs; and
- Other Protected Areas.

The possibility of moving this corridor inland to provide some relief was explored; however, it was decided to maintain the corridor footprint based on a number of reasons, as noted below.

The main reason for expanding the Expanded Western EGI Corridor is to facilitate power integration between Namibia and South Africa. If the corridor were to the shifted further inland, then the Orange River would need to be traversed at its widest. The Orange River gets wider as it moves away from the coastline, and although the Orange River is currently shown as a line (spatial dataset), it is in fact much wider than 500 m. Shifting the proposed corridor inland would therefore pose a greater environmental and engineering constraint given that the maximum distance between two pylons is approximately 500 m apart (to maintain line stability and prevent line sagging).

Furthermore, the footprint of the Expanded Western EGI Corridor (Map 5) is able to connect to the existing substation at the Namibian border, and the corridor includes the footprint of the power line currently planned for construction between 2017 and 2020. Substations are considered anchor points[2] in the context of the SEA Process. The positions of existing and planned new Eskom substations are also illustrated in Map 5. Therefore, any refinement to the position of the corridors undertaken as part of the SEA Process was done within the parameters of the anchor points.

Lastly, from a biodiversity perspective, the Northern Cape is what is termed a "high option landscape", and is under little development pressure. This means that there are many more natural areas left in the province to meet "biodiversity targets". Consequently, the CBA network in the Northern Cape is more flexible in terms of development than any other province, so the CBA sensitivity in the province is not as critical as in others e.g. Mpumalanga or KwaZulu-Natal.

The Expanded Western EGI Corridor was therefore not shifted as part of the draft Pinch Point Analysis.

Expanded Eastern EGI Corridor

The Pinch Point Analysis for the Expanded Eastern EGI Corridor showed little relief (Maps 3 and 6). The main features representing the areas of Very High sensitivity within the corridor included:

- Mining areas in northern KwaZulu-Natal, which pose a threat to potential EGI development, mainly from a stability and safety perspective. Additional detail on the impact of mining areas on EGI and vice versa is captured in Part 4.2.10 of this EGI Expansion SEA Report;
- Densely populated regions and settlements within KwaZulu-Natal, which are under development pressure;
- CBAs within KwaZulu-Natal;
- Protected Areas and World Heritage Sites (including the iSimangaliso Wetland Park, and other nature reserves); and
- Bat eco-regions.

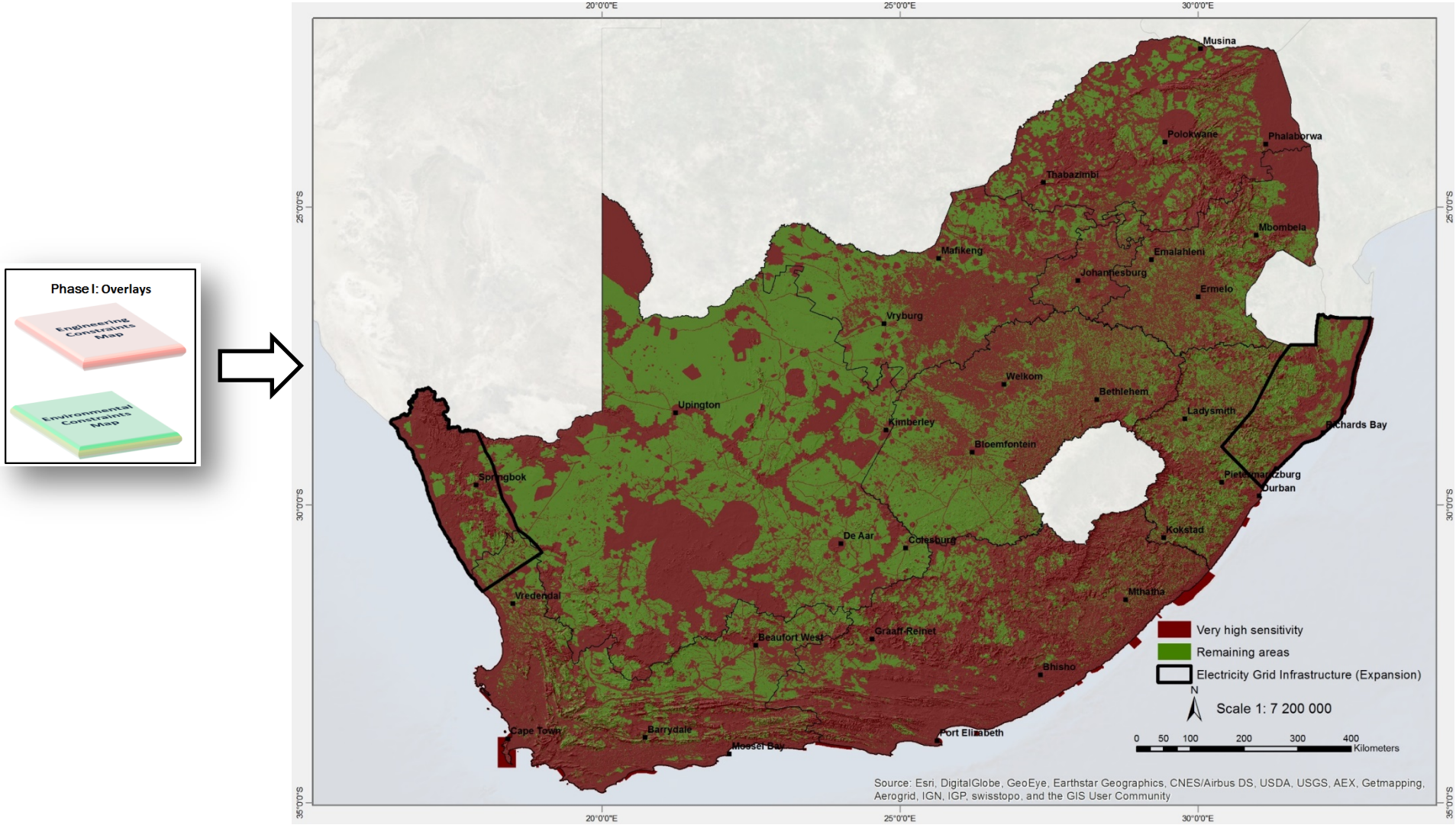
The purpose of this extension is to facilitate the import of power from Mozambique. The corridor could not be shifted further inland to find more relief due to the location of Swaziland (i.e. the outputs of this SEA applies within the bounds of the Republic of South Africa).

The Expanded Eastern EGI Corridor was therefore not shifted as part of the draft Pinch Point Analysis.

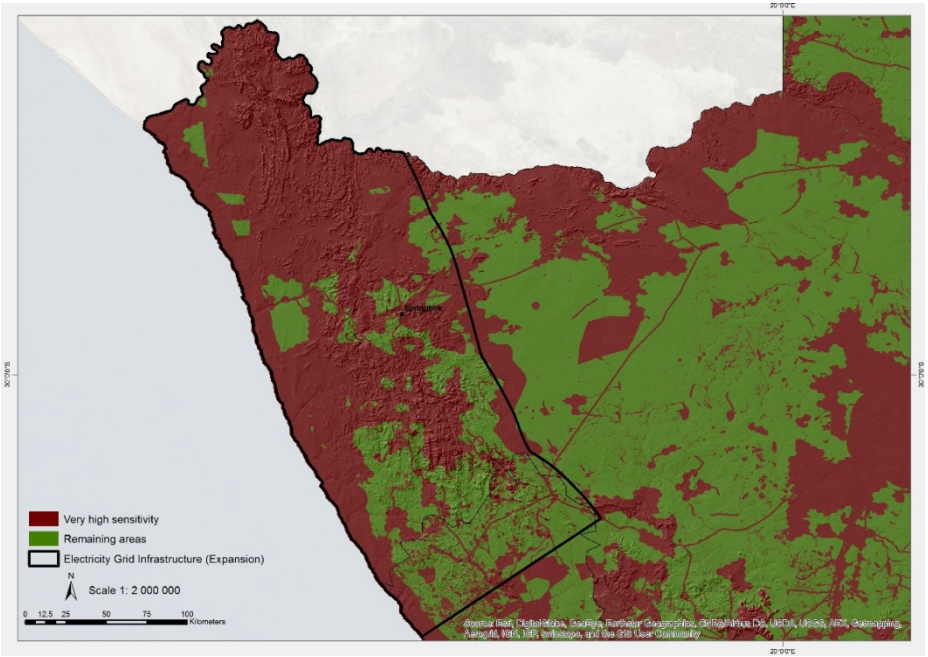
3.5.2 Draft Refined Corridors

The output from this first Pinch Point Analysis process was a set of Draft Refined Corridors (Maps 7 and 8). A 25 km assessment buffer was added, and 125 km wide corridors were used in the specialist assessment phase (Phase 4). This was undertaken to make provision of potential realignment of the corridors subsequent to the specialist studies and consultation.

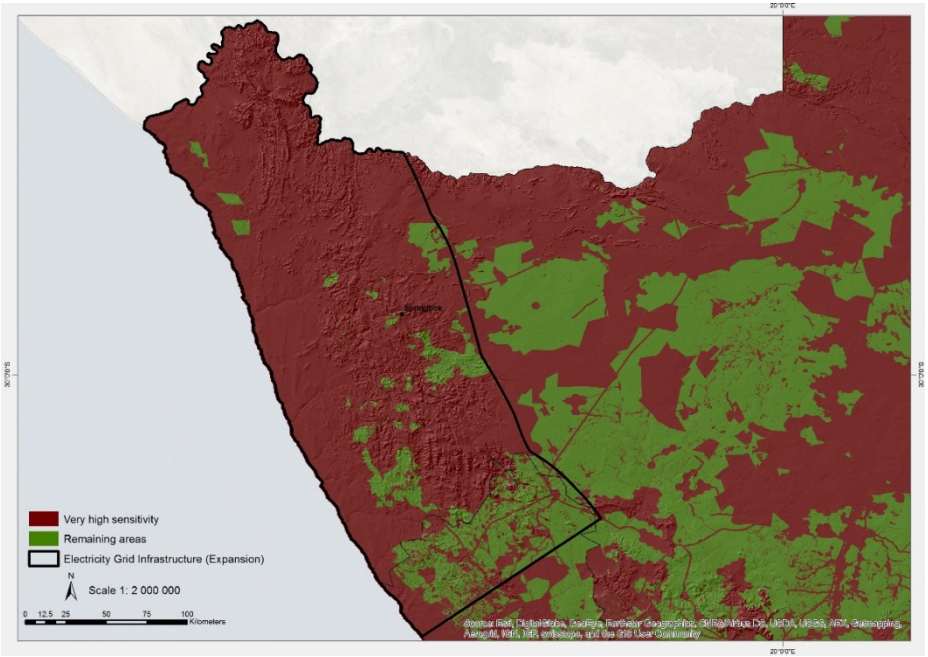
[2] Any positional change made to the corridors must not compromise the intersection of the corridors with the fixed position of the substations.



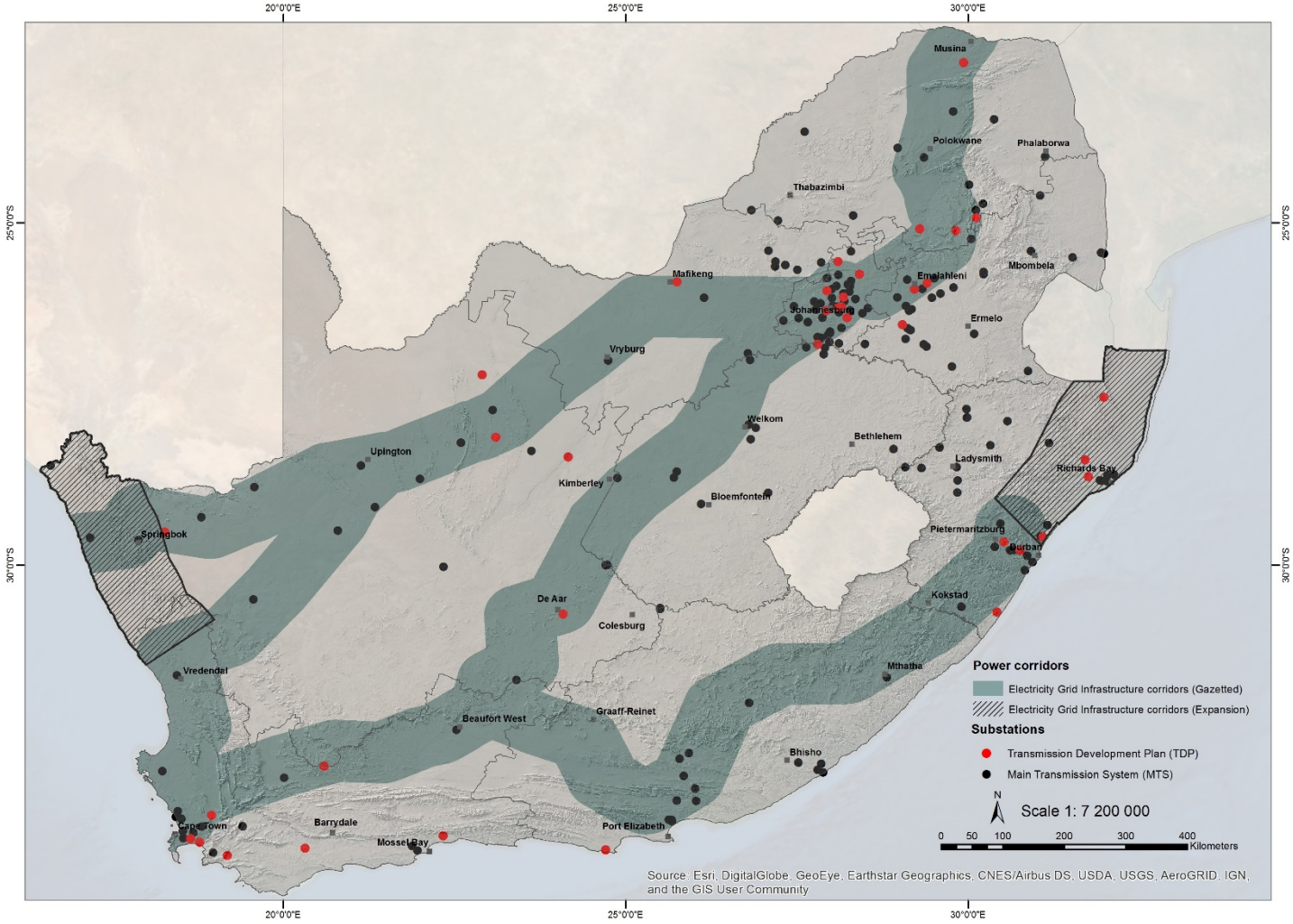
Map 3: Consolidated environmental sensitivity map with Preliminary EGI Expansion corridors overlay (excluding Rivers, Mining Areas, Towns, Villages and Settlements)



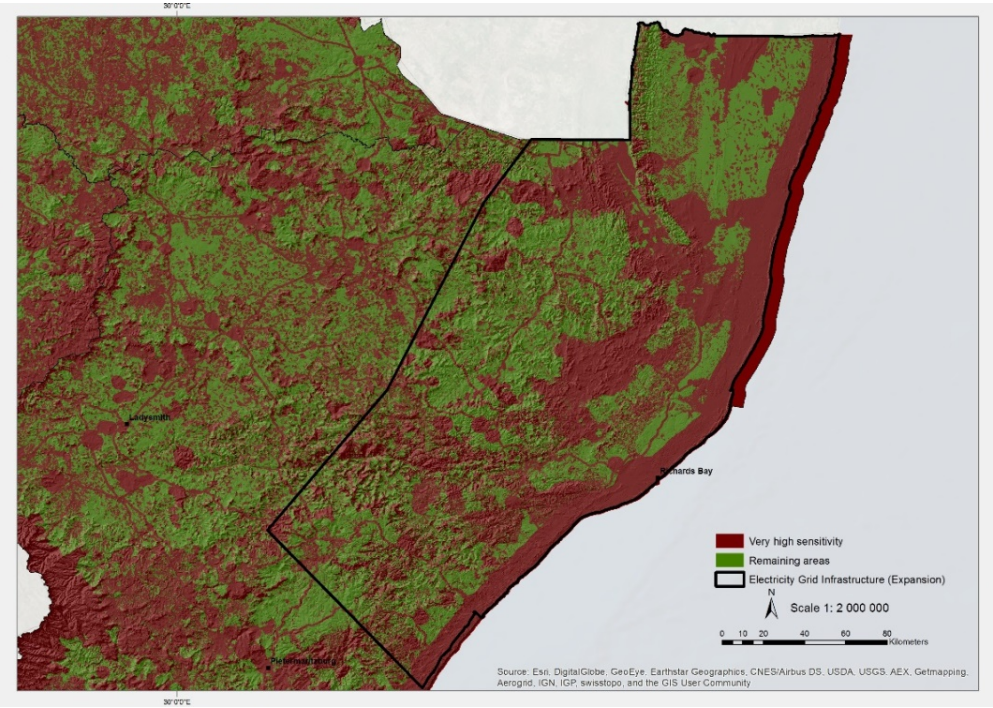
Map 4a: Pinch Point Analysis: Zoomed in map of the Expanded Western EGI Corridor (Rivers, Mining Areas, Towns, Villages and Settlements excluded due to scale).



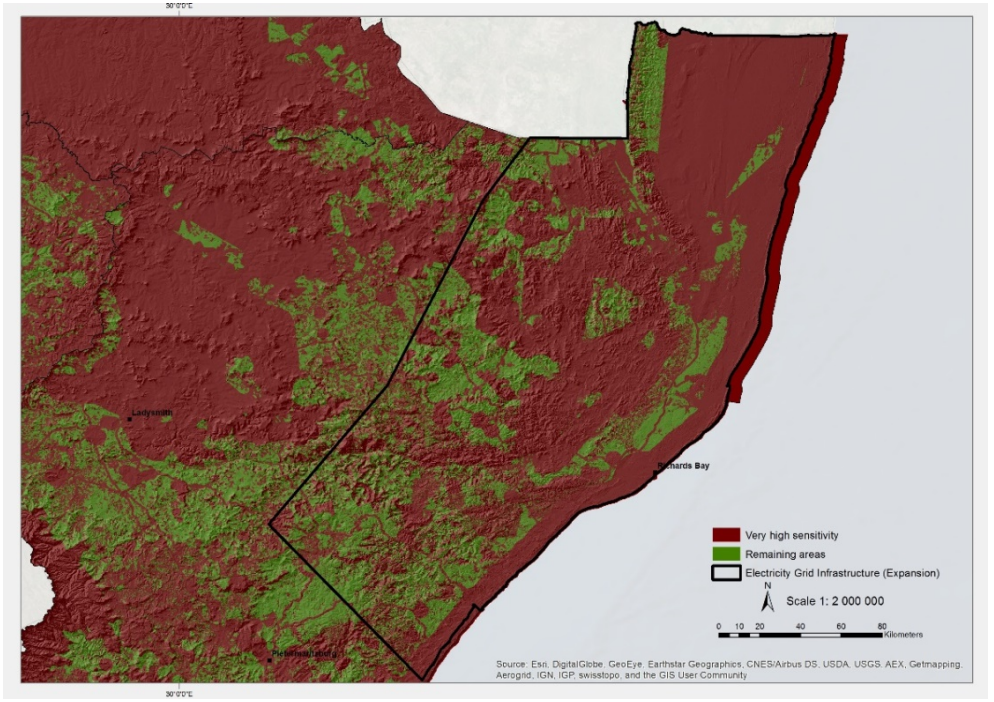
Map 4b: Pinch Point Analysis: Zoomed in map of the Expanded Western EGI Corridor (including only mining applications that have been granted, and excluding Rivers, Towns, Villages and Settlements).



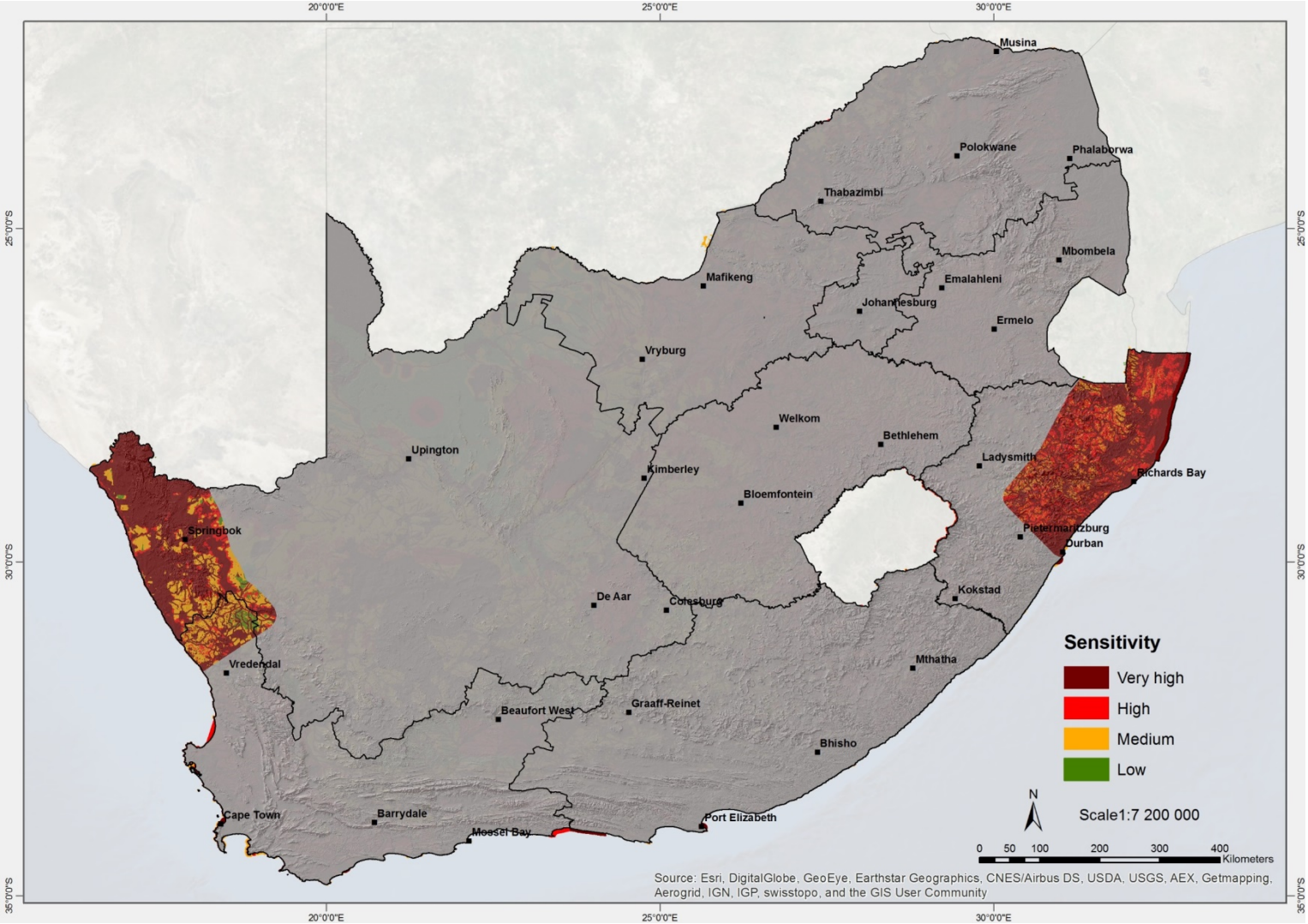
Map 5: Eskom Preliminary EGI Expansion Corridors (100 km wide) and future planned transmission substations shown in red and existing transmission substations shown in black in accordance with the Eskom Transmission Development Plan 2019 – 2028.



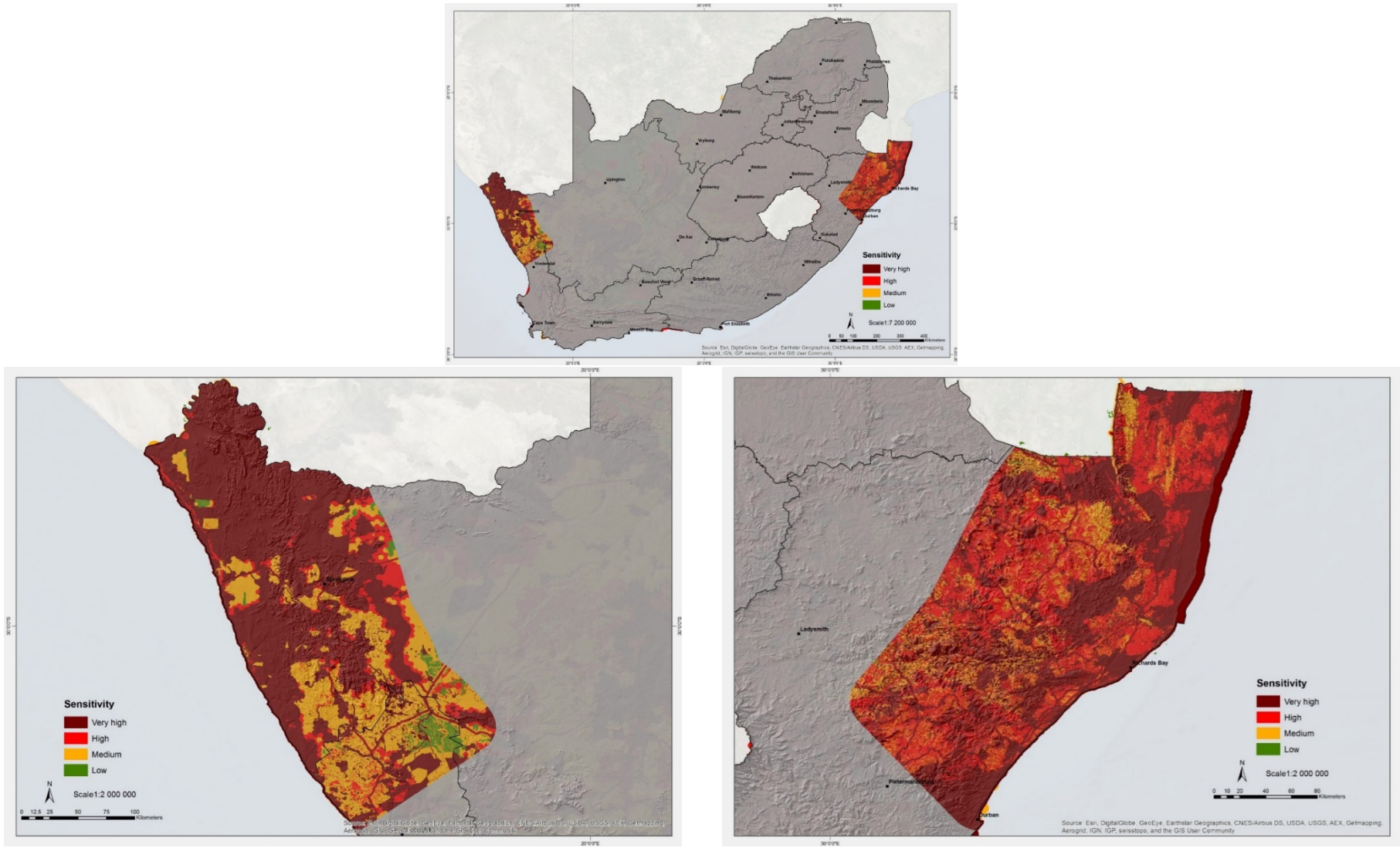
Map 6a: Pinch Point Analysis: Zoomed in map of the Expanded Western EGI Corridor (Rivers, Mining Areas, Towns, Villages and Settlements excluded due to scale).



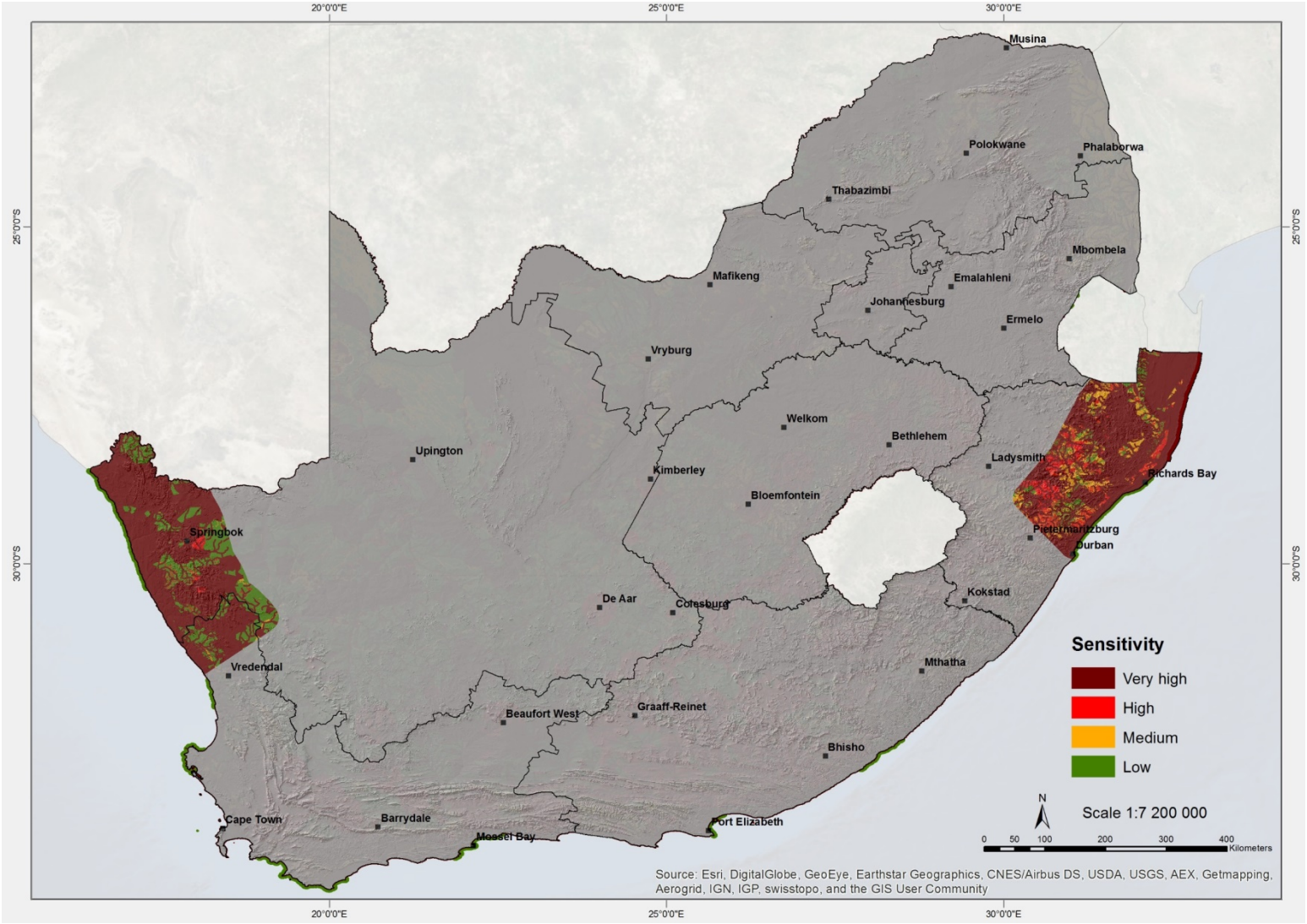
Map 6b: Pinch Point Analysis: Zoomed in map of the Expanded Western EGI Corridor (including only mining applications that have been granted, and excluding Rivers, Towns, Villages and Settlements).



Map 7a: Environmental Sensitivities for the Draft Refined Corridor Map (Rivers have been included in this map)



Map 7b: Environmental Sensitivities for the Draft Refined Corridor Map (excluding Rivers and Visual Sensitivities)



Map 8: Engineering Constraints for the Draft Refined Corridor Map

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PART 4

Specialist Assessments

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

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Part 4.2. - Key Findings of Specialist Assessments

Part 4.2.1. Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species Assessment Report)

Part 4.2.2. Visual Assessment

Part 4.2.3. Seismicity Assessment

Part 4.2.4. Socio-Economic Assessment

Part 4.2.5. Agriculture

Part 4.2.6. Defence

Part 4.2.7. Civil Aviation

Part 4.2.8. Heritage

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Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.1

Introduction and Scope of Work

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TABLES

ABBREVIATIONS

ACSA	Airports Company of South Africa
BA	Basic Assessment
BSc	Bachelor of Science
CSIR	Council for Scientific and Industrial Research
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPR	Environmental Management Programme
GIS	Geographic Information System
ILASA	Institute of Landscape Architects of South Africa
MSc	Master of Science
NRE	Natural Resources and the Environment
PV	Photovoltaic
SABAAP	South African Bat Assessment Advisory Panel
SACAP	South African Council for the Architectural Profession
SACLAP	South African Council for the Landscape Architectural Profession
SACNASP	South African Council for Natural Scientific Professionals
SAIA	South African Institute of Architects
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.1 Introduction and Scope of Work

This section of the Electricity Grid Infrastructure (EGI) Expansion Strategic Environmental Assessment (SEA) Report describes the process undertaken for the assessment of the Draft Refined Corridors. This includes assessment undertaken by Specialists and the Project Team. The latter is informed by previous SEAs undertaken by the Council for Scientific Industrial Research (CSIR) (such as the EGI SEA in 2016), as well as discussions with various specialists, experts and authorities.

4.1.1 Scope of Work and Approach

4.1.1.1 Scope of Work

The geographic scope of the assessment was focused on the Draft Refined Corridors (as described in Part 3 of the SEA Report). The Specialist Assessments considered the construction and operation of EGI, and include an assessment of social, economic and biophysical opportunities and risks associated with the proposed development. The scope of issues addressed in the SEA was informed by an in-depth review of similar assessments undertaken locally and globally, as well as by engagement with stakeholders and governance groups.

In order to advance the principles of balance and comprehensiveness, the main specialist topics in the assessment have been addressed by multi-author teams. Each Specialist Assessments therefore has multiple authors, which were selected on the basis of their acknowledged expertise, inclusive of appropriate formal qualifications and experience, peer-group recommendations and track record of outputs.

Each team includes one Integrating Author, several Contributing Authors and in some cases Corresponding Authors. The Integrating Authors were responsible for ensuring that all the components written by Contributing and Corresponding Authors were delivered punctually and incorporated in a logical manner in each Chapter; and that the scope of the Chapter was addressed. Integrating Authors also reviewed the input from Contributing and Corresponding Authors, and compiled sections of the assessment chapters. They were also responsible for ensuring that comments from experts, project partners, project team members, stakeholders and peer reviewers were adequately addressed and/or incorporated and documented.

Contributing Authors were responsible for compiling text, references, tables and graphics for sections of the assessment chapters. These were submitted to their Integrating Authors, based on agreed formats and templates. They also assisted in addressing reviewer comments relating to text they have contributed.

The Corresponding Authors were also responsible for delivering text, references, tables and graphics to the Integrating Authors. They were also selected to conduct reviews and provide expert feedback on relevant sections of the assessment reports.

During the SEA Process, two Multi-Author Workshops were held with the Specialist Teams. The Integrating and Contributing Authors were expected to attend all writing workshops and actively participate in the discussions and decisions taken. The first Multi-Author Workshop took place on 7 December 2017 to inform the Specialist Team of the scope of the project, as well as to discuss and confirm the scope of the specialist assessments and the report structure, and potential alignment between studies, data requirements, gaps, and any concerns raised. The second Multi-Author Workshop was held on 20 April 2018 in order to discuss the first draft reports compiled by the Specialists, as well as to discuss information requirements, gaps and tasks for completion.

4.1.1.2 Specialist and Author Team Expertise

Table 1 illustrates the Specialist Assessments that have been undertaken as part of this SEA, as well as the associated authors. Table 2 includes a description of the Specialist and Author Team expertise. Signed specialist declarations of independence are also included in Appendix B of the Final SEA Report.

4.1.1.3 Review Process

In this EGI Expansion SEA, the review of reports, tools and outputs during various stages of the SEA was considered a significant element of the process. These included review by key stakeholders and experts that have in-depth knowledge and insights into the subject of the SEA, as well as review by academic peers and members of the public. These types of reviews promote transparency and enables concerns raised by affected parties to be considered, where applicable. It also ensures that the SEA is relevant and scientifically comprehensive. Academic peer review of specialist chapters compiled for the SEA promotes overall robustness of the process and ensures that scientific credibility is upheld. The overall review processes undertaken for this SEA are described in this section.

- **Initial SEA Team Review**

The first draft of each Specialist Assessment chapter was reviewed internally by the SEA Project Team consisting of the CSIR and South African National Biodiversity Institute (SANBI). The chapters were then revised by the specialists based on the initial review comments and a second draft was compiled.

- **Peer Review and Project Partner Review**

The second draft of the chapters was then sent to the Peer Reviewers and Project Partners for review (i.e. the National Departments of Environmental Affairs, Energy and Public Enterprises, as well as Eskom, iGas and Transnet).

The expert peer reviewers were identified from existing scientific publications collected throughout the process and through nominations from the SEA Project Team, general stakeholders, Expert Reference Group and the Specialists. A total of 10 peer reviewers, from NGOs, academia and research institutions; and the private sector provided peer review comment. The peer reviewers that were appointed for the EGI Expansion SEA Process are listed in Table 1.

The Peer Reviewers were requested to provide their comments in a standardised document making reference to the specific page number and line number of the specialist assessments when documenting their comments. When the Specialists were re-drafting their third version of the report for public and stakeholder review (as described below), they were requested to detail, in the Peer Review Sheets, how the comments have been addressed and incorporated into the Specialist Assessment Chapters. The completed Peer Review Sheets and Specialists Responses are included as annexures to each Specialist Assessment chapter included in Appendix C of this Final SEA Report. Copies of these sheets and specialist responses were also released to the stakeholders during the review period.

- **Stakeholder and Public Review**

The chapters were then revised by the specialists based on the partner and peer review comments, and a third version was finalised and released for wider public and stakeholder review extending from **25 April 2019** to **24 June 2019**. To facilitate the stakeholder review process, the Specialist Chapters and introductory and background chapters were uploaded to the project website (https://gasnetwork.csir.co.za/) for access and downloading. In order for the authors to respond efficiently, the comment submitted needed to be clear and specific. In line with this, a guideline detailing the manner in which comments on the report chapters needed to be prepared and submitted was provided to stakeholders and uploaded to the project website, along with a comment form (Microsoft Excel Spreadsheet). Each chapter that was released for review was labelled, formatted and included page numbers. In addition, each page included line numbers on the left margin, which restarted at line 1 on

every new page. Stakeholders were therefore requested to clearly specify the exact passage of text to which their comment refers, by indicating the page number and line number for the beginning and end of the text. Additional detail regarding the mechanisms adopted to inform stakeholders of the review period is included in Appendix A of the Final SEA Report (i.e. Consultation Process).

- Final SEA Team Review

Following the stakeholder review period, the specialist assessments were updated where relevant and where required. These chapters were reviewed internally by the SEA Project Team, followed by the finalisation of the chapters by the specialists for inclusion in this Final SEA Report. The final chapters are included in Appendix C of this Final SEA Report, with summaries provided in Part 4.2.1 to Part 4.2.4.

Table 1: Details of the Specialist Assessment Chapters, Specialist Team and Peer Reviewer Team

Specialist Chapter	Integrating Author	Specialist Section	Contributing Author	Corresponding Author	Peer Reviewer
Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species Assessment Report)	Luanita Snyman-Van der Walt, CSIR	Fynbos Biome	▪ Dr. David Le Maitre; CSIR		▪ Professor Brian W. van Wilgen; Academic/Researcher (associated with the University of Stellenbosch)
		Savannah and Grassland Biomes	▪ Dr. Graham von Maltitz; CSIR ▪ Bonolo Mokoatsi[1]; CSIR		▪ Professor Bob Scholes; University of the Witwatersrand Johannesburg
		Indian Ocean Coastal Belt Biome	▪ Simon Bundy and Alex Whitehead; SDP Ecological and Environmental Services		▪ Duncan Hay, Catherine Pringle, and Leo Quayle, Institute of Natural Resources
		Succulent and Nama Karoo Biomes	▪ Lizande Kellerman; CSIR ▪ Simon Todd; 3 Foxes Biodiversity Solutions		▪ Professor Sue J. Milton-Dean; Renu-Karoo Veld Restoration
		Estuaries	▪ Dr. Lara Van Niekerk, Carla-Louise Ramjukadh and Steven Weerts,; CSIR		▪ Professor Janine Adams; Nelson Mandela University
		Wetlands and Rivers	▪ Gary de Winnaar and Dr. Vere Ross-Gillespie; GroundTruth		▪ Duncan Hay, Catherine Pringle, and Leo Quayle, Institute of Natural Resources ▪ Nancy Job; SANBI
		Avifauna	▪ Albert Froneman and Chris van Rooyen; Chris Van Rooyen Consulting		▪ Jonathan Booth and Robin Colyn, Birdlife South Africa
		Bats	▪ Kate MacEwan; Inkululeko Wildlife Services		▪ Refer to **Note 1** below
		Fauna	▪ All of the above (Refer to **Note 2** below)	▪ Kate MacEwan; Inkululeko Wildlife Services	
Visual Assessment	Quinton Lawson and Bernard Oberholzer; QUINTON LAWSON architect	Visual Impacts			▪ Scott Mason, SRK Consulting (South Africa) (Pty) Ltd
Seismicity Assessment	Prof Raymond Durrheim; University of the Witwatersrand	Impacts of Earthquakes, Seismicity and Faults	▪ Brassnavy Manzunzu; Council for Geoscience		▪ Dr Alistair Sloan; University of Cape Town

[1] Note that this specialist is no longer under the employ of the CSIR.

Specialist Chapter	Integrating Author	Specialist Section	Contributing Author	Corresponding Author	Peer Reviewer
Socio-Economic Assessment - Refer to **Note 3** below	Surina Laurie[2], CSIR	Socio-Economics		▪ Tony Barbour; Tony Barbour Environmental Consulting and Research ▪ Dr Hugo van Zyl; Independent Economic Researchers	
Additional Issues (Agriculture, Defence, Civil Aviation, Heritage, Climate Change and Mining) - Refer to **Note 4** below	Annick Walsdorff[2], CSIR Rohaida Abed, CSIR	Agriculture	▪ Johann Lanz; Independent Consultant		
		Defence	▪ Fahiema Daniels, SANBI ▪ Tsamaelo Malebu, SANBI		
		Civil Aviation			
		Heritage			
		Climate Change			
		Mining			

Note 1: A detailed assessment of impact on bats as a result of EGI development was not required as it is not expected to be of extreme significance. However the report does discuss potential impacts relating to habitat destruction or disturbance during the construction phase. This high level assessment is deemed suitable for an SEA study of this nature and where necessary the site specific studies will provide more detail.

Note 2: Note that faunal input was provided by the Specialist Contributing Authors for each Biome and Ecosystem Report included in the Integrated Biodiversity and Ecology Assessment (Terrestrial and Aquatic Ecosystems, and Species). This input was reviewed and augmented by Kate MacEwan of Inkululeko Wildlife Services.

Note 3: The Socio-Economic Assessment undertaken for this EGI Expansion SEA is significantly based on the 2016 EGI SEA Socio-Economic Assessment, which has been reviewed by various stakeholders as part of that separate SEA Process.

Note 4: Due to its linear nature, the impact of EGI development on Agriculture, Defence, Civil Aviation and Heritage features is anticipated to be of limited significance. This section is largely based on the 2016 EGI SEA Assessment due to impact similarities and where required additional specialist input was obtained. In addition, in terms of the National Heritage Resources Act (Act 25 of 1999), a Heritage Impact Assessment will need to be done for EGI development during the project specific phase. The input on Mining has been included to highlight some of the risks associated with development of EGI in proximity to mining areas, as well as the potential impact EGI has on mining areas. The input on Climate Change has been included to display some of the areas in South Africa that are likely to experience climate change in terms of flooding, coastal flooding, extreme rainfall, change in drought tendencies, and increased fire danger (based on the CSIR Green Book, 2019) to ensure these areas could potentially be flagged during the EGI planning stage, as and where applicable.

[2] Note that this specialist is no longer under the employ of the CSIR.

Table 2: Specialist and Author Team Expertise

Specialist and Affiliation	Project Role	Biosketch
Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species Assessment Report)		
Luanita Snyman-Van der Walt, CSIR	Integrating Author	Luanita Snyman-Van der Walt commenced work at CSIR in January 2014, after completing a BSc Botany-Zoology-Tourism, a BSc Honours in Environmental Science, as well as a MSc in Environmental Science at the North West University, Potchefstroom Campus. She is currently pursuing an MSc in Geographical Information Science at Vrije Universiteit Amsterdam, and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) (Registration Number 400128/16). Her work at the CSIR involves strategic environmental assessment and management, with a focus on Geographic Information System (GIS) analyses for environmental assessment and decision-making. She has conducted numerous ecological specialist studies and served as project manager for several EIAs and BAs across South Africa. She assisted in managing the shale gas development scientific assessment. She also fulfilled the role of Integrating Author for the Biodiversity Assessment of the Gas Pipeline and EGI Expansion SEA. She also provided technical GIS and mapping support on the Strategic Environmental Assessment Aquaculture Development in South Africa.
Dr. David Le Maitre; CSIR	Contributing Author	Dr. David Le Maitre has more than 30 years of research experience in the ecology of Cape fynbos vegetation, as well as fire ecology and management. His work focuses on assessing the hydrological and ecological impacts of invading alien plants and in the dynamics of invasion processes. His area of interests lies in the impacts of invasions on river and wetland systems and the ecosystems services they generate, including river assimilatory capacity; and developing diagnostic tools to assess the impacts of land-use and land management practices on water quality regulation based on the landscape features and water flows. David Le Maitre is a research associate at the Centre for Invasion Biology, Stellenbosch University, and an associate professor extraordinary at the School of Public Management and Planning, at the same university. Le Maitre holds a PhD in plant ecology, specialising in invasion ecology and hydrology from the University of Cape Town.
Dr. Graham von Maltitz; CSIR	Contributing Author	Dr. Graham von Maltitz specialises in large, integrated multidisciplinary projects involving the interface between humans and natural resource management in the terrestrial environment. He holds a PhD in ecology from the Nelson Mandela Metropolitan University and has over 30 years of experience in environmental and global change, focused on unique problems associated with resource ecology and management in southern Africa, with a special focus on areas of communal land management. He has worked extensively in the savanna, forest and grassland biomes of southern Africa, focusing particularly on natural resource use within the communal areas. More recently he has focused on the causes and consequences of global change. This included terrestrial feedbacks to climate processes, land use and land-use change as well as biomass-based energy. He has been involved in a number of global science/policy forums and processes, including links with the United Nations Convention to Combat Desertification and the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services.
Bonolo Mokoatsi; CSIR	Contributing Author	Bonolo Mokoatsi is a GIS analyst and emerging environmental researcher with a B.A. Honours in Geography from the University of Johannesburg. She commenced work at CSIR in April 2018 while pursuing a MSc in Environmental Management. With her MSc research, she aims to support precision agriculture through a non-destructive approach for monitoring crops' seasonal responses to variable-rate fertilizers and irrigation. Her work at CSIR involved GIS support and satellite image processing for multi-disciplinary studies, NEXUS trade-off analyses, environmental assessments and technical reports. She fulfilled the role of GIS specialist for the Biodiversity Assessment of the Gas Pipeline and EGI Expansion SEA. She also provided GIS support for assessing canopy cover versus above-ground biomass in an effort to map the distribution of bush encroachment in the Savannah and Grassland biomes of South Africa. Bonolo also serves as an external marker for the University of South Africa in the subject of GIS and remote sensing.
Simon Bundy; SDP Ecological and Environmental Services	Contributing Author	Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. Simon Bundy has a core competency in coastal ecological systems, coastal management and botanical issues including the undertaking of EIAs and Specialist Assessments. He has local and international experience, and in South Africa, he has been involved in a number of large scale power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu-Natal, Eastern Cape and Western Cape, where he has provided both technical

Specialist and Affiliation	Project Role	Biosketch
		support, as well as the undertaking of rehabilitation programmes. From a technical specialist perspective, Simon focuses on coastal ecological systems in the near shore environment and is competent in a large number of ecological methodologies and analytical methods including multivariate analysis and canonical analysis. He is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. He has also worked on coastal marine pollution projects for various insurance and salvage companies and has undertaken projects for the Global Environment Fund of the United Nations. He acts as botanical and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the CSIR, Stellenbosch. He is a registered Professional Natural Scientist (Ecology – Registration Number: 400093/06) with SACNASP.
Alex Whitehead; SDP Ecological and Environmental Services	Contributing Author	Alex Whitehead is an Ecologist registered with SACNASP (400176/10). He holds a BSc Honours specializing in Ichthyology and Fisheries Science from Rhodes University. He serves as a lead specialist in a number of terrestrial, aquatic and wetland studies. His specialist involvement has been linked with a diverse range of development scenarios, including waste water treatment works, housing estates, industrial estates, bulk infrastructure such as water and power lines, harbours, piers, renewable energy (solar and wind power), dams, and aquaculture and agri-industrial facilities. His specialist fields of interest include aquatic ecology (both freshwater and estuarine, ichthyofauna and invertebrates); wetland delineation and functionality assessments; and terrestrial ecology (fauna and flora). Alex has 13 years of experience, which includes projects undertaken throughout South Africa, as well as in Ghana.
Lizande Kellerman; CSIR	Contributing Author	Lizande Kellerman holds a Bachelor's degree in Zoology and Entomology, with an Honours and Masters in Botany both at the University of Pretoria. She is currently completing her PhD in Conservation Ecology from Stellenbosch University. She is a registered Professional Natural Scientist (Botanical Sciences – Registration Number: 400076/10) with SACNASP. She has more than 10 years' experience in environmental assessment and management studies, primarily in planning, preparing, managing and conducting environmental assessments (BA, EIA and SEA), environmental management plans (EMPs), environmental screening studies, fatal flaw assessments, cultivation rights and license applications for air emissions, water use, waste management, mining, bioprospecting and biodiversity permitting for numerous projects in the agricultural (including aquaculture), construction, environmental, mining and renewable energy sectors.
Simon Todd; 3 Foxes Biodiversity Solutions	Contributing Author	Simon Todd has 18 years' experience as a terrestrial ecologist in arid systems and biodiversity assessments. His primary focus includes examining the impacts of land use on biodiversity with the arid ecosystems of South Africa. He has contributed to the REDZ SEA, Shale Gas SEA, SKA, as well as the ESKOM EGI SEA. Apart from the above studies, he has also worked extensively across the Nama and Succulent Karoo and has provided specialist ecological assessments for more than 150 different developments. He is the Nama and Succulent Karoo representative on the National Vegetation Map Committee. He is a recognised arid-areas ecological expert and is a past chairman of the Arid-Zone Ecology Forum and has 20 years' experience working throughout the country. He is registered with SACNASP (Registration Number: 400425/11).
Dr. Lara Van Niekerk; CSIR	Contributing Author	Dr. Lara van Niekerk joined the CSIR in 1994, where she fulfils a role of Senior Scientist. Lara is part of a core team that developed the ecological flow requirement methods, strategic/operational policies and legislation required for the effective management of South Africa's estuaries. She has been involved in over 50 estuarine freshwater flow requirement studies. Lara is the architect of the SA National Estuarine Management Protocol and related planning guidelines. She led the team of specialists that assessed the ecosystem condition of all South Africa's estuaries as part of the SA National Biodiversity Assessment in 2011 and in the process of refining this for 2018.
Carla-Louise Ramjukadh; CSIR	Contributing Author	Carla-Louise Ramjukadh served as a Candidate Researcher in the Coastal Systems Research Group of the Natural Resources and the Environment (NRE) group in CSIR from 2016 - 2018. She is currently working for the South African Weather Services – Marine Research Institute as a Scientific Researcher. She holds a BSc and BSc Honours in Environmental and Water Science from the University of Western Cape, as well as a MSc in Biological Science from the University of Cape Town. She has been involved in various research projects, including but not limited to, Estuarine Management Plans in the Western Cape Province, effect of climate change in coastal systems, and characterisation of pH in estuarine systems.
Steven Weerts; CSIR	Contributing Author	Steven Weerts joined the CSIR in 2004 as a Senior Scientist, and currently fulfils the role of Research Group Leader for the Coastal Resources Group. He holds a BSc., BSc Honours and MSc from the University of Natal, and the latter from the University of Zululand. He has extensive experience in Marine Ecology and has authored more than 150 contract research and specialist consultancy reports to private and public sectors clients, stakeholders and users.

Specialist and Affiliation	Project Role	Biosketch
		He has also published many scientific publications. He has worked on several Estuary Management Plans, Outfall Monitoring Programmes, and Port Planning projects, and also served as the Integrating Author for the Marine Ecology chapter of the Strategic Environmental Assessment Aquaculture Development in South Africa.
Gary de Winnaar; GroundTruth	Contributing Author	Gary de Winnaar has over ten years of experience in professional consulting services while conducting assessments of aquatic and terrestrial ecosystems, and associated fauna and flora. He has provided specialist input for a range of studies requiring solutions regarding practical and applied terrestrial and aquatic ecology, including abilities to integrate aquatic and terrestrial elements, survey fauna and flora, characterise and map biodiversity features (including sensitive habitats), conduct specialist GIS modelling and mapping, as well as identifying and assessing impacts to biodiversity and the environment. He is particularly interested in the assessment of environmental flows to ensure that biodiversity patterns and processes are supported by sustained water flow. He managed and integrated specialist teams and inputs covering specialist fields such as terrestrial invertebrates, botany, and ecosystem services/resource economics, etc. He is a registered Professional Natural Scientist (Ecological Science – Registration Number: 400454/13) with SACNASP.
Dr. Vere Ross-Gillespie; GroundTruth	Contributing Author	Dr.Vere Ross-Gillespie currently manages the Rivers Division of GroundTruth, where work consists of conducting environmental flow and Instream Flow Requirement studies, biological and water quality monitoring, impact assessments, river ecological surveys, rehabilitation and also research. Vere has eight years of experience in the field of aquatic entomology and freshwater ecology. He is also involved in a wide range of active research projects, both local and internationally. Vere's research interests include Aquatic Ecology, Entomology, Limnology, Climate Change and Biology. Current/recent research projects include Adaptability and Vulnerability of Riverine Biota to Climate Change, the development and application of Periphyton as Indicators of flow and nutrient alterations for the management of water resources. He is a registered Professional Natural Scientist (Ecological Science) with SACNASP.
Albert Froneman; Chris Van Rooyen Consulting	Contributing Author	Albert Froneman has more than 15 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee. At present he is consulting to ACSA with wildlife hazard management on all their airports. He is also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies and pre-construction monitoring reports. He was a specialist author on the Avifauna Assessment of the 2016 EGI SEA. Since 2009 Albert has been a registered Professional Natural Scientist (Registration Number 400177/09) with SACNASP, specialising in Zoological Science.
Chris van Rooyen; Chris Van Rooyen Consulting	Contributing Author	Chris van Rooyen has nineteen years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed more than 100 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 30 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He was also a specialist author on the Avifauna Assessment of the 2016 EGI SEA.
Kate MacEwan; Inkululeko Wildlife Services	Contributing Author	Kate MacEwan is a SACNASP registered zoologist and environmental scientist and holds a BSc (Honours) in Zoology from Wits University. She has over 20 years of zoological and practical bat conservation experience and wide diversity of contacts with various African bat academics and biologists. Kate is currently the chairperson for the South African Bat Assessment Advisory Panel (SABAAP), and a co-author of both the South African Good Practise Guidelines

Specialist and Affiliation	Project Role	Biosketch
		for Surveying Bats in Wind Farm Developments: 4th Edition (Sowler et al 2016) and the South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities: 1st Edition (Aronson et al., 2014). Kate is also the co-author on several bat species accounts (including some from Mozambique) in the latest southern African Red Data mammal listings (Child et al. (2016)). She has also served as a specialist author in the Phase 1 Renewable Energy Development Zones SEA, and is also part of the Phase 2 assessment.
Visual Impact Assessment		
Quinton Lawson; Private Consultant	Integrating Author	Quinton Lawson is a professional architect, with more than 20 years' experience in visual assessments, including numerous wind and solar renewable energy projects, and is familiar with some of the strategic areas in the Western Cape, Eastern Cape and Free State. He holds a Bachelor of Architecture from the University of Natal, and is a Professional Member of the South African Council for the Architectural Profession (SACAP) (Registration Number 3686), as well as the South African Institute of Architects (SAIA) (Registration Number 4759). He is visiting lecturer for the University of Cape Town and serves on the Impact Assessment Committee of Heritage Western Cape for the Provincial Government Western Cape. He has also worked on large scale landscape projects on the Eastern Cape, Southern Cape, West Coast and Namaqualand coastlines. He was the specialist author for the Visual Impact Assessment compiled for the EGI SEA in 2016.
Bernard Oberholzer; Bernard Oberholzer Landscape Architects	Integrating Author	Bernard Oberholzer is a landscape architect and environmental planner with over 28 years' experience in visual assessments, particularly for wind and solar energy, as well as gas pipelines and powerlines. He holds a Bachelor of Architecture from the University of Cape Town; and a Master of Landscape Architecture from the University of Pennsylvania. He is a Professional Member of the South African Council for the Landscape Architectural Profession (SACLAP) (Registration Number 87018). He is also a Fellow of the Institute of Landscape Architects of SA (ILASA). He authored the Guideline for Involving Visual and Aesthetic Specialists in EIA Processes, and co-authored a heritage and scenic resources study for the Provincial Government, Western Cape. He was the specialist author for the Visual Impact Assessment compiled for the EGI SEA, Shale Gas Scientific Assessment, and SKA Phase 1 SEA Assessment.
Seismicity Assessment		
Professor Raymond J Durrheim; University of the Witwatersrand Johannesburg	Integrating Author	Professor Raymond Durrheim is the South African Research Chair of Exploration, Earthquake and Mining Seismology and holds appointment as a research chair and supervisor at the University of the Witwatersrand School of Geosciences. He is co-director of the AfricaArray research and capacity-building programme and was co-leader of the Japanese-South African collaborative project "Observational studies in South African mines to mitigate seismic risks" (2010-2015). He holds a BSc in Geology and Physics from the University of Stellenbosch; a BSc Honours in Geophysics from the University of Witwatersrand; a MSc in Geophysics from the University of Pretoria, and a PhD in Geophysics from the University of Witwatersrand. Research conducted by Professor Raymond Durrheim may be divided into three categories: (i) investigations of the structure and evolution of the crust and mantle (exploration seismology); (ii) earthquake physics and seismic hazard assessment; and (iii) engineering seismology (particularly related to deep mining).
Brassnavy Manzunzu; Council for Geoscience	Contributing Author	Brassnavy Manzunzu is a seismologist with the Council for Geoscience. He completed a MSc in Geophysics in 2013 and is currently undertaking his PhD at University of Witwatersrand. He joined the Zimbabwe Meteorological Services as a trainee Meteorologist in 2007. In April 2008 he moved to the seismology section where he began his career as a trainee seismologist and eventually fulfilled the position of Seismology Manager. In 2012, he joined the Council for Geoscience as a seismic hazard scientist. He has worked on several projects on seismic hazard in Africa. He has published a number of peer reviewed international journal articles. He has been part of the GEM- sub-Sahara Africa since its inception.
Socio-Economic Assessment		
Surina Laurie, CSIR	Integrating Author	Surina has more than 7 years of experience in environmental assessment and management and has a Masters degree in Environmental Management from the University of Stellenbosch and a Certificate in Environmental Economics from the University of London. She is a Registered Professional Natural Scientist (Registration Number: 400033/15) with the SACNASP. Surina has experience in the management and integration of various types of environmental

Specialist and Affiliation	Project Role	Biosketch
		assessments in South Africa for various sectors, including renewable energy, industry and tourism. She has also been part of advisory teams advising on financing, real estate, corporate, construction, environmental and regulatory aspects for various sponsors, developers and lenders during the DOE's first and second bidding windows in 2012 and 2013. Surina has undertaken several Solar Photovoltaic (PV) and Wind Energy Environmental Assessments (i.e. EIAs, BAs, and Amendment and Appeal Processes) in the Northern Cape, Western Cape and Free State. She also served as the Integrating Author for the Socio-Economics chapter of the Strategic Environmental Assessment Aquaculture Development in South Africa.
Tony Barbour; Tony Barbour Environmental Consulting and Research	Corresponding Author	Tony Barbour holds a master's degree in environmental science and has 23 years' experience in the environmental sector. His experience includes ten years as an environmental consultant in the private sector in South Africa followed by four and a half years at the University of Cape Town's Environmental Evaluation Unit. In 2004 he established his own environmental consulting company, Tony Barbour Environmental Consulting and Research, with a focus on Social Impact Assessment (SIA), Strategic Environmental Assessment (SEA), Independent Review Work, Training and Capacity Building and Environmental Project Management. Tony has conducted over 40 Social Impact Assessments and is the lead author of the Western Cape Provincial Government guidelines on social specialist inputs into EIAs.
Dr Hugo van Zyl; Independent Economic Researchers	Corresponding Author	Dr. Hugo van Zyl holds a PhD in economics from the University of Cape Town and has more than 18 years' experience focusing on the analysis of projects and policies with significant environmental and development implications. Hugo van Zyl is the director of Independent Economic Researchers, focusing on economics impact assessment, project appraisal and applied environmental resource economics. He has been involved in over 60 economic and socio-economic appraisals of infrastructure projects, industrial developments, mixed use developments, mining, energy projects, conservation projects and eco-tourism initiatives throughout southern Africa. The majority of these appraisals have involved the use of economic impact assessment tools and cost-benefit analysis in order to inform decision-making. He has lead, participated in and co-ordinated research in environmental resource economics (including environmental valuation, payments for ecosystem services, policy reform), socio-economic impact assessment, strategic assessment and protected area business planning. From a policy perspective he has provided economic inputs and guidance to national water tariff, air pollution, biodiversity conservation, biofuels, mine closure funding and climate change policy. Dr Van Zyl is also the lead author of the Western Cape Provincial Government guidelines on economic specialist inputs into EIAs. These guidelines have been accepted at a national level and are applied throughout the country.
Additional Issues (Agriculture, Defence, Civil Aviation, Heritage, Climate Change and Mining)		
Annick Walsdorff, CSIR	Integrating Author	Annick Walsdorff is a Principal Environmental Assessment Practitioner in the Environmental Management Services group of the CSIR. She holds a Degree in Chemical Engineering which was obtained with Great Distinction from the Université Libre de Bruxelles in Belgium, and a Masters Degree in Chemical Engineering (Cum Laude) from the University of Stellenbosch. She has more than 16 years' experience in environmental assessment and management and has been involved in several environmental studies of national importance including Preliminary Environmental Assessments, EIAs and Environmental Management Plans (EMPs). She played a key role in the Integrated Environmental Management Plan for the SKA.
Rohaida Abed, CSIR	Integrating Author	Rohaida Abed is an Environmental Assessment Practitioner in the EMS group of the CSIR, based in Durban. She holds a MSc Degree in Environmental Science from the University of KwaZulu-Natal. She has nine years of experience in the Environmental Management field, and has been involved in various transport infrastructure related projects as an Environmental Control Officer. She has also been involved in BAs and EIAs relating to Port infrastructure, Bulk Liquid Storage facilities and Renewable Energy in the capacity of Project Manager. She is a registered Professional Natural Scientist (400247/14) with the SACNASP.
Fahiema Daniels, SANBI	Contributing Author	Fahiema Daniels is a Deputy Director of the Biodiversity Planning Directorate at SANBI. She obtained a BSc (Ecology and Environmental & Geographical Science); BSc Honours (Botany: Plant Ecology); and MSc (Conservation Biology) from the University of Cape Town. Fahiema Daniels plays a key role in supporting biodiversity planning in South Africa by leading spatial analyses for National-scale projects, such as the Electricity Grid Infrastructure SEA, Shale Gas SEA and REDZ SEA. Additional projects include listing of threatened ecosystems; supporting the spatial prioritization for identifying Biodiversity Economy Nodes in South Africa, and developing the spatial layers that feed into the Department of Environmental Affairs Natural Resource Management Land User Incentive tool.

Specialist and Affiliation	Project Role	Biosketch
Tsamaelo Malebu, SANBI	Contributing Author	Tsamaelo Malebu is a GIS Specialist in the Biodiversity Information and Planning Directorate of SANBI. He holds a BSc Degree (Environmental Science) and BSc Honours in Ecology, Environment and Conservation from the University of the Witwatersrand. He has supported the 2016 EGI SEA, the development of the South African Mining and Biodiversity Guideline, provided technical support to the GEF funded Grasslands Programme and the identification of Marine Protected Areas as part of the Operation Phakisa Oceans Economy lab.
Johann Lanz; Independent Consultant	Contributing Author	Johann Lanz is registered as a Professional Natural Scientist in the field of Soil Science with SACNASP (Registration Number 400268/12). He holds a BA (English, Environmental & Geographical Science) from the University of Cape Town, a B.Sc. Agriculture (Soil Science, Chemistry) from the University of Stellenbosch, and a M.Sc. (Environmental Geochemistry) from the University of Cape Town. He provides soil specialist study inputs to EIAs, SEAs and EMPRs. These focus on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. He was also a specialist author on the Agricultural Assessment of the 2016 EGI SEA. He also undertakes soil resource evaluations and mapping for agricultural land use planning and management, and has conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.

4.1.1.4 Terms of Reference and Methodology

The Terms of Reference of each Specialist Assessment are detailed in each chapter (Appendix C of the Final SEA Report); however the overall general study requirements are noted below:

- Undertake a review of existing literature (including the latest research undertaken both locally and internationally); maps and aerial photographs; and relevant data (if available) to compile a baseline description applicable to each corridor; including a list of species or features that are sensitive to EGI that have been observed and/or are likely to occur in each corridor;
- Identification of any additional features of interest or any gaps in information within the corridors not identified in the existing sensitivity analysis, making use of datasets made available through the draft environmental constraints map and additional information sourced by the specialist;
- Review and update, where required, the environmental sensitivity for the proposed EGI corridors provided by the CSIR and SANBI and develop/verify the approach for classing each sensitivity feature according to a four-tiered sensitivity rating system i.e. Very High, High, Medium or Low;
- Assess the proposed corridors in terms of the potential impacts associated with the construction and operation of EGI on the various environmental features, ecosystems and habitats, and outline proposed management actions to enhance benefits and avoid/reduce/offset negative impacts; and
- Provide input to the pre-construction site specific environmental assessment protocol, as applicable (e.g. additional information and level of assessment is required in each sensitivity category before an authorisation should be considered), Standards or Minimum Information Requirements[3] and Environmental Management Programme (EMPr).

The Specialists were requested to adopt the same methodologies and structures used in the 2016 EGI SEA, as the Eastern and Western EGI Corridors are an expansion of the gazetted EGI Corridors as assessed in 2016.

Part 4.2 of the EGI Expansion SEA Report provides a summary of the key findings of the specialist assessments of the Draft Refined Corridors. These findings were one of the factors considered in the identification of the final corridors, which is described in detail in Part 5 of this Final SEA Report.

The complete specialist assessments are included in Appendix C of this Final SEA Report (Specialist Assessment Reports).

[3] As noted in Part 1 of the Final SEA Report, two options were considered as Decision-Support Outputs to streamline the Environmental Authorisation Process. As noted in Part 1, the option for exemption from Environmental Authorisation for proposed EGI development within the Expanded EGI Corridors (once gazetted) has been put forward for the Decision-Support and Gazetting phase. This will only be achieved through compliance with a Standard (once gazetted).

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2

Key findings of specialist studies

CONTENTS

PART 4. SPECIALIST ASSESSMENTS

Part 4.2 Key Findings of Specialist Assesments

This section provides a summary of the key findings of the specialist assessments undertaken as part of this SEA. These assessments were carried out on the Draft Refined Corridors and the findings thereof were considered in the identification of the Final Corridors.

Key findings of the following studies are included in this section:

- Part 4.2.1: Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species Assessment Report) – Appendix C.1 of the Final SEA Report;
- Part 4.2.2: Visual Assessment - Appendix C.2 of the Final SEA Report;
- Part 4.2.3: Seismicity Assessment - Appendix C.3 of the Final SEA Report;
- Part 4.2.4: Socio-Economic Assessment - Appendix C.4 of the Final SEA Report;
- Part 4.2.5: Agriculture;
- Part 4.2.6: Defence;
- Part 4.2.7: Civil Aviation;
- Part 4.2.8: Heritage;
- Part 4.2.9: Climate Change; and
- Part 4.2.10: Mining.

The complete specialist assessments are included in Appendix C of this Final SEA Report (Specialist Assessment Reports).

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.1

Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species Assessment Report)

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ABBREVIATIONS

CA	Conservation Area
CBA	Critical Biodiversity Area
CR	Critically Endangered
ECBCP	Eastern Cape Biodiversity Conservation Plan
EFZ	Estuary Functional Zone
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EI	Ecological Importance
EN	Endangered
ES	Ecological Sensitivity
ESA	Ecological Support Areas
HDD	Horizontal Directional Drilling
IAP	Invasive Alien Plants
IUCN	International Union for Conservation of Nature
KZN	KwaZulu-Natal
LT	Least Threatened
NP	National Park
NPAES	National Protected Areas Expansion Strategy
ONA	Other Natural Area
PA	Protected Area
PES	Present Ecological State
SABAP	The Southern African Bird Atlas
SCC	Species of Conservation Concern
SEA	Strategic Environmental Assessment
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
VU	Vulnerable
WHS	World Heritage Site

PART 4. SPECIALIST ASSESSMENTS

Part 4.2 Key Findings of Specialist Assessments

Part 4.2.1 Integrated Biodiversity and Ecology Assessment

4.2.1.1 Introduction

The Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species) Assessment Report (Appendix C.1 of this Final SEA Report) consolidates and summarises the key findings of the following specialist investigations on the potential impacts from the development of Electricity Grid Infrastructure (EGI) on terrestrial and aquatic ecology and biodiversity in the draft refined Expanded EGI corridors:

- Biodiversity and Ecological Impacts (Terrestrial Ecosystems and Species):
  - Fynbos Biome (Appendix C.1.1 of the Final SEA Report);
  - Savanna and Grassland Biomes (Appendix C.1.2 of the Final SEA Report);
  - Indian Ocean Coastal Belt Biome (Appendix C.1.3 of the Final SEA Report);
  - Succulent and Nama Karoo Biomes (Appendix C.1.4 of the Final SEA Report);
- Biodiversity and Ecological Impacts (Aquatic Ecosystems and Species):
  - Estuaries (Appendix C.1.5 of the Final SEA Report);
  - Wetland and Rivers (Appendix C.1.6 of the Final SEA Report);
- Biodiversity and Ecological Impacts - Avifauna (Appendix C.1.7 of the Final SEA Report); and
- Biodiversity and Ecological Impacts - Bats (Appendix C.1.8 of the Final SEA Report).

Furthermore, it recommends management actions and best practice mechanisms to avoid and minimise any potential negative impacts to sensitive ecosystems, the ecological processes that underpin their functioning, and the plant and animal species inhabiting those ecosystems.

Figure 1 shows the location of the two Draft Refined Expanded EGI Corridors assessed in the Integrated Biodiversity and Ecology Assessment together with the key terrestrial and aquatic ecosystem components.

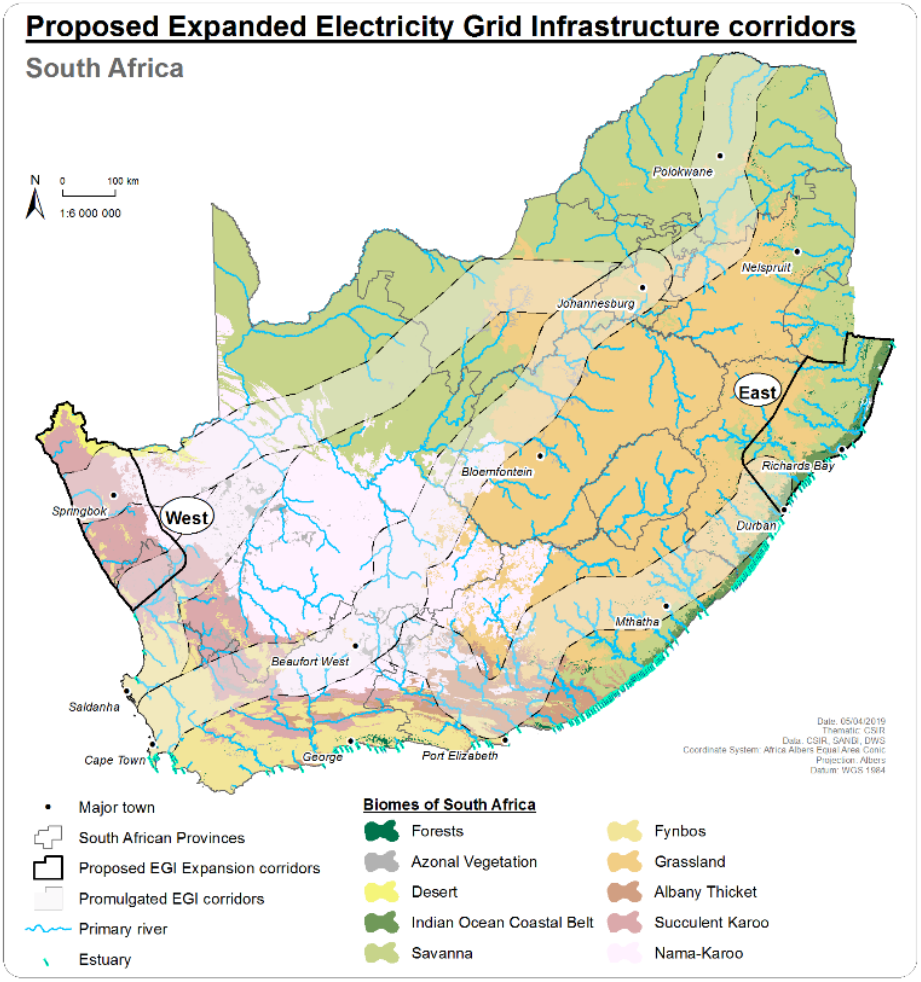


Figure 1: Location of the two proposed Draft Refined Expanded EGI Corridors in South Africa with the key terrestrial and aquatic ecosystem components considered in the Integrated Biodiversity and Ecology Assessment. The five Gazetted EGI Corridors are also indicated on this map.

4.2.1.2 Scope of the Assessment

The ecological and biodiversity environmental aspects of the proposed Expanded EGI Corridors have been grouped according to the biomes that are found within the corridors, which act as the point of departure for terrestrial ecosystems and the fauna that inhabit these systems. The forest biome has not been included in the SEA as it represents an engineering constraint for the EGI due to mature trees impacting on the servicing and maintenance of power lines. Therefore, the forest biome will be avoided for the routing of the EGI. The Albany Thicket biome is not situated within either of the Expanded EGI corridors, and is thus not included in the assessment. The aquatic ecosystems considered in the SEA include freshwater and estuarine habitats, and associated species.

Figure 2 provides an overview of the topics forming part of the assessment, focusing on biomes, sensitive ecosystems, the ecological processes that underpin their functioning, and the plant and animal species inhabiting those ecosystems.

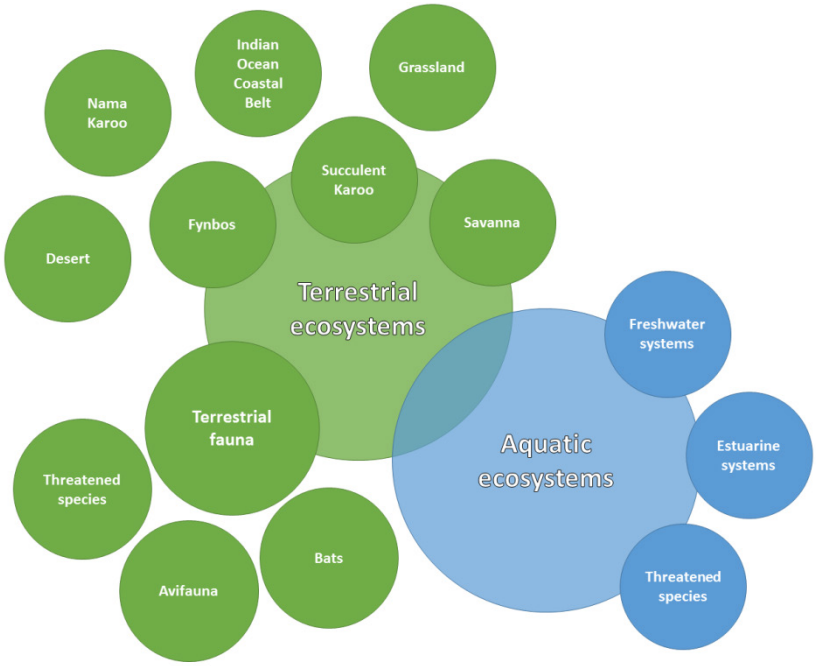


Figure 2: Overview of the terrestrial and aquatic ecosystem topics forming part of the Integrated Biodiversity and Ecology Assessment.

4.2.1.3 Spatial Data and Key Assumptions

The features considered sensitive to the development of EGI and included in the biodiversity assessment are listed in Table 1. Refer to Section 4.2 of the Integrated Biodiversity and Ecology Assessment Report (Appendix C.1 of the EGI Expansion SEA Report) for a list of the spatial datasets used in this assessment. This assessment made use of existing literature and available useable information, i.e. no fieldwork was done and no additional raw data were collected and/or processed. Some datasets are outdated, or lacking data for certain areas of ecological importance within each biome. For species, in particular, records are limited to primarily areas which are easy to access and where monitoring is safe to undertake e.g. in Protected Areas (PAs). Those datasets are therefore likely to contain sampling bias. In addition, data contained within some of the fauna species databases are coarse and insufficient to be able to identify endemics with any certainty, and the threat status of most invertebrate groups has not been assessed according to the International Union for Conservation of Nature (IUCN) criteria.

It is thus important to keep in mind that the consideration of ecological pattern and process in this assessment is limited by the resolution and scale of the spatial data. For site-specific routings of electricity grid infrastructure, ground-truthing will still be required.

Table 1: Available Spatial Data pertaining to Terrestrial Ecosystems, Aquatic Ecosystems, and Species used in the Integrated Biodiversity and Ecology (Terrestrial and Aquatic Ecosystems, and Species) Assessment Report.

Feature
Terrestrial Ecosystems
Provincial conservation planning
Protected and Conservation Areas
National Protected Area Expansion Strategy (NPAES) Focus Areas
Vegetation of South Africa
Threatened ecosystems
National Land Cover
Ecoregions
National Forests
Karoo ecological and biodiversity sensitivity
Field crop boundaries

Feature
Aquatic Ecosystems – Freshwater Ecology
SQ4 sub-quaternary drainage regions (referred to as SQ4 catchments)
River Ecoregions (Level 1 and 2)
River Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES)
NFEPA Rivers and Wetlands
Ramsar Sites
National Wetland Vegetation Groups
Provincial Wetland Probability Mapping
Mpumalanga Highveld Wetlands
Aquatic Ecosystems – Estuarine Ecology
Estuarine health
Estuary ecological classification
Estuaries in Formally /desired protected areas
Estuaries of high biodiversity importance
Important nurseries
Important estuarine habitats
Natural or near natural condition estuaries
Species – Terrestrial and Aquatic Fauna
Red Data Species
Species – Birds
The Southern African Bird Atlas 1 (SABAP1)
The Southern African Bird Atlas 2 (SABAP2)
Crane, raptor and vulture nests
National vulture restaurant database
Eagle nests on Eskom transmission lines in the Karoo
Locality of Red Data nests
Cape Vulture colonies
Blue Swallow breeding areas
Southern Ground Hornbills nesting areas.
Various Red Data bird species nests
Southern Bald Ibis breeding colonies
Potential Bush Blackcap, Spotted Ground-Thrush and Orange Ground-Thrush breeding habitat.
Yellow-breasted Pipit core distribution
Rudd's Lark core distribution
Botha's Lark core distribution
White-winged Flufftail confirmed sightings 2000 – 2014
Red Data nest localities in the Western Cape
Species – Bats
Terrestrial Ecoregions
Geology
Bat Roosts
Bat species occurrence data

4.2.1.4 Key Environmental Attributes and Sensitivities

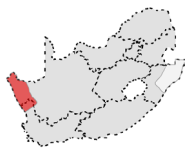
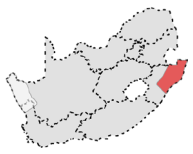
All of the biomes of South Africa, except for Albany Thicket, are within either the proposed expanded Eastern or Western EGI corridor (Table 2).

Table 2: Extent of the biome within each of the proposed expanded EGI corridors.

Biome	Extent (% of each proposed expanded EGI corridor)	
	Expanded Western EGI corridor	Expanded Eastern EGI corridor
Succulent Karoo	75	
Nama-Karoo	11	
Fynbos	3	
Azonal Vegetation	2	2
Albany Thicket		
Grassland		25
Indian Ocean Coastal Belt		14
Savanna		55
Desert	8	
*Forests**		*3*
**The forest biome has not been included in this assessment as it represents a constraint to the EGI as mature trees will impact on the servicing and maintenance of power lines. Therefore, the forest biome will be avoided for the routing of the EGI. However, where the forest biome cannot be avoided by the power line route, due to the rare and sensitive environments that are associated with the biome, developers would be required to fulfil the requirements of the EIA Regulations at the time.*		

Table 3 provides a summary of the key environmental features of the Draft Refined Expanded EGI Corridors.

Table 3: Summary of key environmental features of the Draft Refined Expanded EGI Corridors.

Site	Brief description
Expanded Western EGI corridor 	• This proposed corridor is situated within Fynbos, Succulent Karoo, Nama Karoo, Desert vegetation types in the Northern Cape and Western Cape Provinces. • Mostly arid environment, with prominent protected areas that include the Richtersveld and Namaqua National Parks, with extensive areas earmarked as potential NPAES focus areas. • Relatively untransformed when compared to the proposed expanded Eastern EGI corridor.
Expanded Eastern EGI corridor 	• This proposed corridor is situated within Savanna, Grassland and Indian Ocean Coastal Belt vegetation types in the KwaZulu-Natal Province. • Transformed by urban settlement and agriculture, especially in the vicinity of Richards Bay. • The dense human population has resulted in large-scale transformation of the natural habitat, resulting in large sections of the corridor rated as low sensitivity for birds. However, the remaining natural areas support a wide variety of power line sensitive Red Data bird species. • Many protected areas associated with large wetlands are present.

4.2.1.5 Sensitivity Criteria and Mapping

Sensitivities and buffers (where relevant) were assigned to various important environmental features (Refer to Table 4). The sensitivities of the different biomes may vary, as they are known to have various degrees of resilience and recoverability. For example, rehabilitation may be more easily and successfully achieved in the Savanna and Grassland vegetation types than in Fynbos and Karoo vegetation types.

Table 4: Approach to the allocation of Sensitivity Ratings to important environmental features of the Desert, Succulent Karoo, Nama Karoo, Fynbos, Indian Ocean Coastal Belt, and Grassland and Savanna Biomes; and important freshwater and estuarine features, as well as Avifauna and Bats.

Feature Class	Sensitivity Rating
Desert, Succulent Karoo and Nama Karoo Biomes	The biodiversity sensitivity values are adapted from Critical Biodiversity Area (CBA) classifications from provincial systematic conservation plans for the Northern, Western and Eastern Cape provinces, as well as relevant specialist experience and previous SEAs conducted in these biomes.
Fynbos Biome	The Fynbos sensitivity analysis relied primarily on the most recent conservation plans for the areas concerned as they already include all the relevant layers of information such as threatened vegetation, threatened vertebrates, protected area expansion strategies and climate adaptation corridors in their CBAs and Ecological Support Areas (ESAs) and the latest information on the protected areas.
Indian Coastal Belt	For the Indian Ocean Coastal Belt areas of high conservation value, existing conservation plans were selected as basis for the sensitivity analysis.
Grassland and Savanna Biomes	The sensitivity of biodiversity and ecological features was based largely on sensitivities as used in Provincial biodiversity conservation plans.
Freshwater Ecosystems	The sensitivity rating for freshwater ecosystems is a combined rating for rivers, wetlands and freshwater biota. The total score for each sub-quaternary drainage regions (SQ4 catchment) were collapsed into the four sensitivity classes using a quantile data split. This coverage provides an integration of all data pertaining to freshwater biodiversity and ecosystems, and is particularly useful for identifying preferred alignments for EGI in order to reduce impacts on freshwater ecosystems and associated biodiversity.
Estuaries	Sensitivity was assigned to a suite of environmental indicators for estuaries, such as protected areas, biodiversity importance, importance as nurseries, condition of the estuaries, conservation importance, coastal rovers, wetlands and seeps.
Birds	An aggregated bird habitat sensitivity score for each habitat class within each biome, within each corridor was calculated by summing the species-specific probability scores for that particular habitat class.
Bats	Habitat features and types were assigned varying sensitivities according to their bat importance. Where appropriate, buffers with a specific sensitivity have been assigned. The exact bat roost points have remained confidential in order to protect the roosts.

The sensitivity ratings assigned to environmental features in Table 3 have been expressed spatially as sensitivity maps. Figures 3 and 4 below respectively illustrate the sensitivity of terrestrial, freshwater aquatic and estuarine features and species, as well as birds and bats for the Draft Refined Expanded Western and Eastern EGI Corridors. The individual sensitivity maps per corridor and theme are included in Section 7.2 of the Integrated Biodiversity and Ecology Assessment (Appendix C.1 of the Final SEA Report), and in the individual assessments (Appendices C.1.1 to C.1.8 of the Final SEA Report) respectively.

Highly sensitive ecological features exist in both corridors, and are mainly related to protected areas and areas identified in Provincial Conservation Plans as Critical Biodiversity Areas (CBAs). CBAs are areas characterised by key ecological processes, ecosystems and species required to meet conservation targets and to protect the biodiversity of South Africa. Areas that have already been transformed by anthropogenic activities such as urbanisation and agriculture are mainly of low sensitivity. Aligning the proposed EGI routings to follow existing disturbance corridors presents an (environmental) opportunity.

Overall low human population, with most of the natural habitat relatively untransformed, results in the proposed expanded Western EGI corridor being more sensitive for birds. This, coupled with the occurrence of several high-risk species, has resulted in the majority of the habitat receiving a High Sensitivity rating (Figure 3). Conversely, the dense human population in the proposed expanded Eastern EGI corridor has resulted in large-scale transformation of the natural habitat (cultivation, plantations, urbanisation and rural settlements), resulting in large sections of the corridor rated as low sensitivity for birds (Figure 4). However, a significant proportion of the remaining area is protected by existing conservation areas (e.g. Isimangaliso Wetland Park, Hluhluwe-Imfolozi Game Reserve, Tembe Elephant Park, Ndumo Game Reserve, Ithala Game Reserve). These areas support a wide variety of power line sensitive Red Data bird species. A number of Red Data Bat species also occur in the proposed expanded Eastern EGI corridor (Figure 4). Fruit bats and large insectivorous bats in particular could be affected by EGI development, however, no record of bat fatalities due to power line infrastructure exists to date in South Africa. In addition, there is limited evidence to suggest that electromagnetic radiation emitted by the power lines will affect flying bats or interfere with the echolocation of insectivorous bats during foraging.

The proposed Expanded Western EGI corridor is situated in more arid areas and are less sensitive from an aquatic ecology perspective due to the relatively limited presence of aquatic features. Due to existing pressures from other anthropogenic activities, many of the aquatic ecosystems in the rest of the country are threatened and are resultantly highly sensitive to new development (Figure 3). The most sensitive aquatic ecosystems must be avoided as far as reasonably possible, or mitigated using engineering solutions (e.g. increased power line spanning distance across watercourses) and best practice to reduce potential impact.

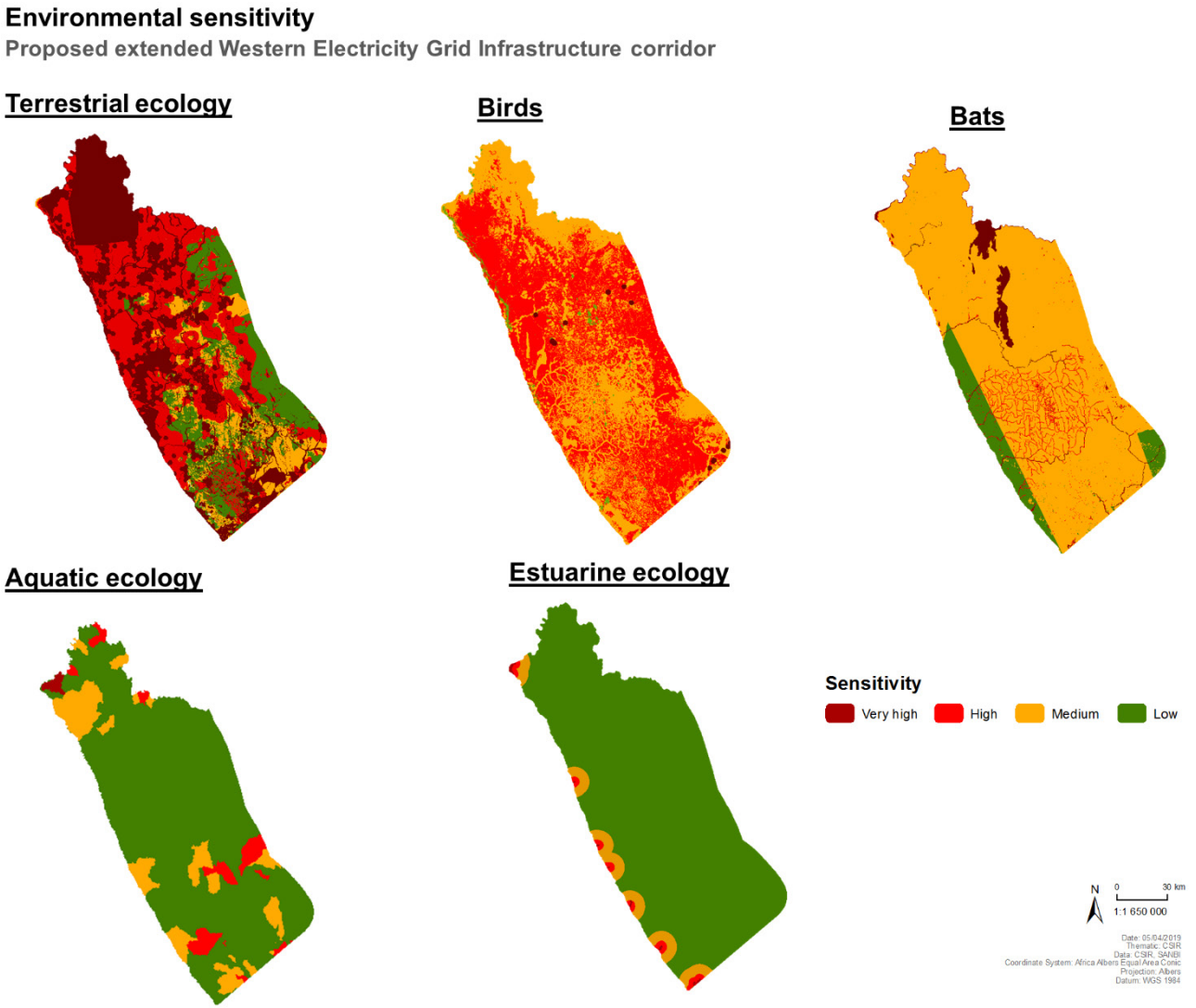


Figure 3: Environmental sensitivity of terrestrial, aquatic and estuarine ecosystems and species, including Birds and Bats in relation to proposed EGI development within the Western Expanded EGI Corridor.

Figure 4: Environmental sensitivity of terrestrial, aquatic and estuarine ecosystems and species, including Birds and Bats in relation to proposed EGI development within the Eastern Expanded EGI Corridor.

4.2.1.6 Key Potential Impacts and Mitigation

Key potential impacts of proposed EGI development to terrestrial and aquatic ecosystems and biodiversity are mainly related to vegetation clearance during construction and maintenance activities, which may also have consequences for terrestrial fauna directly (e.g. habitat loss). Potential impacts to birds include collision and electrocution, whilst bats may also be impacted mainly via habitat alteration and loss (Figure 5).

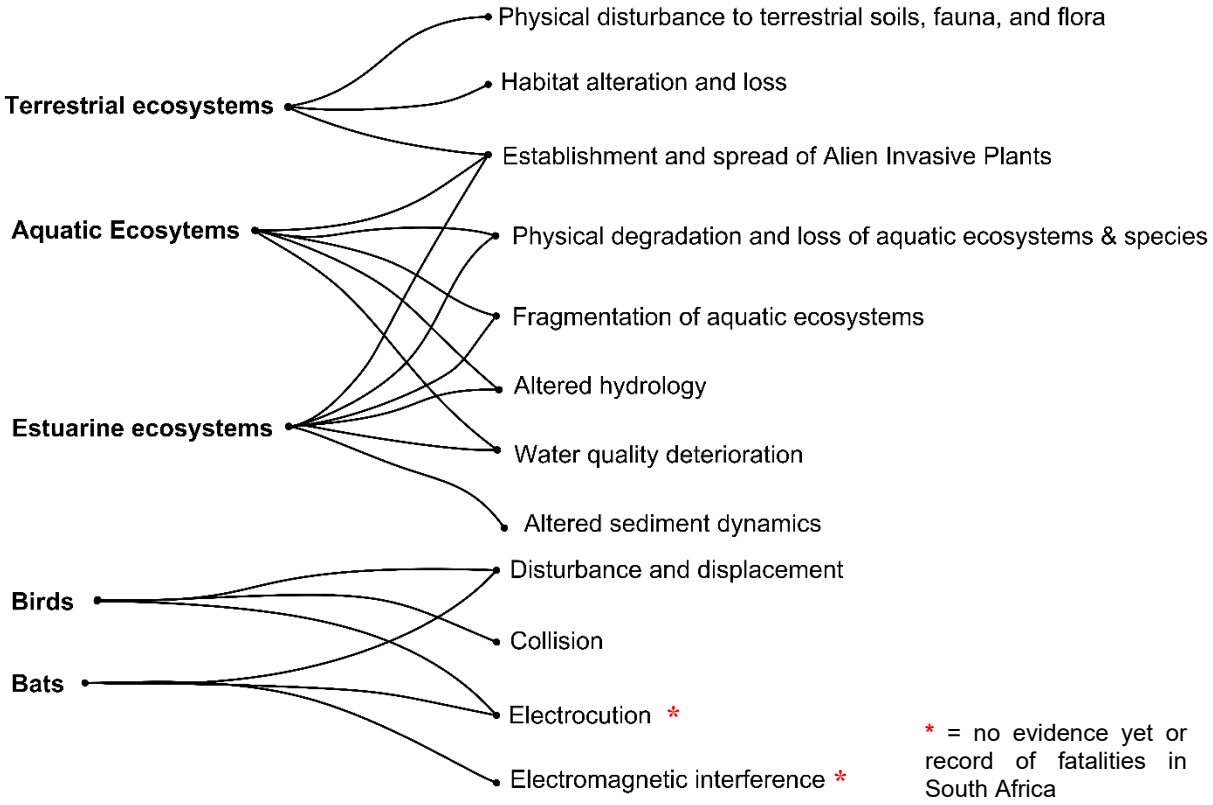


Figure 5: Key potential impacts of proposed EGI development to terrestrial and aquatic systems.

Table 5 provides a summary of the key potential impacts and possible consequences, as well as associated activities. These impacts will be assessed and adequate management actions recommended during the planning and design phase.

Table 5: Key potential impacts and possible consequences

Impact	Activities and Possible Effect	Phase		
		Construction	Operation and Maintenance	Post-closure and Rehabilitation
TERRESTRIAL ECOSYSTEMS				
Physical disturbance to soils, fauna and flora	EGI, specifically power lines, require a wide servitude that is regularly maintained and kept clear of significant woody or larger plant species to better facilitate the management and maintenance of the infrastructure. The natural vegetation within	x	x	

Impact	Activities and Possible Effect	Phase		
		Construction	Operation and Maintenance	Post-closure and Rehabilitation
	the servitudes are therefore kept at an early seral stage, preventing secondary and more advanced seral processes. Under some situations, such vegetation clearance may serve to bisect habitats and changes in vegetation form and structure may extend beyond the servitude boundary. Some of the key consequences of physical disturbance to soils, fauna and flora include: ▪ Loss of biodiversity; ▪ Establishment and invasion by Invasive Alien Plants (IAPs); ▪ Loss of faunal habitat and consequently Species of Conservation Concern (SCC); ▪ Increased human activities may cause animals to migrate away from their natural habitat; ▪ Poaching, collection of plants and animals that are collectable or have indigenous/medicinal uses; ▪ Entrapment of animals open excavations (which could then have fatal consequences as a result of drowning in pools of collected water, dehydration, or starvation); ▪ Road mortalities; ▪ Electrocution on ground as tortoises and other small fauna that become trapped underneath or against electrical fences, should such electrified fencing be installed; and ▪ Electrocution of fauna that climb or perch on pylons.			
Establishment and spread of IAPs	Power line servitudes are areas of high physical disturbance, subject to regular vehicular traffic and periodic clearance. This sustained level of disturbance presents suitable conditions for the establishment and spread of IAPs. Servitudes often act as repositories and vector corridors of exotic plant propagules and thereby promote and facilitate the spread of IAPs.	x	x	
Ecosystem alteration and loss	Physical disturbance to soils, fauna and flora, and IAP establishment and spread can ultimately manifest as ecosystem alteration and loss. Some of the key consequences of ecosystem alteration and loss include: ▪ Changes in local habitat features and ecological processes; ▪ Changes in habitat suitability for local species; ▪ Reduction/loss in endemic and rare species populations; ▪ Transformation of intact habitat within a CBA. ▪ Transformation of habitat within an ESA. ▪ Local or global extinction; ▪ Changes in species movements, abundance and distribution; and ▪ Changes in ecosystem functions, interactions, and resilience.	x	x	x
BIRDS				
Electrocution	When a large bird makes contact with two live components simultaneously, or a live and earthed component, a short circuit is created, which electrocutes the bird. Electrocution risk is a		x	

Impact	Activities and Possible Effect	Phase		
		Construction	Operation and Maintenance	Post-closure and Rehabilitation
	function of the pole configuration and the size of the bird. In South Africa, large raptors and vultures are most vulnerable to electrocutions, on voltages of 11 kV up to 132 kV (Van Rooyen, 1998[1]).			
Collision	Bird injury or death can be caused by the bird colliding at high speed with the power line infrastructure, usually the earthwire of transmission and sub-transmission lines (> 66kV), or the conductors themselves in the case of reticulation lines (11 – 33 kV). In South Africa, most heavily impacted upon are bustards, storks, cranes and various species of waterbirds (Jenkins et al., 2010[2]).		x	
Displacement	During the construction and maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat, which could result in temporary or permanent displacement. The above-mentioned construction and maintenance activities also impact on birds through disturbance, particularly during breeding activities. Disturbance of breeding individuals could lead to breeding failure through abandonment of the nest or through exposing the eggs and nestlings to predation when the adult birds temporarily leave the nest area.	x	x	x
BATS				
Disturbance and displacement	During the construction phase, particularly the erection of pylons, the clearance of vegetation, digging and drilling of foundations, noise and vibrations from construction activities may cause disturbance to bats and displace them from their original habitat. Construction activities could cause noise, dust and vibrational disturbances to roosting colonies, especially during the breeding season from approximately October to March. South African fruit bat species may potentially be affected by the development; however, no record of bat fatalities due to power line infrastructure exists to date in South Africa.	x	x	x
Electrocution	No record of bat fatalities due to power line electrocution or collision with infrastructure exists to date in South Africa. Collision related impacts may be compounded if the power line is erected along established migratory pathways.		x	
Electromagnetic interference	There is limited evidence to suggest that electromagnetic radiation emitted by the power lines will affect flying bats or interfere with the echolocation of insectivorous bats during foraging.		x	

[1] Van Rooyen, C.S. 1998. Raptor mortality on power lines in South Africa. *Proceedings of the 5th World Conference on Birds of Prey and Owls*. Midrand (South Africa). Aug.4 – 8, 1998.

[2] Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. *Bird Conservation International,* 20: 263-278.

Impact	Activities and Possible Effect	Phase		
		Construction	Operation and Maintenance	Post-closure and Rehabilitation
AQUATIC ECOSYSTEMS				
Degradation, fragmentation and loss	Fragmentation of freshwater ecosystems, estuary mouth dynamics and flow patterns may result in an indirect loss of ecological patterns and processes such as species movement and dispersal, habitat connectivity, increased edge effects and disturbance, establishment of IAPs. Earthworks and excavations would mainly affect fossorial fauna (i.e. animal adapted to living underground), as well as small, less-mobile fauna (e.g. amphibians, as well as freshwater obligate reptiles and shrews/rodents). Certain fauna are more susceptible to impacts from increased noise and/or artificial lighting. Noise and light impacts ultimately result in the displacement of fauna away from the noise impact area, but is expected to be temporary, and restricted to the construction phase.	x	x	
Hydrological alteration	Compaction of soils, creation of preferential flow paths and stormwater runoff may result in increased flows (hydrological alteration) within receiving aquatic environments, particularly in relation to runoff discharge points, which in turn has a number of indirect issues such as bank erosion and collapse, scouring and channel incision, headcut erosion, desiccation of wetland/riparian soils and vegetation, increased turbidity, sedimentation and smothering of benthos. Stormwater runoff resulting in increased flows into estuaries/watercourses may lead to bank erosion and collapse, scouring, channel incision, desiccation of estuarine/wetland/riparian soils and vegetation, increased turbidity, sedimentation and smothering of benthos.	x	x	x
Water quality deterioration	Waste pollution and contamination of aquatic environments from foreign materials (e.g. fuels/hydrocarbons, cement, and building materials) results in deteriorated water quality. Water quality may also deteriorate as a result of sediment disturbance and/or the removal of estuarine and riparian vegetation, or pollution events, resulting in, for example, an increase of the Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). This can have knock-on effects on aquatic biota.	x	x	x
Altered sediment dynamics	Pylon infrastructure may alter estuarine physical dynamics in the event of being placed inside the EFZ, e.g. infilling, altered channel migrating, increased mouth closure. Estuarine channels can develop and migrate anywhere within the EFZ under the influence of tidal flows, river flows and floods. Stabilising sections of the estuary morphology or floodplain for construction, operation and maintenance of EGI can lead to changes in long-term physical dynamics. Disruption of channel and bed formation process will alter sediment structure, change estuary hydrodynamics, mouth	x	x	x

Impact	Activities and Possible Effect	Phase		
		Construction	Operation and Maintenance	Post-closure and Rehabilitation
	dynamics, and ultimately impact catchment and marine connectivity. This altered functioning of a system will ultimately affect the biota.			
Establishment and spread of IAPs	As described above.	x	x	

The mitigation hierarchy must be applied during all development phases of the proposed EGI. Key mitigation measures include:

- Avoid, as far as possible, the most sensitive areas identified in this assessment and areas identified by specialists in the field during subsequent environmental assessment (as and where required);
- Minimise footprint and construction duration;
- Minimise new development footprints through utilising existing infrastructure and disturbance corridors as far as possible;
- Manage and continuously control Invasive Alien Plants;
- Manage and continuously control soil erosion;
- Manage people and vehicles on- and around the site through proper induction, environmental awareness and monitoring of their activity; and
- Rehabilitate to a near-natural state as far as possible.

Additional details on recommended mitigation measures and best practice guidelines are provided in Sections 8 and 9 of the Integrated Biodiversity and Ecology Assessment (Appendix C.1 of the Final SEA Report).

Overall, if mitigation and best practice measures are adhered to, it is expected that the risk to terrestrial and aquatic ecosystems and biodiversity from EGI development can be reduced to acceptable levels.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

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Part 4.2.2

Visual Assessment

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ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
SAHRA	South African Heritage Resources Agency
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.2 Visual Assessment

4.2.2.1 Introduction

The Visual Assessment Report (included in Appendix C.2 of this Final Strategic Environmental Assessment (SEA) Report) focused on the identification of features of visual or scenic value, as well as sensitive receptors within the two expanded Electricity Grid Infrastructure (EGI) corridors. The purpose of the assessment was to determine overall visual sensitivity within the corridors in the context of EGI and to identify typical visual impacts associated with the proposed type of development.

4.2.2.2 Scope of the Assessment

The scope of the Visual Assessment includes scenic, aesthetic and amenity values, relating to both the natural and cultural landscape, and heritage resources where these are prone to visual impacts. This strategic study was conducted at a regional scale and covers a broad area in order to determine optimum areas for EGI and to identify management actions to avoid or minimise the potential negative impacts. The objectives are therefore different to that of an Environmental Impact Assessment (EIA) at the local project scale.

The landscape characteristics of the two Expanded EGI Corridors was based on desktop studies using available information, and no fieldwork or ground-truthing was carried out.

To ensure consistency, this Assessment followed the same approach and criteria used in the Visual assessment undertaken as part of the 2016 EGI SEA (Department of Environmental Affairs (DEA), 2016[1]).

4.2.2.3 Spatial Data

The analysis made extensive use of data resources as indicated in Table 1.

Table 1: Available Spatial Data used in the Visual Assessment Report.

Feature	Data Source
Geological Stratigraphy and Lithology	▪ 1:2 000 000 Simplified Geological Map of South Africa, Lesotho and Swaziland. Council for Geoscience, 2008.
Topographical and Cadastral Information	▪ 1:500 000 and 1:250 000 topographical maps of South Africa. Surveys and Mapping (several sheets with various dates).
National Parks and Protected Areas	▪ South African Protected Areas Database. DEA, Q4, 2017.
Heritage Sites	▪ Inventory of Heritage Sites for South Africa. South African Heritage Resources Agency (SAHRA), 2017.
Scenic Routes and Mountain Passes	▪ Map Studio, Road Atlas of South Africa.

The assumptions and limitations applicable to the study are captured in Section 4.3 of the Visual Assessment (included in Appendix C.2 of this Final SEA Report).

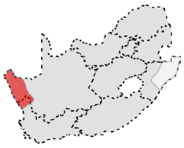
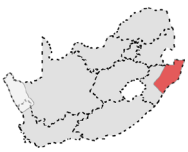
[1] DEA. 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

4.2.2.4 Key Environmental Attributes and Sensitivities

This section provides a brief description of key visual features and sensitivities in each of the corridors (Table 2). Landforms are the dominant landscape features at the regional scale, and therefore these play a major role in determining scenic resources.

Low visual sensitivity areas are those with relatively even topography and adequate distance from visually sensitive features or receptors. Medium and high visual sensitivity areas are those within reasonable viewing distance or close range of any proposed transmission line development, as indicated by the recommended buffers for various sensitive features and receptors. Very high visual sensitivity areas are those scenic resources and sensitive receptors that are in close proximity to, or could be compromised by proposed transmission lines. In the Expanded Western EGI Corridor, these tend to include national parks and visually sensitive topographic features; whilst in the Expanded Eastern EGI Corridor, these tend to include game reserves, heritage sites and settlements.

Table 2: Summary of key features and overall suitability of the Draft Refined Expanded EGI Corridors from a visual perspective.

Draft Refined Expanded EGI Corridor	Brief Description
Expanded Western EGI Corridor 	▪ This corridor forms part of the Namaqua Metamorphic Province, an arid, mountainous, rugged landscape. Rivers are few and dry for most of the year. ▪ Except for the few towns clustered around the copper mining area, settlements tend to be small and scattered far apart. Nababeep, Okiep and Concordia, north of Springbok, are all historical mining towns. ▪ The main landscape types that fall within this corridor include the: o Namaqua Metamorphic rocks – which is the largest landscape and includes gneiss, schist and quartzite; o Coastal peneplain of sand, gravel, calcrete and alluvium; and o Inland plateau, about 1000 m above sea level, of similar materials to the coastal peneplain. ▪ In the south of the corridor, the Kamiesberg Mountains are particularly scenic, although much of the escarpment between the coastal plain and the inland plateau has scenic value. The Namaqua National Park, west of Kamieskroon, and the Goegap Nature Reserve near Springbok are known for their spring flowers. The Richtersveld Transfrontier Park, part of which is a World Heritage Site (listed as the Richtersveld Cultural and Botanical Landscape) is located in the far north of the corridor. ▪ This corridor has moderate to good suitability for power line infrastructure development in visual/scenic terms. ▪ Potential transmission line routes exist along the coastal plain or inland plateau areas where these avoid major scenic or heritage resources. Some pinch-points present a severe constraint.
Expanded Eastern EGI Corridor 	▪ The corridor is a geologically and topographically complex landscape. ▪ The landscape is covered with grassy hills and densely forested valleys. Numerous rural settlements straddle the hillsides. The southern portion of the corridor is characterised by cattle farming, sugar cane, timber and wattle plantations. There is a large concentration of game reserves further north. ▪ The main landscape types that fall within this corridor include the: o Natal Metamorphic rocks overlaid by the Natal Sandstones; o Karoo Ecca Group shales and sandstones intruded by dolerite; o Basalt band and rhyolite of the Lebombo Mountains; and o Wide coastal plain of sand, calcrete and limestone, becoming narrower to the south. ▪ The southern section of the corridor contains a deeply dissected landscape, where the rivers have cut down to the gneiss and granite basement rocks, combined with considerable faulting, resulting in numerous ridges and valleys, sometimes with steep cliffs. ▪ The central portion of the corridor consists of Ecca Group shales and sandstones, the softer rocks resulting in a more subdued topography. These are

Draft Refined Expanded EGI Corridor	Brief Description
	intruded in places by Karoo dolerites, which tend to form the peaks. ▪ The eastern and northern parts of the corridor form a flat coastal plain, more than 50 km wide in the north. The plain consists mainly of sand, calcrete and limestone, with siltstone and sandstone further inland. ▪ Scenically prominent features of the corridor include the mountainous terrain around Greytown, Kranskop and Nkandla, the deep, steep-sided river gorges, the high dunes with coastal forest, and the famous St Lucia wetlands, which have been declared a World Heritage Site. To the north, scenic features include the Lebombo Mountains, Pongolopoort Dam (Lake Jozini), Lake Sibaya, and Kosi Lake. ▪ This corridor has moderate suitability for power line infrastructure development in visual/scenic terms. ▪ Potential transmission routes exist slightly inland of the coast. The complex topography and cultural landscape features further inland present numerous constraints.

4.2.2.5 Sensitivity Criteria and Mapping

Table 3 provides a list of the key visual and scenic features considered during the Visual Assessment of the Expanded EGI Corridors. The features were spatialised by means of buffers, based on the scale of the EGI development, as well as the relative sensitivity of the feature or receptor (i.e. very high, high, moderate or low sensitivity) (Table 3). The recommended buffers are consistent with those used in the 2015 Visual Assessment (DEA, 2016). The sensitivity mapping is displayed in Figure 1 (Expanded Western EGI Corridor) and Figure 2 (Expanded Eastern EGI Corridor).

At the project scale, the viewshed, as well as viewing distances and visual absorption capacity of the landscape, would be additional criteria that are used to quantify potential visual impacts. The buffers could vary at the project scale depending on viewshed mapping and site conditions. The buffers indicated with a "*****" in Table 3 below show viewsheds that should be taken into account at the project scale. Buffers could be reduced if proposed transmission infrastructure is located outside the viewshed or in a view shadow.

The actual footprint and height of the proposed EGI also needs to be taken into account during the project specific stage. However, the buffers provided in Table 3 are based on a 400 kV transmission line 30 to 60 m high, and substations of about 1 ha or more. Buffers could be reduced where towers are less than 20 m high, or where substations are less than 1 000 m^2.

The buffers provided are in response to potential visibility of the proposed transmission infrastructure as indicated below based on field observations. Visibility would be increased by development on ridges or skylines:

- High visibility: Clearly noticeable within the observer's viewframe 0 to 0.5 km.
- Moderate visibility: Noticeable feature within observer's viewframe 0.5 to 1 km.
- Marginal visibility: Partially noticeable within observer's viewframe 1 to 2 km.
- Low visibility: Hardly visible unless pointed out to observer 2 to 4 km+.

Table 3: Nominal buffer distances between EGI development and sensitive features and receptors used in the regional sensitivity mapping.

Feature Type	Very High Sensitivity	High Sensitivity	Moderate Sensitivity	Low Sensitivity
Topographic features including steep slopes	250 m	500 m	1 km	-
Major rivers	500 m	1 km	2 km	-
Water bodies, dams, wetlands, pans	500 m	1 km	2 km	-
Ramsar Sites	1 km	2 km	3 km	-
Coastal zone	1 km	2 km	3 km	-
National Parks, World Heritage Sites	2 km	3 km *	4 km *	-
Protected Areas - Nature Reserves	1 km	2 km *	4 km *	-
Private reserves and game farms	n/a	1 km *	2 km *	-
Cultural landscapes	250 m	500 m *	1 km *	-
Heritage sites	250 m	500 m *	1 km *	-
Towns / villages / settlements	500 m	1 km	2 km	-
National roads	500 m	1 km *	2 km *	-
Provincial routes	250 m	500 m *	1 km *	-
Scenic routes	1 km	2 km *	3 km *	-
Passenger rail lines	250 m	500 m *	1 km *	-
Airfields	3 km	-	8 km	-

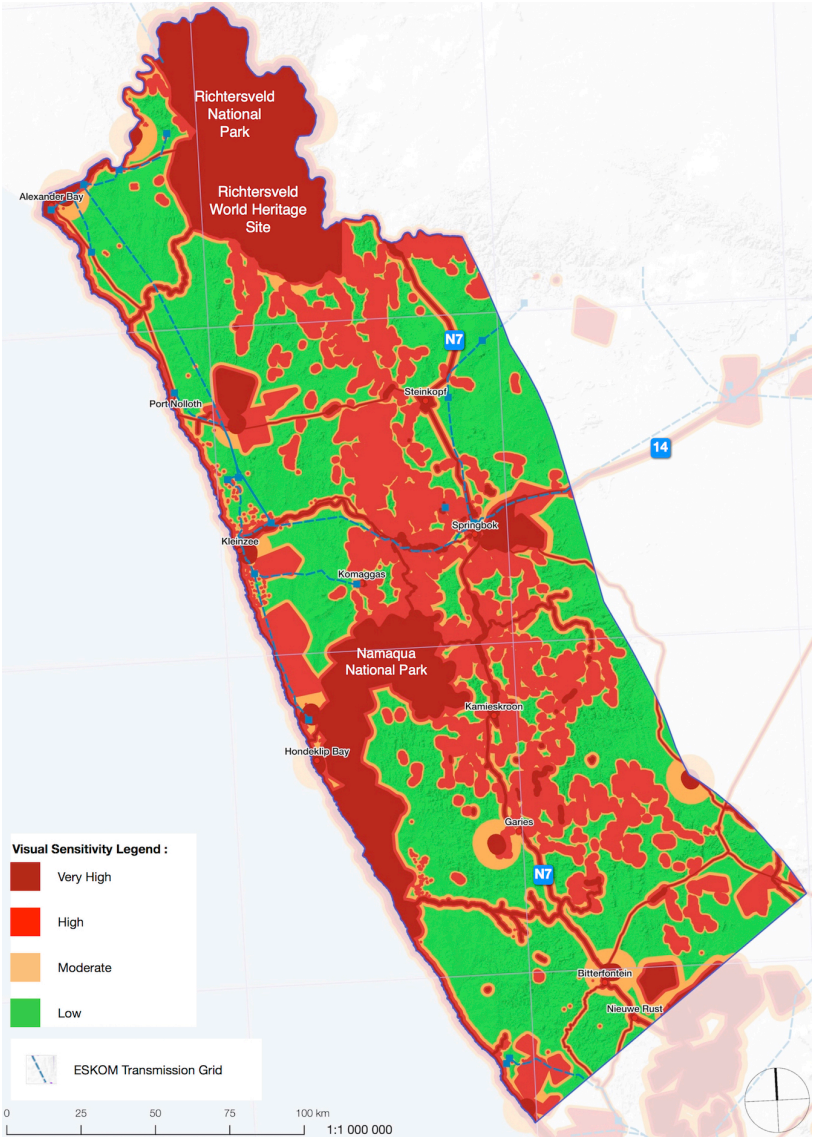


Figure 1: Visual Sensitivity of the Expanded Western EGI Corridor.

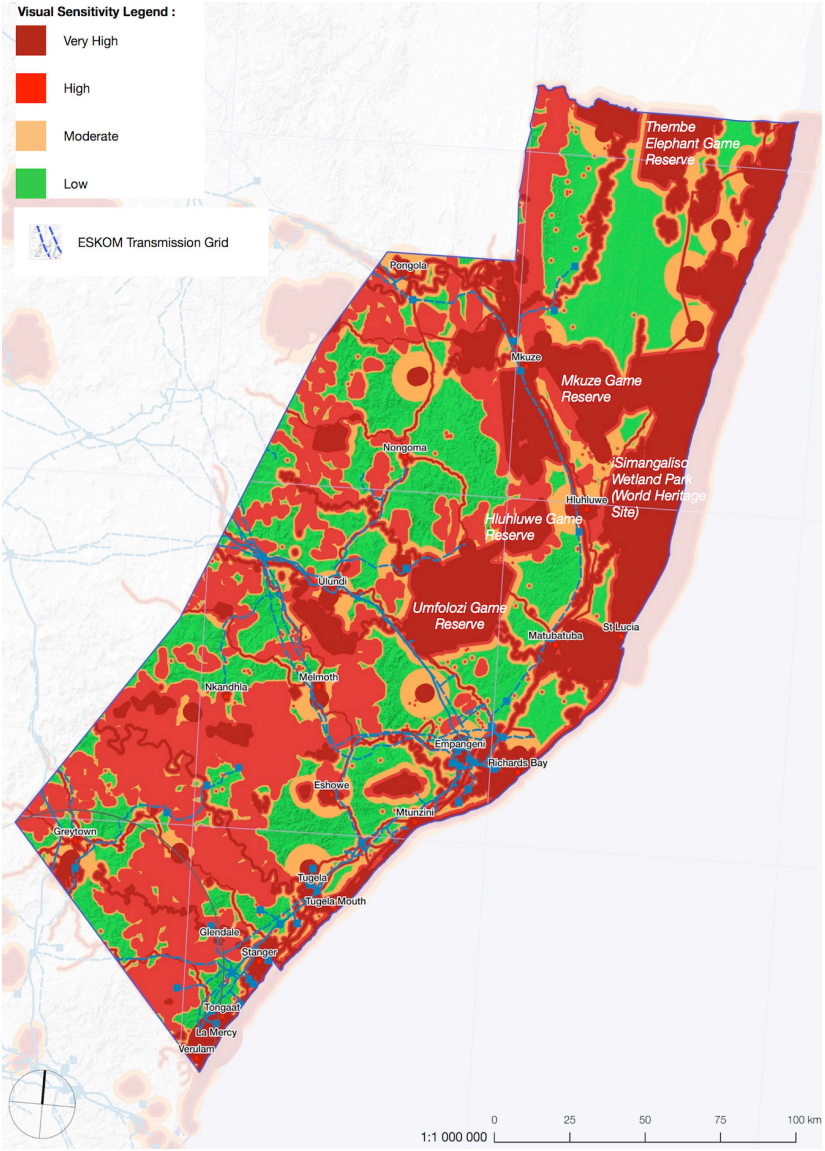


Figure 2: Visual Sensitivity of the Expanded Eastern EGI Corridor.

4.2.2.6 Potential Impacts and Mitigation

Sections 5 and 9 of the Visual Assessment (Appendix C.2 of the Final SEA Report) include detailed feedback on the potential visual impacts associated with the EGI. This section and Table 4 provides a summary of the potential impacts and key mitigation measures identified.

Table 4: Key Potential Impacts identified in the Visual Assessment.

Key Potential Impacts	
Expanded Western EGI Corridor	**Expanded Eastern EGI Corridor**
Potential visual intrusion on scenic mountain ranges, escarpment and granite outcrops. In relation to the corridor, this includes the Kamiesberg Mountains in the south, Komaggas Mountains, mountain peaks around Springbok and the rugged Richtersveld mountains.	Potential visual intrusion on scenic mountain ranges, ridgelines, scarp edges, dolerite koppies and high coastal dunes. In relation to the corridor, this includes the Lebombo and Ubombo Mountains in the north; mountainous areas around Greytown, Nkandla and Ulundi; and high dunes along the coast.
Potential visual impact on national parks, nature reserves, and their related wilderness experience. In relation to the corridor, this includes the Namaqua National Park and related wild flower reserve,	Potential visual impact on game reserves, nature reserves, wilderness areas and tourism facilities, including their wilderness experience. In relation to the corridor, this includes the Ndumi Game Reserve, Tembe

Key Potential Impacts	
Expanded Western EGI Corridor	**Expanded Eastern EGI Corridor**
Richtersveld Transfrontier Park and World Heritage Site, and the Goegap Nature Reserve.	Elephant Reserve and Mkuze Game Reserve in the north; Hluhluwe/Umfolozi Game Reserves further south; and St Lucia Game Reserve and World Heritage Site at the coast.
Potential visual impact on private reserves, game farms and tourism facilities. Private reserves, game farms and tourism facilities are indicated in the various maps included in Appendix 1 of the Visual Assessment (Appendix C.2 of the Final SEA Report).	
Potential visual impact on river corridors, which often form green oases in the arid landscape. In relation to the corridor, this includes the Orange River, Holgat River, Buffels River, Spoeg River, Bitter River, and Groen River.	Potential visual impact on river valleys, gorges, ravines, waterfalls, estuaries and wetlands. In relation to the corridor, this primarily includes the St Lucia wetland system; Lake Sibayi and Kosi Lake to the north; the large Jozini Dam (Pongolopoort Dam), and the Tugela River Valley and tributaries.
Potential visual impact on mission settlements, historical towns and other heritage sites. In relation to the corridor, this includes the Steinkopf, Rietpoort mission settlements, historical mining towns (Nababeep, Okiep, and Concordia) and other historical settlements/sites.	Potential visual impact on historic towns and settlements, and heritage sites including battle sites and gravesites. In relation to the corridor, this includes numerous traditional settlements. Towns, villages and heritage sites are indicated in the various maps included in Appendix 1 of the Visual Assessment (Appendix C.2 of the Final SEA Report).
Potential visual impact on national/arterial and scenic routes/mountain passes, and historical rail lines. In relation to the corridor, this includes the N7, particularly between Kamieskroon and Springbok, parts of the N14 east of Springbok, Spektakel Pass west of Springbok, and other smaller routes or passes.	Potential visual impact on national, arterial and scenic routes, and passenger rail lines. In terms of the corridor, this includes the N2, particularly along the coast and across estuaries, as well as the Pongola poort to Jozini, and numerous scenic routes and passes in rural areas.

The following key mitigation measures and best practice measures were identified in the Visual Assessment:

- Avoid development on visually sensitive mountain peaks, ridge skylines scarp edges, dolerite koppies, dunes and steep slopes.
- Avoid development within a viewshed of protected landscapes. Screen substations from view.
- Avoid development where scenic resources or tourism facilities would be compromised.
- Although river crossings are inevitable, avoid scenic gorges or ravines and estuaries.
- Avoid power lines and substations intruding on historical settlements and sites, including battle sites. Maintain recommended visual buffers.
- Avoid power lines crossing or running adjacent to scenic routes/passes. Locate substations away from these routes and screen where necessary.
- Transmission lines could share corridors with other compatible linear routes or utilities (where technically allowable), reducing the amount of servitudes required, and reducing the number of new corridors that fragment the landscape.
- Similarly, new transmission lines should be located near existing power line corridors, except where the existing ones are in sensitive areas, or where the cumulative visual impact would be too high.
- Strategically placed foreground planting can be used to screen views from sensitive viewpoints or receptors.
- Careful consideration should be given to the selection of pylon design, such as use of the more modern monopole and T-pylon, as used in Europe, which create less visual 'clutter' than lattice type towers.
- Buildings that form part of substations should be in keeping with their local context, and should be in sympathy with the regional or vernacular architecture.

Additional Best Practice Measures and Monitoring Recommendations are provided in Section 10 of the Visual Assessment included in Appendix C.2 of this SEA Report.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.3

Seismicity Assessment

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ABBREVIATIONS

CGS	Council for Geoscience
DRR	Disaster Risk Reduction
EGI	Electricity Grid Infrastructure
M_{max}	Maximum Credible Magnitude
MMI	Modified Mercalli Intensity
PGA	Peak Ground Acceleration
PSHA	Probabilistic Seismic Hazard Assessment
SANSN	South African National Seismograph Network
SCR	Stable Continental Region
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.3 Seismicity Assessment

4.2.3.1 Introduction

South Africa is generally described as a 'stable continental region' (SCR) as it is remote from the boundaries of tectonic plates and active continental rifts. This does not mean that large earthquakes cannot occur, but that they occur far less frequently than in places such as California, Italy and Japan, and the maximum credible magnitude M_{max} is somewhat lower. Earthquakes are driven either by geological forces (e.g. motion of tectonic plates, isostatic response to erosion, volcanism) or certain human activities (e.g. mining, impoundment of reservoirs, fluid injection or extraction).

Eight damaging earthquakes (5.0<M<6.3) have occurred in South Africa during the last 120 years. Earthquake activity in South Africa is reviewed in Appendix A of the Seismicity Assessment (Appendix C.3 of the Final SEA Report). Five had an unequivocal tectonic origin, while three were in mining districts. Mining-related earthquakes (M_{max}5.7) are restricted to the regions where deep and extensive gold mining has taken place, notably the Welkom and Klerksdorp districts. Thus a potentially damaging earthquake (about 5.0<M<6.5) occurs somewhere in South Africa, on average, every 10-20 years; structural damage is limited to a radius of 100 km from the epicentre. Three of these earthquakes caused deaths (i.e. 1969 Ceres-Tulbagh; 2005 Stilfontein; and 2014 Orkney).

Larger tectonic earthquakes (6.5<M<8.0) are rare in stable regions, but may occur both on faults with a recent (100s-10,000s years) history of earthquake activity, and in areas with no known precursory activity. Such events could therefore take place anywhere. Thus, the locations of historical earthquakes cannot be taken as reliable indicators of areas where large earthquakes will occur.

EGI are "lifelines", a term used by the Disaster Risk Reduction (DRR) community to describe "man-made structures [that are] important or critical for a community to function, such as roadways, pipelines, power lines, sewers, communications, and port facilities" (Aki & Lee 2003: 1821[1]). As noted above, lifelines are vulnerable to damage caused by the shaking of the ground during an earthquake, as well as associated phenomena.

EGI are vulnerable to damage (damage to the structure itself or breakage of cables) caused by seismic (related) hazards such as, (a) ground shaking or displacement across the earthquake fault (direct impact) or (b) ground displacements triggered by the earthquake shaking, such as landslides, liquefaction and lateral spreading (indirect impact). This in turn may lead to social, environmental and economic risks.

4.2.3.2 Scope of the Assessment

The Seismicity Assessment addresses the risks posed by earthquakes and associated phenomena on EGI within the proposed Draft Refined Corridors. The following issues have been assessed:

- What damage could earthquake-related phenomena (e.g. strong ground motion, surface displacement as the result of fault rupture, landslides triggered by strong ground motion, liquefaction of soils induced by ground shaking, tsunami) cause to EGI?
- What impact would the damage to EGI have on the environment and people?

[1] Aki, K and Lee, WHK, 2003. Glossary of interest to earthquake and engineering seismologists, In: WHK Lee, H Kanamori, PC Jennings & C Kisslinger (Eds). *International Handbook of Earthquake and Engineering Seismology*. Part B. Amsterdam: Academic Press. 1793-1856.

EGI do not affect seismicity in any known way. High-level conclusions and recommendations have been included in the assessment, which were based on the evidence contained in the following appendices of the Seismicity Assessment Report (Appendix C.3 of this Final SEA Report):

- Appendix A: Earthquake monitoring, hazard and risk assessment in South Africa;
- Appendix B: OpenQuake Probabilistic Seismic Hazard Assessment (PSHA) computation for South Africa and the energy corridors; and
- Appendix C: Vulnerability of EGI.

The assessment focuses primarily on the interpretation of existing data and is based on defensible and standardised, and recognised methodologies. It discusses potential impacts, and identifies any gaps in information linked to earthquakes and seismicity with respect to EGI. Due to the strategic nature of the SEA and extent of the assessed area, a quantitative Seismicity Assessment was not required. Findings of the Seismicity Assessment were used to inform the location of corridors and the sensitivities within.

4.2.3.3 Data Sources

The analysis made use of the primary information sources indicated in Table 1.

Table 1: Primary Information Sources used in the Seismicity Assessment Report.

Feature	Information Source and Description
Landslide Geohazard for South Africa	This provides a detailed study on landslides in South Africa. Singh et al. 2011.
Council for Science (CGS) Geohazard Atlas	This provides information on collapsing and swelling soils. Data source is indicated below[2].
Earthquake Seismology	This provides a comprehensive review of earthquake monitoring, hazard and risk assessment in South Africa. Durrheim 2015.
The history of mining seismology	This provides a comprehensive review of mining-induced earthquake monitoring, hazard and risk assessment in South Africa. Durrheim & Riemer 2015.
Homogeneous earthquake catalogue for Southern Africa	This contains an earthquake catalogue for South Africa. Mulabisana 2016 (MSc dissertation).
Seismic sources, seismotectonics and earthquake recurrence for the KwaZulu-Natal (KZN) coastal region	This includes active faults in the KZN coastal region. Singh 2016 (PhD thesis).
Seismotectonics of South Africa	This includes a Seismotectonic model for South Africa, which includes active faults and earthquake source mechanisms. Manzunzu et al. 2019.
The Probabilistic Seismic Hazard Assessment (PSHA) of South Africa	This includes the PSHA for South Africa. Midzi et al. 2018 (in review).
Development of a South African Minimum Standard on ground vibration, noise, air-blast and flyrock near surface structures to be protected	This includes blasting-induced ground vibrations. Milev et al. 2016.
Global catalogues of earthquakes in stable continental regions	This includes a global catalogue of earthquakes in stable continental regions. Johnston et al. 1994

The assumptions and limitations applicable to the study are captured in Section 2.4 of the Seismicity Assessment (included as Appendix C.3 of this Final SEA Report).

4.2.3.4 Key Environmental Features and Attributes

As noted above, most earthquakes in Southern Africa are induced by deep-level mining for gold and platinum, and thus restricted to the mining districts. However, natural earthquakes do take place from time to time. Figure 1 shows the location of recorded earthquakes in Southern Africa from 1811 to 2014 in relation to the Expanded EGI Corridors.

[2] http://197.96.144.125/jsviewer/Geohazards/index.html#

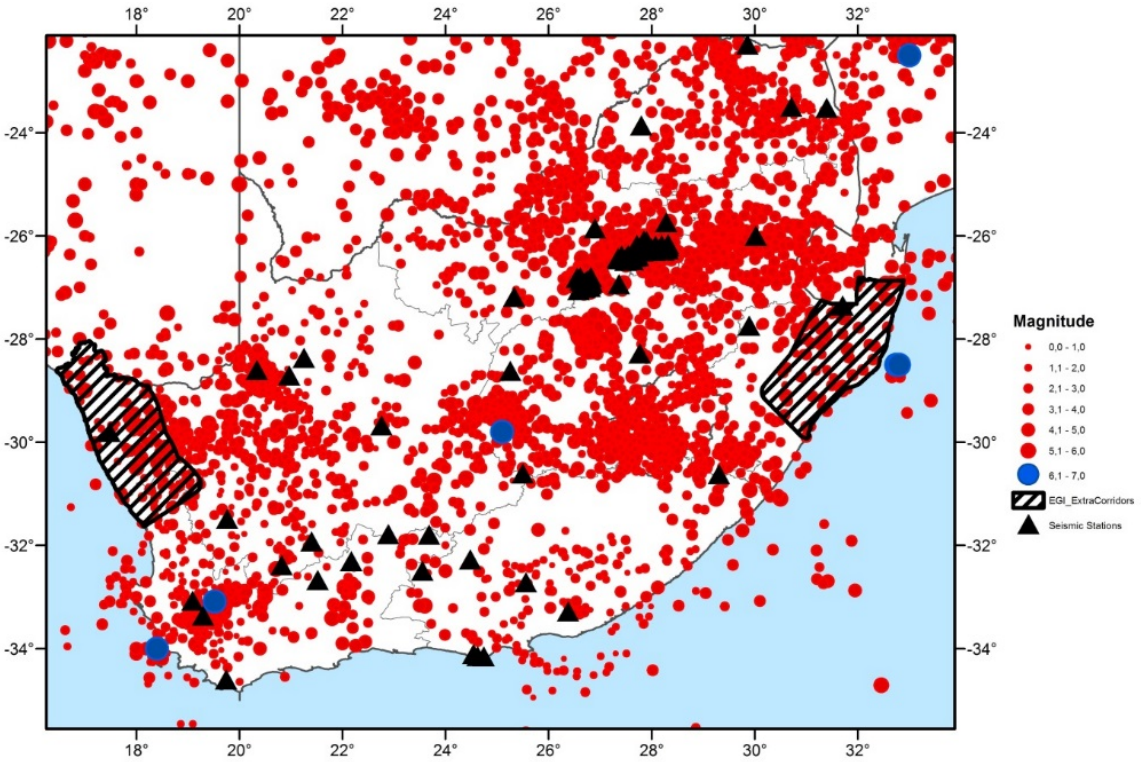

Figure 1: Location of recorded earthquakes in Southern Africa from 1811 to 2014 and the Expanded EGI Corridors. The black triangles indicate the position of the stations that comprise the South African National Seismograph Network (SANSN).

In terms of faults within the Eastern Expanded EGI Corridor, the Tugela Fault has been mapped as "potentially active" by Manzunzu et al. (2019[3]); and a fault near the KwaZulu-Natal – Mozambique border that displaced the 75,000 year-old Port Durnford Formation by 30 m is described by Kruger and Meyer (1988[4]). In the Western Expanded EGI Corridor, several faults have been mapped as "potentially active" by Manzunzu et al. (2019[3]).

Earthquake-related hazards are divided into the following two categories:

- Primary hazards (direct Impacts), i.e. ground shaking and displacement; and
- Secondary hazards (indirect Impacts), i.e. landslides and soil liquefaction.

Parts of the Expanded EGI Corridors that are sensitive to earthquake hazards lie within the following regions:

- Regions with **elevated seismic hazard**. An earthquake may cause the ground and EGI to shake to such an extent that damage occurs; or the earthquake rupture causes a displacement between opposite sides of the fault that is large enough to damage structures or break cables that straddle it.
- Regions prone to **landslides** and/or characterised by **problem soils** (i.e. soils that are prone to collapse, swelling or liquefaction). Earthquake shaking may trigger landslides and rockfalls and cause soils to liquefy. All these phenomena may lead to damage and loss.

These hazards are detailed below.

[3] Manzunzu, B, Midzi, V, Mulabisana, TF, Zulu, B, Pule, T, Myendeki, S and Rathod, GW. 2019. Seismotectonics of South Africa. *Journal of African Earth Sciences*, 149:271-279.

[4] Kruger GP & Meyer R. 1988. A sedimentological model for the northern Zululand coastal plain. Proceedings of the 22nd Earth Science Congress of the Geological Society of South Africa, pp.423-426.

a) Probabilistic Seismic Hazard Assessment

The levels of the shaking intensity scale experienced on the surface of the earth can be roughly related to the Peak Ground Acceleration (PGA). It is expressed either in terms of gals (cm/s^2) or the acceleration of gravity (g, 9.8 m/s^2). The latest and most complete assessment of seismic hazard (PSHA) in South Africa was performed by the Council of Geoscience (CGS) (Midzi et al. 2018[5]) using an up-to-date homogenised earthquake catalogue. For this study, the CGS assessment was extended to cover the Expanded EGI Corridors. The main results of the PGA calculations are shown in Figure 2.

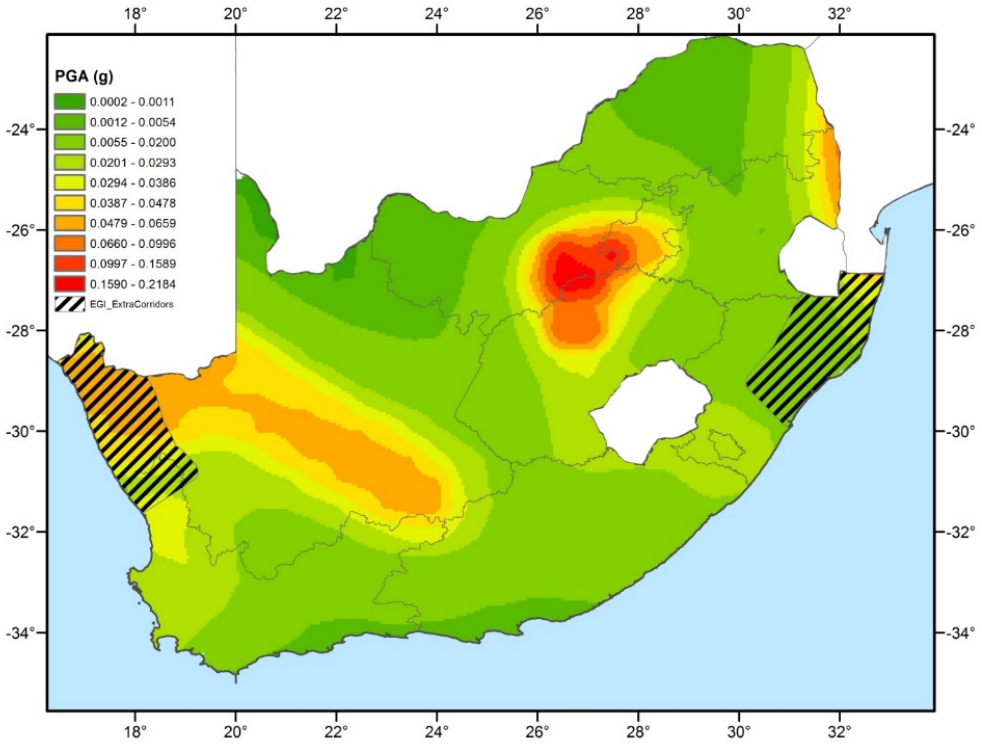

Figure 2: PGA (g) with 10% probability of exceedance in 50 years.

As indicated in Figure 2, the PGA (10% probability of exceedance in 50 years) in the Eastern and Western Expanded EGI Corridors reach values of about 0.04 g and 0.07 g, respectively. These values are typical of Modified Mercalli Intensity (MMI) VI, where the shaking is strong enough to cause alarm but only cause minor damage to buildings and well below the damage thresholds of modern EGI. Larger events are possible, but have recurrence times of centuries.

Regions where the risk is relatively high (but still low) are the Klerksdorp and Welkom mining districts in the North West and Free State Provinces (as noted above). The PGA (10% probability of exceedance in 50 years) in these regions reaches values of about 0.2 g, which is typical of MMI values of about VIII where the shaking is strong enough to cause slight damage to earthquake-resistant structures, considerable damage to solid buildings, and great damage to poorly-built buildings. However, these regions are far removed from the EGI corridors considered.

[5] Midzi V, Manzunzu B, Mulabisana TF, Zulu BS, Pule T, Myendeki S & Rathod, G. 2018. The Probabilistic Seismic Hazard Assessment of South Africa. *Journal of Seismology* (in review).

b) Landslide Hazards

Figure 3 depicts the landslide susceptibility based on comprehensive surveys conducted by Singh et al. (2008[6], 2011[7]). It should be noted that the predominant trigger of landslides is intense rainfall, not earthquakes. As depicted in Figure 3, landslide susceptibility is low within the Western Expanded EGI Corridor but is significant in parts of the Eastern Expanded EGI Corridor. In the Eastern Expanded EGI Corridor, areas of rugged topography are prone to landslides.

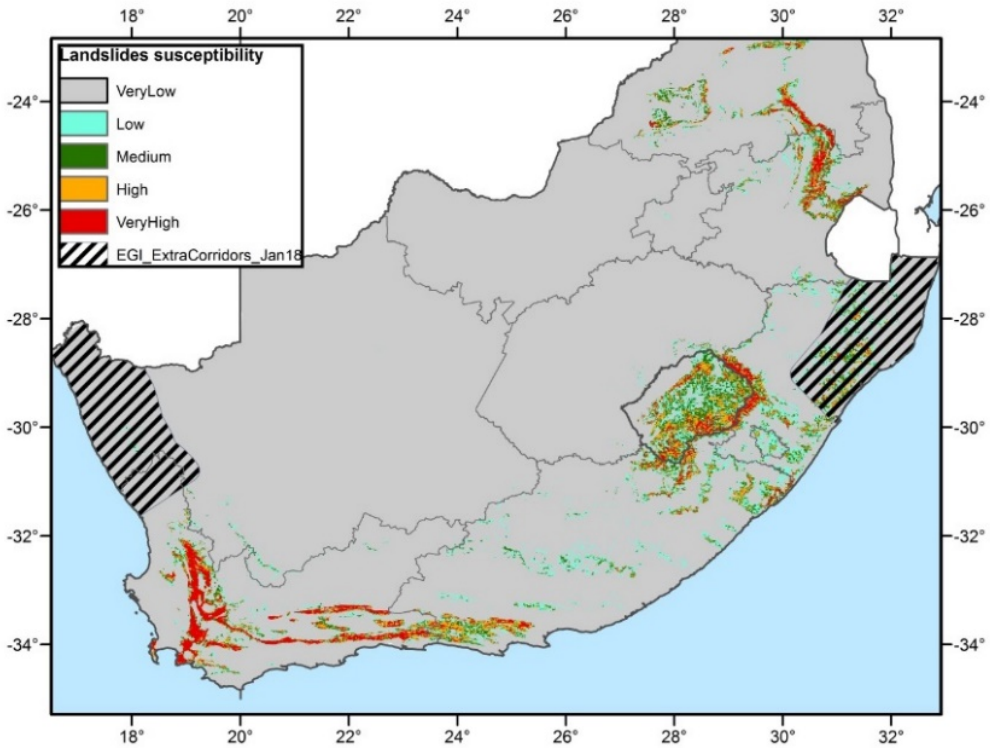

Figure 3: Landslide Susceptibility Map (Singh et al. 2011[7]).

c) Problem Soil Hazards

Problem soils are divided into two main categories (i.e. collapsible soils and swelling soils). Collapsible soils are indicated in Figure 4. They are also known as metastable soils and are unsaturated soils that undergo a large volume change upon saturation. The sudden and usually large volume change could cause considerable structural damage. Collapsible residual granite sand is found in parts of the Expanded Eastern EGI Corridor; and collapsible transported sands are found in parts of both the Expanded Eastern and Western EGI Corridors (Figure 4).

[6] Singh RG, Botha GA, Richards NP & McCarthy TS. 2008. Holocene landslides in KwaZulu-Natal, South Africa. *South African Journal of Geology*, 111:39-52.
[7] Singh, RG, Forbes, C, Chiliza, G, Diop S, Musekiwa C & Claasen D. 2011. *Landslide Geohazards in South Africa.* Report No. 2011-0016, Council for Geoscience.

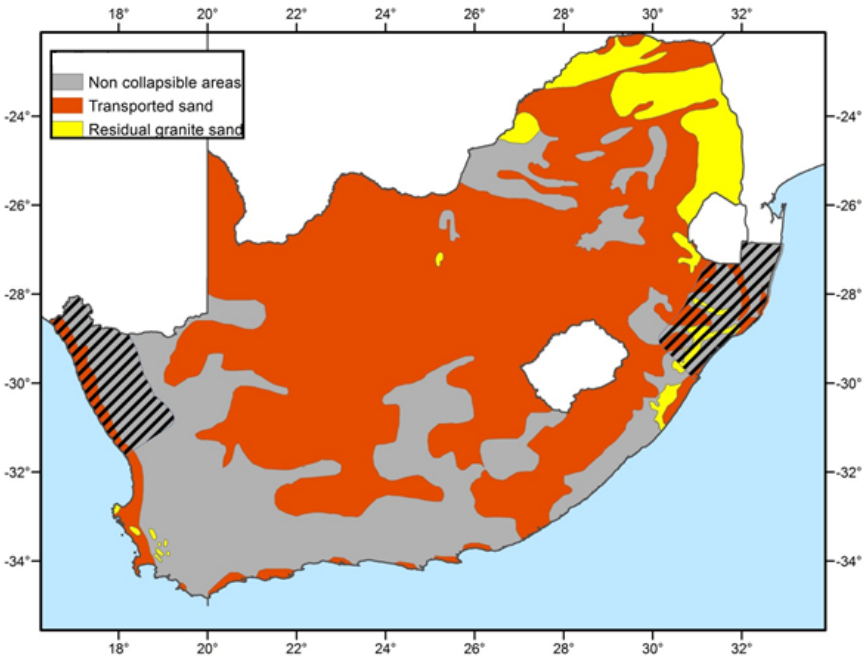

Figure 4: Collapsible Soils in South Africa based on the CGS Geohazard Atlas.

Swelling soils are prone to large volume changes (swelling and shrinking) that are directly related to changes in water content. Soils with a high content of expansive minerals can form deep cracks in drier seasons or years. As indicated in Figure 5, the occurrence of swelling soils in the Expanded Eastern EGI Corridor ranges from “very low” to “moderate to high” (in some small sections). The occurrence of swelling soils in the Expanded Western EGI Corridor is “very low”.

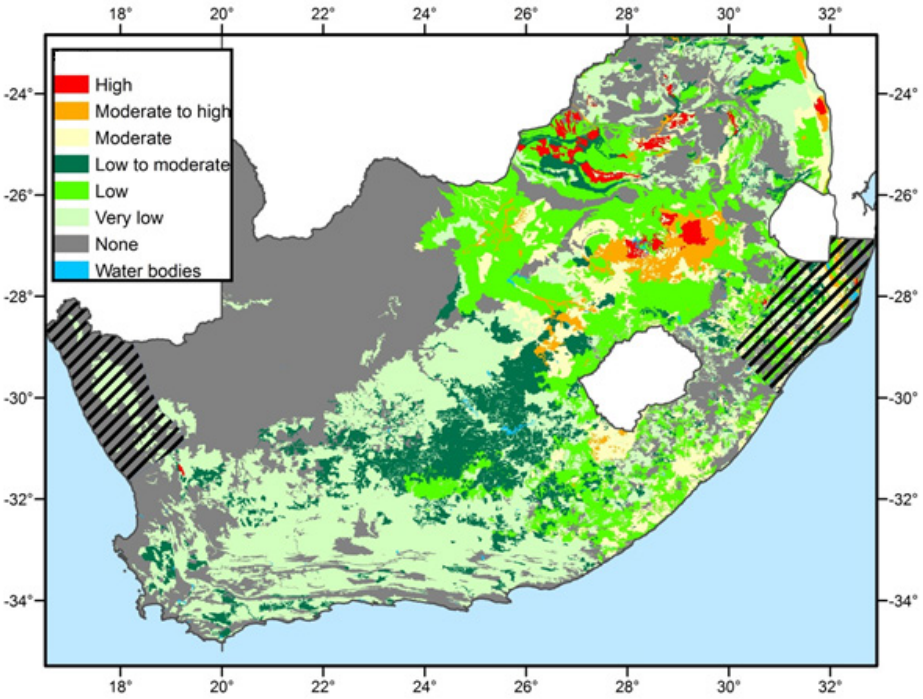

Figure 5: Swelling clays in South Africa based on the CGS Geohazard Atlas.

4.2.3.5 Sensitivity Criteria

Based on the above, the following criteria are proposed to identify regions where EGI may be sensitive to the effects of earthquakes:

- Elevated seismic hazard, i.e. regions that have:
  - Historical or instrumental records of M>5 earthquakes;
  - Palaeoseismic evidence of M>6 earthquakes (age <100,000 years, indicated by mapped and dated fault scarps);
  - PGA>0.05 g (475 years recurrence, equivalent to 10% probability of exceedance in 50 years); or
  - Active faults (indicated by present-day seismic activity).
- Elevated vulnerability, i.e. sub-regions that have:
  - Steep topography prone to seismically-triggered landslides;
  - Thick near-surface low-seismic-velocity layers prone to site amplification; or
  - Saturated soils and sands prone to liquefaction when shaken.

The above should be considered during the planning stage.

Sensitivity maps have not been produced for this specific topic due to the poor resolution of PSHA, large uncertainties, and the lack of detailed information regarding currently active faults and near-surface geology.

4.2.3.6 Potential Impacts and Mitigation

Section 4 of the Seismicity Assessment (Appendix C.3 of the Final SEA Report) includes detailed feedback on the potential seismic related impacts associated with the EGI. This section provides a summary of the potential impacts and key mitigation measures identified.

The key potential impact identified in the assessment is that earthquakes can cause direct and indirect damage to EGI. A direct impact would constitute a M>7 earthquake that causes fault displacement over 20-80 km that damages EGI. An indirect impact would be landslides, liquefaction or lateral spreading that damages EGI triggered by a M>6 tectonic earthquake or M>5 shallow mining-related earthquake. As indicated above, the effects of these potential direct and indirect impacts include disruption of electricity supply, as well as a cascade of other hazardous phenomena that may cause harm to the environment and people, such as fires, explosions, asphyxiation and electrocution (secondary impacts), as a worst case.

Based on the information presented above, local conditions that might increase the hazard posed by secondary effects of earthquakes should therefore be taken into account when siting and constructing EGI; i.e. steep slopes that are prone to landslides and thick soils and alluvium that may amplify ground motions and/or liquefy when shaken. These areas should either be avoided, or the EGI protected or reinforced, or ground improvement measures implemented (i.e. stabilising the sites e.g. driving piles, using raft foundations, dewatering potential landslides, anchoring critically-balanced rocks etc.).

EGI such as pylons and substations built according to international standards are generally resilient to moderate levels of ground shaking expected in South Africa. There is abundant local and international literature describing risks that earthquakes pose on EGI and the required mitigation measures. Given that South Africa is a low seismic hazard region and providing that the recommended design and management actions are effectively implemented in areas prone to landslides and/or characterised by problem soils, risks posed by primary or secondary effects of earthquakes are considered to be low for the development of EGI within the proposed corridors. Overall, earthquakes do not pose a significant risk to EGI in the Expanded Eastern and Western EGI corridors. It must be noted that earthquake risk should not be seen in isolation. The risk posed by other natural hazards, such as floods, wind and landslides should also be considered.

Additional Best Practice Measures and Monitoring Recommendations are provided in Section 5 of the Seismicity Assessment.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.4

Socio-Economic Assessment

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ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EGI	Electricity Grid Infrastructure
EMF	Electro-magnetic Fields
IDZ	Industrial Development Zone
MF	Monitoring Forum
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
WHO	World Health Organisation

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.4 Socio-Economic Assessment

4.2.4.1 Introduction

A Socio-Economic Assessment (dated 2015) was undertaken by Dr Hugo van Zyl and Tony Barbour as part of the 2016 Electricity Grid Infrastructure (EGI) Strategic Environmental Assessment[1] (SEA) to provide an understanding of the socio-economic impacts that were likely to arise as a result of the declaration of transmission line corridors and the associated EGI elements (Department of Environmental Affairs (DEA), 2016).

Such an assessment was also required for the two expanded EGI corridors (i.e. Expanded Western and Eastern EGI Corridors, as indicated in Figure 1), and it is based on the methodology undertaken by Dr Hugo van Zyl and Tony Barbour during the 2016 SEA to ensure that there is an alignment of the scope of work and continuity. The Socio-Economic Scoping Assessment Specialist Report (2015) (DEA, 2016) should therefore be read in conjunction with the current assessment and is available online[2].

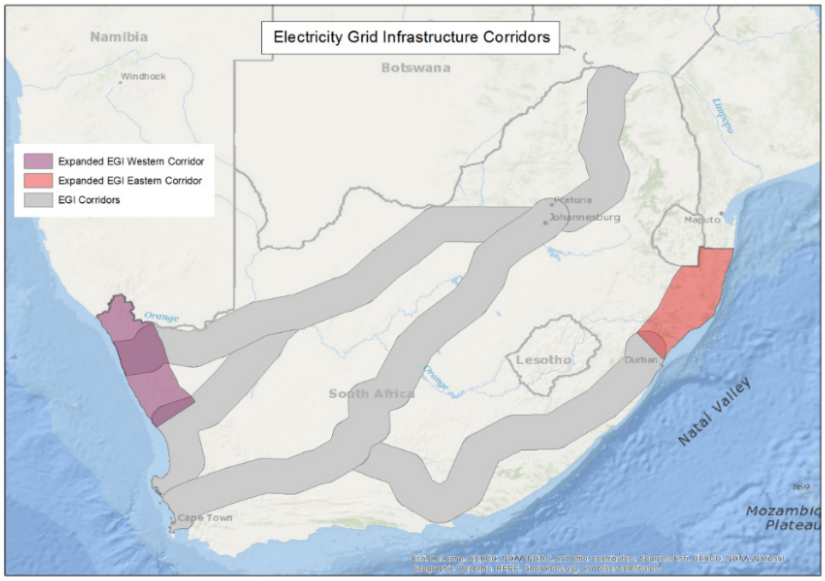


Figure 1: Location of the two proposed preliminary Expanded EGI corridors and the five gazetted EGI corridors identified as part of the 2016 EGI SEA.

[1] DEA. 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.
[2] The EGI SEA Report (DEA, 2016) is available on the following website: https://egi.csir.co.za/?page_id=1375

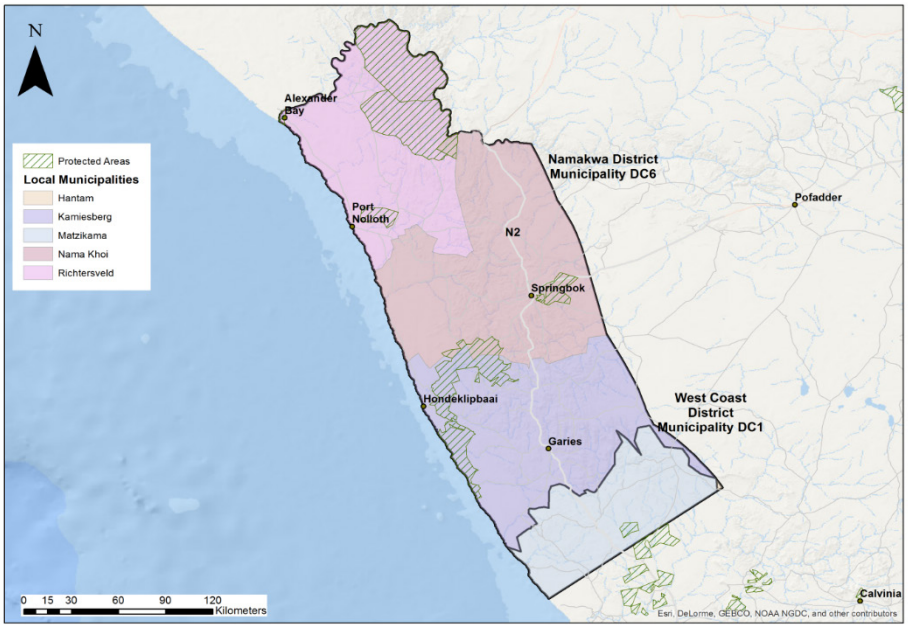


Figure 2a: District and Local Municipalities as well as key roads and formal protected areas falling within the expanded Western Corridor

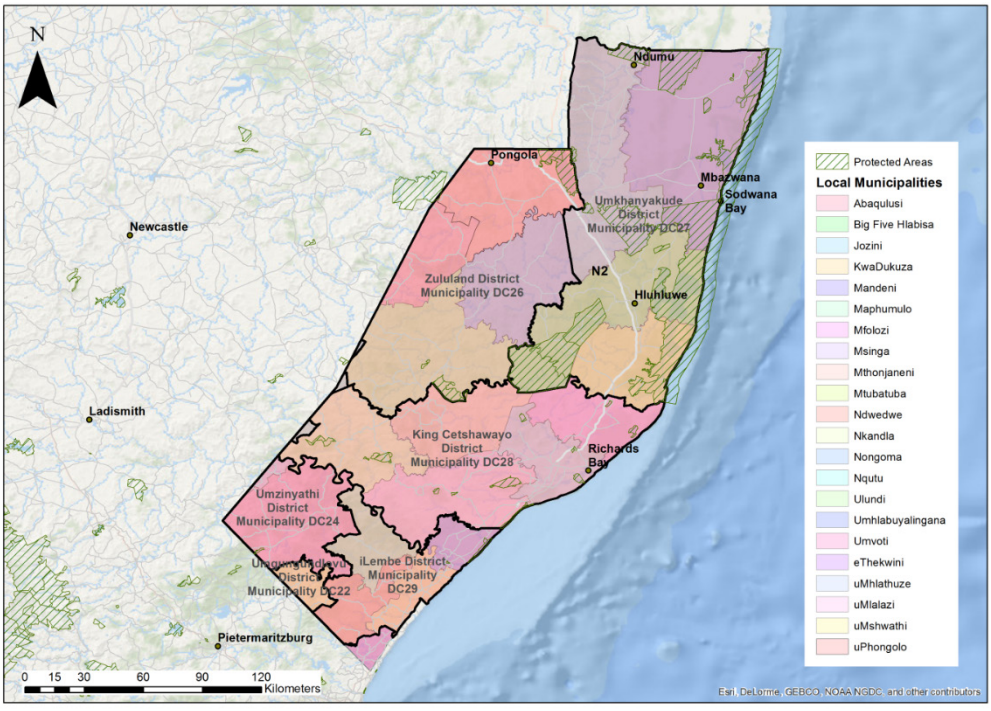


Figure 2b: District and Local Municipalities as well as key roads and formal protected areas falling within the expanded Eastern Corridor

4.2.4.2 Scope of the Assessment

Given the size of the assessment area (i.e. the two Expanded EGI corridors indicated in Figure 1), the objective of the Socio-Economic Assessment was not to undertake an extensive analysis of the social and economic environment but rather focus the assessment on examining a number of key issues concerning the adoption of the Expanded EGI Corridors, guided by the 2015 Socio-Economic Assessment. In particular, the Socio-Economic Assessment concentrated on the following key points:

- Opportunities or challenges for applicants, government and industry associated with the formal adoption of the Expanded EGI Corridors and resultant regulatory changes in terms of environmental processes within these areas;
- Potential impact on land values in the Expanded EGI Corridors; and
- Potential impact on communities, in particular resettlement or displacement, health and well-being.

4.2.4.3 Spatial Data

This assessment included basic socio-economic conditions, land uses and key towns within each of the two proposed Expanded EGI Corridors in order to provide an overview of the socio-economic environment. The data used in this assessment is described in Table 1.

Table 1: Spatial Data used in the Socio-Economic Assessment Report.

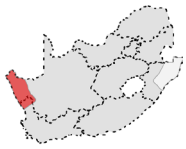
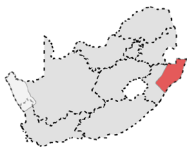
Feature	Data Description
2001 and 2011 Census Data, provided by Statistics South Africa	The following socio-economic indicators from the 2001 and 2011 Census data have been used: ▪ Population numbers; ▪ Population growth (2001 to 2011); ▪ Population density; ▪ Unemployment levels; ▪ Percentage of households with electricity; and ▪ Key towns and tourism location.
CSIR Open Settlement Footprint Layer, 2011	In order to conduct nationally comparable town and settlement specific analyses in the EGI Expansion SEA, the CSIR Open Settlement Footprint framework was also used. This enabled a much better spatial accuracy in the analyses than using municipal level data. This framework has been developed by the CSIR based on spatially disaggregated Statistics South Africa data and a range of other spatial specific datasets.

The assumptions and limitations applicable to the study are captured in Section 4.3 of the Socio-Economic Assessment Report (included in Appendix C.4 of this Final SEA Report).

4.2.4.4 Key Environmental Attributes and Sensitivities

This section provides a brief description of socio-economic conditions in each of the corridors (Table 2). The purpose is a high-level overview of the socio-economic characteristics of each corridor in the context of EGI.

Table 2: Summary of key environmental features of the Draft Refined Expanded EGI Corridors.

Draft Refined Expanded EGI Corridor	Brief Description
Expanded Western EGI Corridor 	▪ The majority of this corridor falls within the Northern Cape, with a small portion extending into the Western Cape (i.e. Matzikama Local Municipality). ▪ It mostly consists of small towns surrounded by arid and semi-arid areas. Some of the small towns, including Nababeep, Okiep and Concordia all fall within the corridor and are historical mining towns. ▪ The key towns within the corridor, from north to south are Alexander Bay, Port Nolloth, Springbok, and Hondeklipbaai, which all fall within the Namaqualand tourism region. ▪ The corridor contains areas that are sparsely populated and have declining population numbers due to urbanisation. ▪ The Matzikama and Nama Khoi Local Municipalities displayed the highest population density. ▪ The percentage of households without electricity (2011) within the western corridor varies from 3.7 to 16.42%. ▪ It also contains the Namaqua National Park, the Goegap Nature Reserve and the Richtersveld Transfrontier Park (a World Heritage Site). ▪ The primary land uses are linked to commercial farming activities, mostly of livestock, along with tourism and mining uses. ▪ The key economic sector within the corridor is government dominated. ▪ The portion of the corridor that falls within Northern Cape is increasingly associated with the development of renewable energy (solar and wind).
Expanded Eastern EGI Corridor 	▪ The corridor falls within KwaZulu-Natal, with a small buffered section falling within Mpumalanga (i.e. Mkhondo Local Municipality). ▪ The eastern section of this corridor passes through dense urban areas, including Durban and Richards Bay. These cities have large mixed economies and coupled with this, large population numbers. The western section of the corridor has lower population numbers but trends are showing that these areas are increasing in population and economy sizes. ▪ eThekwini Metropolitan Municipality and Msunduzi Local Municipality contained the highest population based on the 2011 Census Data. ▪ The percentage of households without electricity (2011) within the expanded eastern corridor varies from 6.46 to 80.78%. ▪ The northern section of the corridor contains the St Lucia wetland system (isiMangaliso Wetland Park, a World Heritage Site), scenically prominent features including Greytown, Kranskop and the Lebombo Mountains, Lake Jozini, Lake Sibaya and Kosi Lake and a large number of game reserves, all adding to its tourism value. ▪ It also contains the Umfolozi and Mkhuze Game Reserves and the Zululand Rhino Reserve. The key tourism regions within this corridor are the Midlands and Battlefields as well as the Zululand and Maputaland. Zululand, especially, is also considered to have cultural and historical significance. ▪ The key economic sectors include agriculture, tourism, industry, forestry, government and services. ▪ Richards Bay, and its port, is a prominent industrial hub in the region. ▪ The Dube TradePort Special Economic Zone (SEZ), international airport and surrounds are also a major growth node with significant scope for further expansion along with nearby coastal areas.

4.2.4.5 Key Potential Impacts and Mitigation

This section provides a summary of the key potential impacts assessed in the Socio-Economic Assessment Report, as well as key management actions.

EGI is essential for the transmission of electricity from locations where it is generated to its end users. Adequate electricity supply is a pre-requisite for reduction in poverty and for the establishment and continued growth of a modern economy. However, proposed EGI projects are generally perceived in a negative manner and subjected to drawn out servitude negotiation processes. It is recognised and understood that in general impacts on surrounding communities and the acceptability of proposed projects are often linked to the way in which the public participation processes are managed. From the SEA perspective, additional information on the public outreach programme undertaken is included in Appendix A of the Final SEA Report. Consultation with Interested and Affected Parties (I&APs) will also be undertaken during the project specific level.

The streamlining or exemption of the Environmental Authorisation process that would be associated with the EGI development inside the declared corridors would have significant economic advantages due to reduction of the timeframes and pre-negotiation of servitudes. The declaration of the corridors will also provide greater certainty to electricity generators and large users and would demonstrate a commitment to prioritising grid expansion and facilitate/accommodate investment. Refer to Section 7.1 of the 2015 Socio-Economic Assessment (DEA, 2016) for further details on the strategic benefits of electricity provision and corridors declaration.

Figure 3 indicates the potential socio-economic impacts associated with the expansion of the EGI corridors that have been identified and assessed in the Socio-Economic Assessment Report. A two-fold assessment was undertaken for each of these impacts:

- From a general point of view - i.e. what kind of consequences (linked to the impact assessed) is usually found when developing EGI in general. These generic impacts were assessed in the 2015 Socio-Economic Assessment (DEA, 2016) and have not been repeated in this current assessment; and
- Consequences linked to the impact assessed and which are specific to the location of the proposed corridors. The key findings for those impacts are presented below.

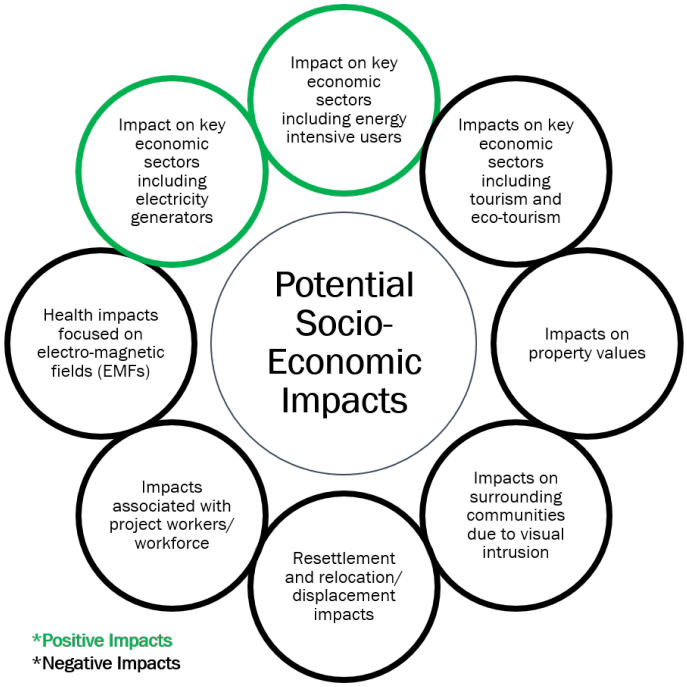


Figure 3: Potential Socio-Economic Impacts assessed in the Socio-Economic Assessment.

As reported in the 2015 Socio-economic Assessment Report, the key direct beneficiaries of improved planning for the roll-out of the EGI network are **electricity generators and the industry and mining sectors**

which are often large, energy intensive users. Linked to industry, the SEZs are spread throughout the country and would also benefit from additional EGI network. The need of these sectors will be access to timely and accurate information about intended development within the corridors. The Richards Bay Industrial Development Zone (IDZ) and Dube TradePort SEZ, in particular, fall within the Expanded Eastern EGI corridor. In addition, the establishment of the two expanded corridors will facilitate energy trading and commerce, which will have a positive impact on the overall energy mix. The Expanded Western EGI Corridor will enable a connection between Namibia and South Africa to support gas to power generation and transmission as well as renewable energy generation integration. The Expanded Eastern EGI Corridor will enable a connection to Mozambique. Notwithstanding the above, several other benefits between electricity development and socio-economic upliftment are noted within literature and include reduced infant mortality and illiteracy and an increased life expectancy. As such, transmission lines in the right location are necessary for the regional economy

Although the declaration of the EGI corridors will also benefit the **tourism sector** given the enhanced planning information available, at a local level, it **may be negatively impacted** due to new tourism **investments and/or expansions** (especially eco-tourism) avoiding sections of the proposed corridors where only limited areas are available for EGI development. This would be particularly evident in the Expanded Eastern EGI Corridor. In addition, the presence of an EGI network itself (which includes power lines, substations, and associated infrastructure) may also have a negative impact on the **tourism sector**. To manage these impacts, it would be important to avoid areas with high ecological and aesthetic values, including protected areas, game farms, private nature reserves, visually sensitive areas, areas of high heritage value and areas of high agricultural value.

The **value of properties** located within or adjacent to the final routing of the future major transmission lines may also be negatively impacted by the presence of an EGI network, although the declaration of the corridors is likely to facilitate the improved functioning of the **property market** by providing a fuller picture of where an EGI network is likely to occur. Payments to land owners for servitudes that adequately compensate for losses will be an important way of mitigating these impacts.

Accepted international best practice requires that **relocation and involuntary resettlement** in particular be avoided, where possible, or minimised. Given the width of the EGI corridors (100 km), it is likely that suitable sub-corridors can be identified that avoid and or minimise the impacts associated with involuntary resettlement. The potential impacts are thus likely to be limited to directly affected households as opposed to villages and or larger communities. The principal mitigation measure therefore involves siting of transmission pylons so as avoid the need for resettlement. Where involuntary resettlement cannot be avoided, the relocation of affected households and or compensation for economic displacement should be guided by international best practice.

While some temporary local employment of unskilled labour is likely to be provided during the construction phase, long term employment opportunities are limited to repairs and maintenance and will be considered at a project specific level. Benefits associated with job opportunities during both the construction and operational phases are therefore anticipated to be limited. Potential negative impacts associated with the **presence of project workers** depend on the size of the workforce, the duration of the construction or operational activity and the location of the site. Given the linear nature and the remote location of the EGI corridors, the anticipated social impacts associated with the development of transmission lines within the EGI corridors are considered to be low and can be suitably managed by adhering to the proposed management actions outlined within the assessment. Such actions include:

- There should be a requirement for contractors to implement a ‘locals first’ policy for construction/maintenance jobs, specifically for semi- and low-skilled job categories.
- A Monitoring Forum (MF) should be established in order to monitor the implementation of the recommended mitigation measures. The MF should be established before the construction/maintenance phase commences, and should include key stakeholders, including representatives from the relevant local municipalities, farmers, local farming unions, local community

representatives etc. The MF should also be briefed on the potential risks to the local community and farm workers associated with construction/maintenance workers.
- A Code of Conduct for the construction/maintenance phase should be developed. The code should identify which types of behaviour and activities are not acceptable, such as trespassing, hunting, stock theft etc.

Electro-magnetic fields (EMFs) are created, to varying levels, with the generation and use of electricity. They are particularly strong beneath high voltage transmission lines sometimes resulting in health concerns among the public. However, based on a comprehensive World Health Organisation (WHO) study and other sources, no health consequences associated with the exposure to EMFs from transmission lines have been found. The potential health related risks associated with the establishment of high voltage transmission lines are therefore not anticipated to be significant. Nevertheless, efforts should be made to ensure that transmission lines are not located within close proximity to dwellings and settlements and that people are discouraged from living underneath them as is current Eskom practice. This would be especially applicable to the Expanded Eastern EGI Corridor that contains dense urban areas.

Section 7 of the Socio-Economic Assessment (Appendix C.4 of this Final SEA Report) includes detailed Best Practice Measures and monitoring requirements.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.5

Agriculture

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ABBREVIATIONS

ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
DAFF	Department of Agriculture, Forestry and Fisheries
EGI	Electricity Grid Infrastructure
EMPR	Environmental Management Programme
PDALB	Preservation and Development of Agricultural Land Bill
SACNASP	South African Council for Natural and Scientific Professions
SALA	Subdivision of Agricultural Land Act (Act 70 of 1970)
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.5 Agriculture

4.2.5.1 Introduction and Scope

This chapter covers the potential impacts on agriculture associated with the development of Electricity Grid Infrastructure (EGI) within the proposed expanded Eastern and Western EGI corridors. Given that the current Strategic Environmental Assessment (SEA) assesses the expansion of the Power Corridors gazetted in February 2018, the approach to the sensitivity analysis and the assessment of impacts as part of this SEA is the same as that undertaken for the 2016 Assessments (DEA, 2016[1]).

The subsequent sections are therefore predominantly based on the Agriculture Assessment undertaken as part of the 2016 EGI SEA (DEA, 2016), which was desktop based and focused mainly on the interpretation of existing data (Appendix C.1 of the 2016 EGI SEA Report). In addition to being based on the latter assessment, this section is also informed by discussions with relevant authorities (such as the Department of Agriculture, Forestry and Fisheries (DAFF) and the Agricultural Research Council (ARC)) and an Agricultural Specialist (Johann Lanz). It includes the identification of existing agricultural resources and agricultural potential within the proposed EGI expansion corridors.

The data sources and the rationale used to identify agricultural features and assign a sensitivity to each of them are described in sections 4.2.5.3 and 4.2.5.5 respectively. The assumptions and limitations applicable to this study are listed in Table 1 below.

Table 1: Assumptions and limitations to the agricultural study

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Resource availability	Only existing, published datasets used with limited desktop verification	Field verification of datasets and outcomes, and extensive local expert consultation	Reasonable accuracy of data layers used. Field verification will take place on a site by site basis linked to development proposals.
Distinguishing criteria for the potential traverse lengths of individual orchards and vineyards.	Measurement of surface area in individual orchards and vineyards.	Measurement of traverse lengths in individual orchards and vineyards.	All orchards and vineyards with an area > 16 hectares have been categorised as having a traverse length of > 400 metres.[2]
Data accuracy	Use of existing data sets only.	Confirmation of on the ground situation in cases where data sets overlap	Areas of overlap with field crop boundaries and plantations were categorised as the former because of the greater accuracy of those data sets compared to the forestry data set.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

[2] Orchards and vineyards with a potential electricity line traverse length of greater than 400 metres are distinguished, for the purposes of this report, from those with a traverse length of less than 400 metres. This is because 400 metres is the approximate maximum span distance (the actual maximum is dependent on site specific factors). Anything greater is likely to result in a pylon having to be erected within an orchard or vineyard, leading to greater agricultural impacts. The > 400 m blocks were distinguished in the GIS processing, as land parcels having a surface area of greater than 16 hectares. The logic is that it is only surface areas of greater than 16 hectares (400 x 400 metres) that do not have an option of being traversed by a length of less than 400 metres. It is always possible to traverse any smaller surface area by less than 400 metres if the direction of traverse is not fixed. If the direction is fixed the length is influenced by the shape of the land parcel. Also the larger than 16 hectares land parcels may be able to be traversed at less than 400 metres, again depending on their shape. Some land parcels that can be traversed by less than 400 metres will therefore be included in those identified as > 400 metres

4.2.5.2 Relevant Legislation

The following legislation is considered relevant to the proposed EGI development:

- The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA):
  - The objective of this Act is the protection of natural agricultural resources including soils. The Act applies to all agricultural land (grazing and cultivated). It manages rehabilitation after disturbances to agricultural land. Any disturbance to soil conservation works such as contour banks requires permission in terms of this Act.

- Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA):
  - The objective of this Act is the preservation of agriculturally viable farm portions. Consent use or change of land use (re-zoning) for developments on agricultural land need to be approved in terms of this Act. This means that any servitude or use of an agriculturally zoned piece of land for non-agricultural purposes requires approval from the DAFF in terms of the SALA. Statutory bodies, such as Eskom, are currently exempt from such approval.

- DAFF Guidelines for the Evaluation and Review of Applications pertaining to Renewable Energy on Agricultural Land, dated September 2011:
  - These guidelines were compiled with the main objective of the preservation of arable land through prohibition of the development of renewable energy facilities (wind and solar) on cultivated and high potential agricultural land. These guidelines were not produced to be applicable to linear infrastructure such as power lines, but may have some relevance in terms of DAFF's general concerns about loss of agricultural land.

- Draft Preservation and Development Of Agricultural Land Framework Bill
  - This Act, once promulgated, will repeal SALA and replace the DAFF Guidelines noted above. The Bill seeks to improve DAFF's fulfilment of its mandate to protect agricultural land for agricultural production. One of its aims is to ensure that development does not lead to an inappropriate loss of land that may be valuable for agricultural production. Any use of agricultural land for non-agricultural purposes will require authorisation in terms of this Act. If the Bill is enacted in its current form, one of the significant implications for EGI development will be that all Eskom servitudes for power lines will require agricultural consent. Eskom is currently exempt from agricultural authorisation for power line servitudes.

4.2.5.3 Data Sources

The list of updated data used in this current EGI Expansion SEA is indicated in Table 2 below.

Table 2: Agricultural Data used in the EGI Expansion SEA as part of the Environmental Sensitivity Analysis

Dataset	Source and Date of Publication	Data Description
Field Crop Boundaries	DAFF, 2017	Delineates the boundaries of all cultivated land, based on satellite and aerial imagery. Five different categories of cultivated land are distinguished. These are irrigated areas (pivot agriculture); horticulture; viticulture; shadenet; and other cultivated areas.
National Land Cover and Habitat Modification Layer (improved land cover)	DEA, 2013/2014 SANBI, 2017	Delineates natural areas, modified areas, and old fields (mapped from imagery)
Land Cover (Sugar Cane Farming) KwaZulu-Natal Land Cover Sugar Cane Farming and Emerging Farming Data	KZN Provincial land cover, Ezemvelo KZN Wildlife, 2011	Delineates all sugar cane fields, including emerging farms in Kwazulu-Natal.
Agricultural Land Capability	DAFF, 2016	Categorises all land nationally into 15 different classes of agricultural land capability. The classification is based on soil, terrain and climate parameters.
Demarcated High Value Agricultural	DAFF, outstanding	Preservation and Development of Agricultural Land Bill (PDALB) requires the demarcation of high value agricultural areas which is a combination of land capability; crop suitability, agricultural land uses etc. on a priority rating of A, B, C and D (not yet released).

4.2.5.4 Corridor Descriptions

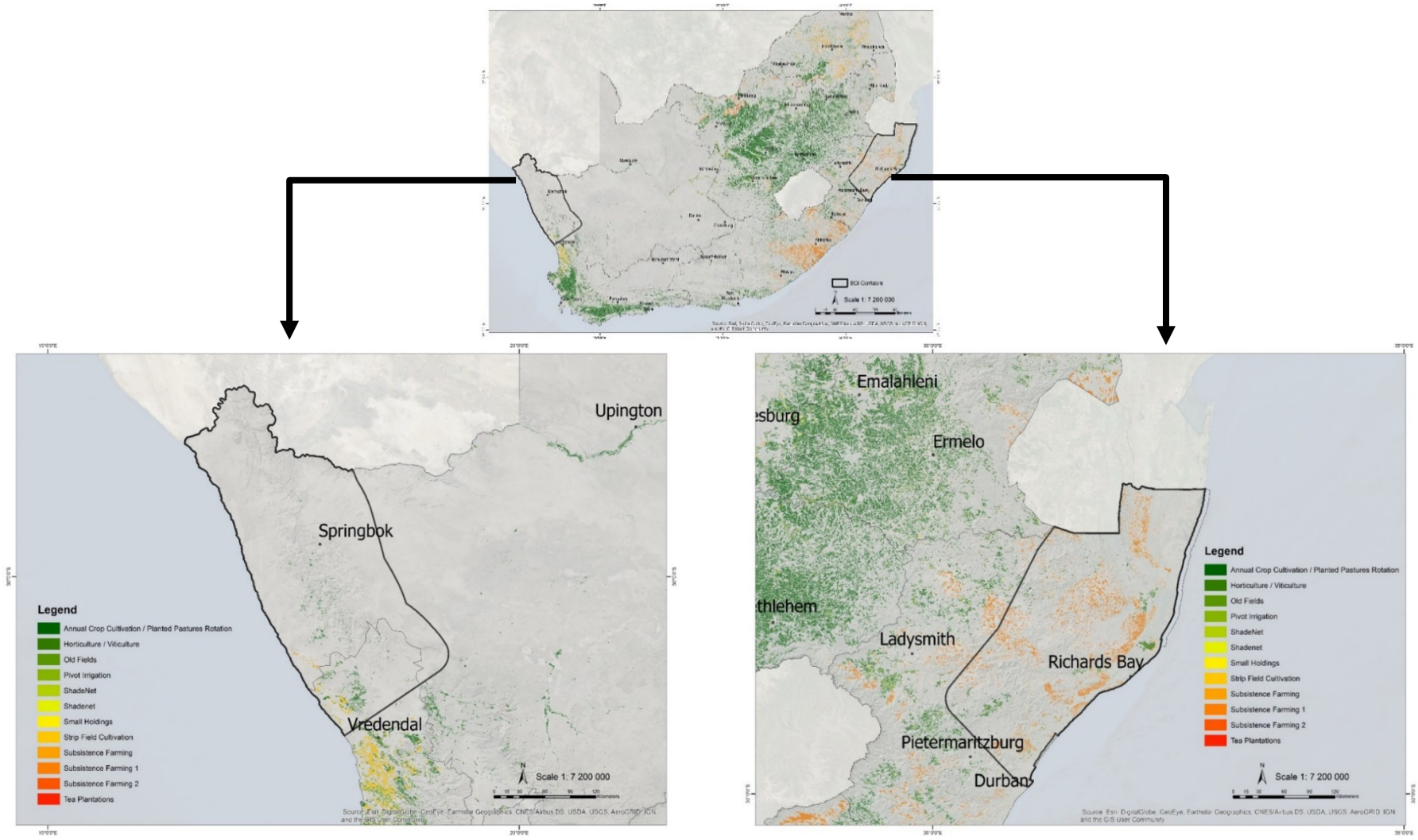
Maps 1 and 2 respectively provide an indication of the Field Crop Boundaries and Land Capabilities within the corridors.

- Expanded Western EGI Corridor:

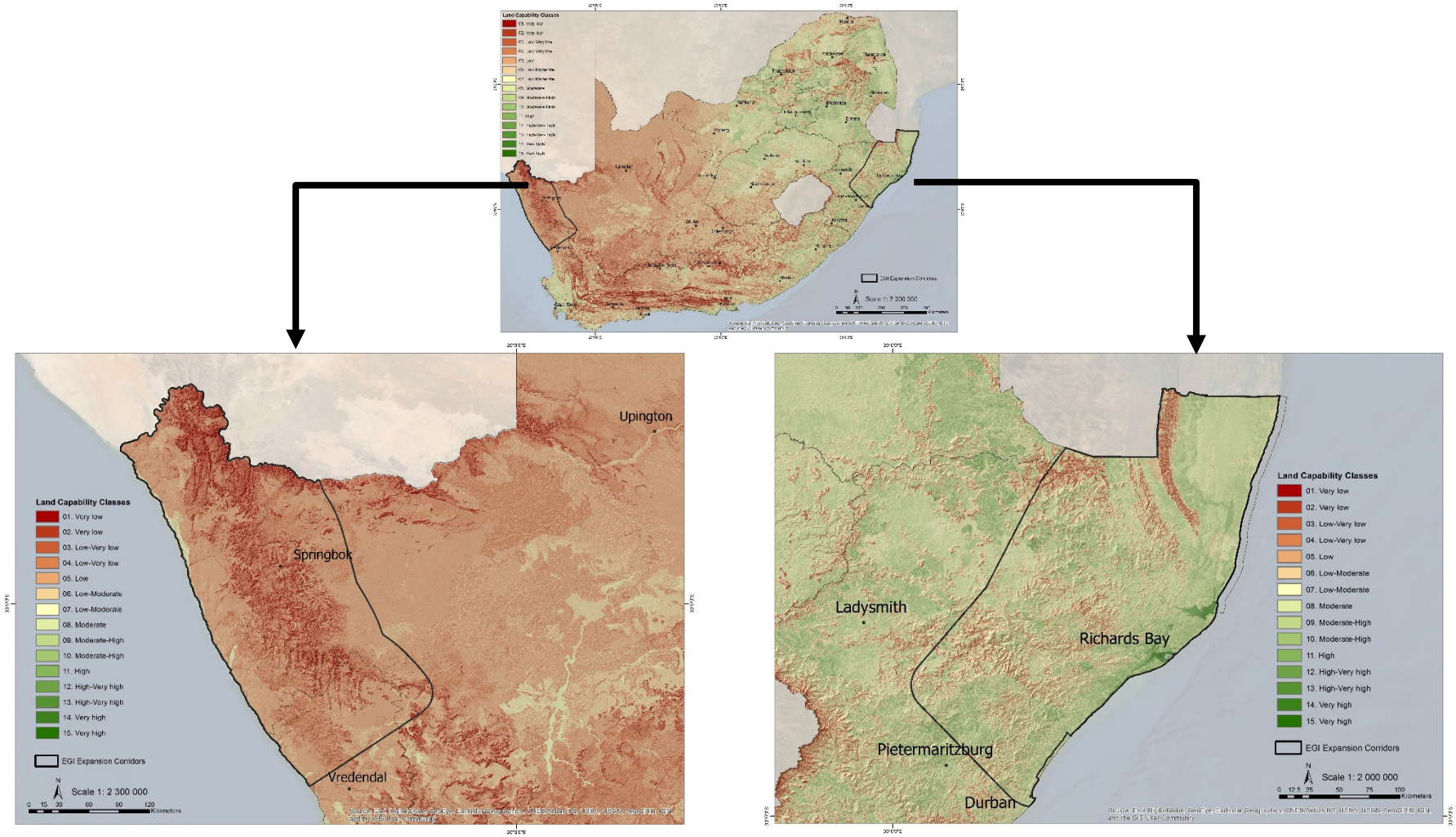
The agricultural potential of the entire Expanded Western EGI Corridor is severely constrained by limited climatic moisture availability making it unsuitable for most agriculture other than the extensive sheep farming which is almost the only agricultural land use throughout the corridor. Rainfall generally decreases northwards in the corridor from a high of approximately 200 mm per annum to as low as 30 mm per annum in the Richtersveld in the north. Grazing capacity varies from a high of 42 hectares per large stock unit in the south to 120 hectares per large stock unit in the north. Land capability varies between 5 and 1. The only patch of cultivation occurs where the corridor intersects, for a short distance, with the Olifants River which has intensive cultivation, mainly of table grapes, along its flood plain.

- Expanded Eastern EGI Corridor:

There is diverse and productive agriculture across the Expanded Eastern EGI corridor. The most important agricultural enterprises are sugar, subsistence farming, cattle and forestry. Mean annual rainfall varies between approximately 600 and >1,500 mm. Grazing capacity is high and varies between 3.5 and 20 hectares per large stock unit. Land capability is mostly greater than 8 and goes as high as 15 in places, although in the more mountainous terrain it drops as low as 2.



Map 1: Field Crop Boundaries Sensitivity Map for EGI Development



Map 2: Land Capability[3] Sensitivity Map for EGI Development

[3] Note that the classes specified in the legend represent **land capability classes** and **not** the **sensitivity levels** assessed as part of this SEA.

4.2.5.5 Sensitivity Analysis

The agricultural features that would be impacted by EGI development are indicated in Table 3. The following three factors were identified in the 2016 Agriculture Assessment Report (DEA, 2016) to determine the sensitivity of the agricultural features as a result of EGI development:

- Factor 1: The first is the reduction of the potential agricultural productivity (per unit area and unit time) of the affected land;
- Factor 2: The proportion of agricultural land that is affected; and
- Factor 3: The degree of disturbance that will occur. This axis increases from zero disturbance through minor alterations to agricultural activity and on to total prevention of agriculture equating to a loss of agricultural production on a particular piece of land. It also includes any alterations that a particular agricultural activity would impose on the standard EGI.

The 2016 Agriculture Assessment Report (DEA, 2016) determined the following sensitive agricultural features:

- Pivot irrigation, irrespective of its size, is incompatible with power lines because of the danger of an electrical short between the lines and the overhead water pipes. In terms of the three factors discussed above pivot lands are high on all three axes: high agricultural productivity; the entire pivot field is impacted; and the disturbance is high, given the exclusion of the possibility of irrigation. These areas are therefore classified as **Very High** environmental sensitivity. From an engineering constraints perspective, pivot agriculture is also rated as a Very High constraint and those with a diameter of more than 500 m is planned to be avoided for the EGI due to the irrigation infrastructure than moves during watering and the distance between pylons.

- Horticulture and vineyards with a potential electricity line traverse length of greater than 400 m are distinguished, in terms of their sensitivity, from those with a traverse length of less than 400 m. This is because a span of greater than 400 m will result in a pylon having to be erected within an orchard or vineyard, leading to greater agricultural impacts. For horticulture and vineyards, agricultural productivity is high, but less surface area is impacted (only pylon footprint if >400m) with less disturbance i.e. agricultural activity can continue. There is disturbance in terms of restrictions on windbreak heights underneath the power line. Lands that require windbreaks would incur a greater impact than lands that do not require windbreaks. The need for windbreaks is a function of the crop type (some crops are more sensitive to wind than others) and of the prevailing wind conditions of an area and particular site. In general, all fruit orchards require windbreaks with citrus being the most sensitive and therefore requiring the most closely spaced windbreaks. Vines do not generally require windbreaks. If windbreaks are restricted around an orchard it will have the impact of lowering yield and fruit quality. Areas of viticulture and horticulture, with a potential electricity line traverse length of greater than 400 m, have been classified as **Very High** environmental sensitivity features. On the other hand, those viticulture and horticulture areas with a potential electricity line traverse length of less than 400 m, are rated as **High** environmental sensitivity features. From an engineering constraints perspective, these areas (i.e. vineyards and orchards) are also rated as a Very High constraint as the EGI would include permanent above ground infrastructure.

- Shadenet areas are classified as **Very High** environmental sensitivity due to the need to remove the nets should EGI be developed in these areas, leading to a potential loss of agricultural areas and loss of income.

- Other cultivated areas represented under Field crops boundaries are also classified as **High** environmental sensitivity.

- Timber plantations are lower productivity enterprises in comparison to horticultural areas and vineyards, but larger areas would be impacted with a greater level of disturbance in that trees are excluded from the entire servitude width below the power lines.

- Land Capability Classes 11 – 15 and 8[4] - 10 have been included in the **Very High** and **High** environmental sensitivity categories respectively given that within the context of South Africa's very limited agricultural land resources, the entirety of these high potential lands should be preserved for agricultural production as far as possible, and these are also to be earmarked for agricultural expansion.

- Areas demarcated as high value agricultural areas are earmarked for agricultural expansion to support food security, as described further below:
    - Very high potential agricultural lands (priority rating of A and B) have been classified as **Very High** sensitivity once this data will become available.
    - Areas with a priority rating of C and D have been classified as **High** sensitivity once this data will become available.
    - The DAFF also recommended that the demarcated high value agricultural areas need to have an additional feature with an E and F rating.

- The agricultural impact of EGI on all other land is very low. The actual footprint of impact is very small and agriculture can continue largely undisturbed beneath power lines. However, there are some differences between different agricultural features and for this reason certain features have been identified as **Medium** sensitivity, including land capability classes 6 - 7 that should also be preserved for agricultural production where possible.

- Sugar cane fields have an impact on EGI in that increased cable height is required for the burning of sugar cane crop residues, or an alternative practice of crop residue management is required on land crossed by power lines. This feature is therefore rated as **Medium sensitivity**.

- In terms of land cover, natural areas, modified areas and old fields have been rated with a **Low** sensitivity. Natural areas are “Other natural areas”, which are available for sustainable development. Modified areas are not an environmental priority and are preferred for development. Old fields are formerly ploughed areas that are degraded, and are more favourable than natural areas for development.

- In all other cultivated fields, the minimal disturbance and loss of land on pylon bases, substations and supporting infrastructure is still more significant than on uncultivated land. All agricultural land not included in the categories above is therefore classified as **Low** sensitivity (i.e. Land Capability Class 1 – 5).

- Soil erosion was not included in the categorisation of agricultural sensitivity. Erosion risk was not considered to be a significant independent factor that should influence power line routing options. There are several reasons for this:
    - The threat of EGI development on erosion risk is very minimal and mitigation management at the time of construction is simple to implement.
    - Mitigation measures for erosion should be implemented across all EGI developments, regardless of their status according to large scale erosion risk data. Mitigation strategies are largely generic for all developments but the detailed level of required mitigation will vary from pylon to pylon and therefore cannot be usefully informed by large scale data.
    - Erosion risk is primarily a function of slope steepness which is already taken into account in terms of engineering constraints but could also be a risk in areas that have or are poorly

[4] DAFF requested that Land Capability Class 8 be elevated to a high sensitivity class as most of the viable long-term farming takes place on Land Capability Class 8.

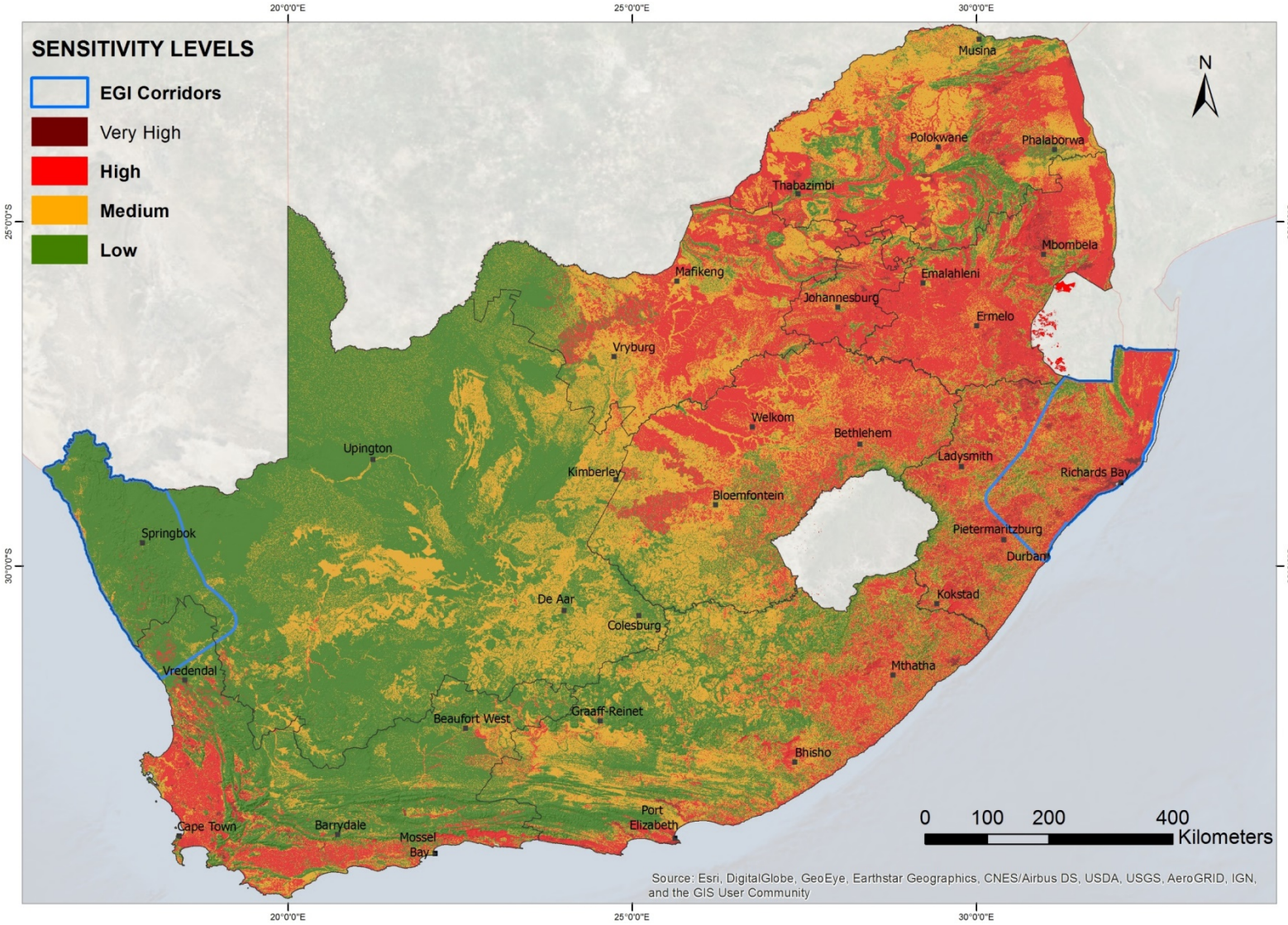
managed and have lots of existing dongas/ rills/ gullies. The risk of erosion is higher in these areas as the surfaces are already impacted.

A sensitivity map (Maps 3) was produced for Eastern and Western Expanded EGI Corridors according to the criteria set out in Table 3 to classify agricultural sensitivity spatially into four tiers namely, Very High, High, Medium and Low.

Table 3: Summary of Datasets used per Agricultural Feature in the EGI Expansion SEA as part of the Environmental Sensitivity Analysis

Sensitivity Feature	Data Source + Date of Publications	Data Preparation and Processing	Sensitivity
Pivots (Irrigated Areas)	Field crop Boundaries, DAFF, 2017	Extracted from field crop data.	Very High
Shadenet	Field Crop Boundaries, DAFF, 2017	Extracted from field crop data.	Very High
Horticulture >400 m (line traverse length)	Field Crop Boundaries, DAFF, 2017	Extracted surface area >16 hectares from field crop data.	Very High
Viticulture >400 m (line traverse length)	Field Crop Boundaries, DAFF, 2017 Land Cover (Viticulture), DEADP, 2014	Union process between field crop data and Land cover (viticulture) data. Surface area >16 hectares.	Very High
Land Capability Class 11 - 15	Land Capability, DAFF, 2016	Extracted from the Agricultural Land Capability data	Very High
Other cultivated fields/areas	Field Crop Boundaries, DAFF, 2017	Extracted from field crop data.	High
Horticulture <400 m (line traverse length)	Field Crop Boundaries, DAFF, 2017	Surface area <16 hectares.	High
Viticulture <400 m (line traverse length)	Field Crop Boundaries, DAFF, 2017 Land Cover (Viticulture), DEADP, 2014	Union process between filed crop data and Land cover (viticulture) data. Surface area < 16 hectares.	High
Land Capability Class 8 - 10	Land Capability, DAFF, 2016	Extracted from the Agricultural Land Capability data	High
Sugar Cane	KwaZulu-Natal Land Cover Sugar Cane Farming and Emerging Farming Data, 2011	Union process between Land Cover Sugar Cane Farming and Emerging Farming Data	Medium
Land Capability Class 6 - 7	Land Capability, DAFF, 2016	Extracted from the Agricultural Land Capability data	Medium
Land Capability Class 1 - 5	Land Capability, DAFF, 2016	Extracted from the Agricultural Land Capability data	Low
Natural Areas	National Land Cover, DEA, 2013/2014 Habitat Modification Layer (improved land cover), SANBI, 2017	Extracted from the land cover classes in the habitat modification layer representing natural features/ ecosystems	Low
Modified Areas	National Land Cover, DEA, 2013/2014 Habitat Modification Layer (improved land cover), SANBI, 2017	Extracted from the land cover classes in the habitat modification layer representing modified areas (e.g. urban areas, mining areas, industrial areas)	Low
Old Fields	Habitat Modification Layer (improved land cover), SANBI, 2017	Extracted from Habitat Modification Layer; old fields were mapped using aerial photographs to identify areas that were ploughed and left fallow before the 1990 land cover reference point.	Low

Note: These agricultural features are listed in their order of sensitivity.



Map 3: Combined Agriculture Sensitivity Map for EGI Development

4.2.5.6 Impact Description and Mitigation

Agricultural impact is understood as "any impact that translates into reduced agricultural production (including forestry). This may occur by way of a degradation of the agricultural resource base or by way of a direct disturbance to agricultural activities. The significance of agricultural impacts increases as the agricultural productivity of the lands (its agricultural sensitivity), the surface area of disturbed land and the level of disturbance increases. In the case of EGI, even if the sensitivity is high, impact is generally of low significance because both the surface area of disturbed land and the level of disturbance is low. In most cases, agriculture can continue largely undisturbed below power lines and the actual footprint of impact is confined to only pylon bases and substations and involves an extremely small proportion of the land surface".

The potential negative impacts of EGI development on agriculture are listed below, as per the 2016 Agriculture Assessment Report (DEA, 2016, Section 9, Page 23-24):

- Loss of agricultural land use, caused by direct occupation of land by the footprint of power line infrastructure, which removes the affected land portions from agricultural production.
    - Mitigation measure: Plan the fine-scale positioning of pylons, access roads and construction camps to have minimal disturbance on agricultural activities and agricultural land. Pylons should be positioned on existing boundaries or edges of agricultural units of land wherever possible, so as not to interfere with agricultural activities within a unit.

- Loss of agricultural land use due to fragmentation of agricultural land as a result of EGI, which can cause the division of fields and isolation of land portions into non-viable small areas for cultivation. Such fragmentation leads to an effective additional loss of agricultural land over and above that lost to the direct footprint.
    - Mitigation measure: As above.

- Limitation to the existence of plantation trees, wind break trees and tall crop trees under power lines due to height restrictions. Exclusion of wind breaks has the effect of reducing the environmental suitability and therefore agricultural potential of affected land for horticultural crops.
    - Mitigation measure: Not possible.

- Disturbance to crop spraying by aircraft over land occupied by power lines.
    - Mitigation measure: Not possible.

- Soil erosion caused by alteration of run-off characteristics due to vegetation removal and surface disturbance and compaction, particularly on access roads and construction camps. The disturbance of existing contour banks and drainage systems used for erosion control, by construction activities on or near them, can also cause erosion. Erosion causes loss and deterioration of soil resources.
    - Mitigation measure: Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Soil surface stabilising measures must be used if necessary on all areas that are highly susceptible to erosion. Plan the fine-scale positioning of pylons, access roads and construction camps to avoid land that has contour banks. If any contour banks are disturbed, fully restore their integrity and that of the run-off system of which they are a part, after disturbance. The effectiveness of the run-off control system and the occurrence of any erosion on site or downstream must be monitored. Corrective action must be implemented to the run-off control system in the event of any erosion occurring;

- Degradation of vegetation beyond the direct footprint due to construction disturbance, dust and vehicle trampling.
    - Mitigation measure: Restrict all vehicle traffic within the footprint of disturbance and control dust during construction.

- Loss of topsoil due to poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in the capability of that soil to support plant growth.
    - Mitigation measure: If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled separately for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on newly topsoiled areas, which are likely to be susceptible to erosion.

- Disturbance to agricultural practices and management during construction.
    - Mitigation measure: Not possible.

4.2.5.7 EGI and Agricultural Consent

Eskom is currently exempt from agricultural consent for power line servitudes. Developers do however have to apply for authorisation in terms of the SALA for substations. As noted above, the new Draft Preservation and Development of Agricultural Land Framework Bill, as it is currently proposed, will change this and authorisation of all power line servitudes will be required in terms of the Bill. Authorisation will require ministerial approval and a comprehensive process if it involves any cultivated land, and a slightly less rigorous process if it only involves grazing land. The new Bill requires a fairly high minimum level of assessment for all levels of risk to agricultural land. The registration of the servitude needs to be done per farm portion. Long power lines will more often than not traverse many portions, each of which would need a separate agricultural authorisation. This is likely to complicate and significantly lengthen the time required for power line servitude approval.

With the foregoing in mind and due to the relatively low impact of EGI development on agriculture, particularly within the Power corridors as the proposed corridors are positioned to avoid agriculturally important areas where there was a pinch point for very high sensitivity, this section of the report recommends, for EGI development, an alternative process for agricultural assessment to that proposed in the Draft Preservation and Development of Agricultural Land Framework Bill. Much of the Western Expanded EGI corridor land is in areas of extremely low agricultural potential, such as the Karoo and Northern Cape, where there is negligible risk to agriculture from EGI developments.

The Bill may therefore need to make provision for such a process for EGI development. The current situation does recognise such a difference for power line servitudes, for which Eskom, for example, is exempt from agricultural authorisation in terms of the existing SALA. It would be recommended to extend that exemption to other developers too.

This report recommends that the process of agricultural authorisation for EGI development inside the Power Corridors triggering either a Basic Assessment or Environmental Impact Assessment process in terms of National Environmental Management Act 107 of 1998 (as amended) is done in terms of an exemption from the requirements stipulated in the Bill, and that an Agricultural Compliance Statement be prepared by a soil scientist/agricultural specialist registered with the South African Council for Natural and Scientific Professions (SACNASP), on the site being submitted as the preferred development site. The compliance statement must indicate whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site. Such a statement should also focus on and clearly highlight, only the essential aspects that are important for the preservation of agriculturally productive land within EGI developments rather than insist, as the Bill does, on a detailed agro-ecosystem report, much of which might be irrelevant under conditions of low agricultural productivity. These essential aspects making up the recommended way forward are briefly presented in Table 4 and will be included in the decision support outputs currently under development as part of this SEA.

4.2.5.8 Interpretation of Sensitivity Maps

As discussed in section 4.2.5.7, the agricultural impacts of EGI, even where agricultural sensitivity may be high, are generally of low significance because of the low disturbance of EGI to agriculture. Table 4 provides information on the interpretation of the agricultural sensitivity and associated assessment requirements inside the Expanded EGI Corridors.

Table 4: Interpretation of Agricultural Sensitivity and associated Assessment Requirements inside of the Expanded EGI Corridors

Sensitivity Class	Interpretation of Sensitivity	Further assessment requirements for EGI developments
Very High Land capability evaluation values 11 – 15; all irrigated land; horticulture and viticulture; demarcated high value agricultural areas with a priority rating of A and/or B.	Potentially unsuited to development owing to: • high agricultural value and preservation importance; • high production capability; • high capital investment made; and • unique agricultural land attributes.	It is recommended that an Agricultural Compliance Statement be prepared by a soil scientist/agricultural specialist registered with the SACNASP, on the site being submitted as the preferred development site and indicates whether or not the proposed EGI development (with self-supporting electricity pylons) will have an unacceptable negative impact on the agricultural production capability of the site. The Agricultural Compliance Statement must contain, as a minimum, the following information: 1. Details and relevant expertise as well as the SACNASP registration number of the soil scientist/agricultural specialist preparing the statement, including a curriculum vitae; 2. A signed statement of independence by the specialist; 3. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national web based environmental screening tool; 4. Calculations of the total development footprint area for each land parcel as well as the total footprint area of the development (including supporting infrastructure); 5. Confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimize fragmentation and disturbance A substantiated statement from the soil scientist/agricultural specialist on the acceptability of the development and a recommendation on the approval or not of the development (i.e. impacts to the agricultural resource are temporary and the land in the opinion of the soil scientist/agricultural specialist based on the mitigation and remedial measures, can be returned to the current land capability within two years of the completion of construction phase); 6. Any conditions to which the statement is subjected; 7. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and 8. A description of the assumptions made and any uncertainties or gaps in knowledge or data. If this statement is subject to any conditions these must also be clearly stated; and where required, proposed mitigation measures for inclusion in the EMPr.
High Land capability evaluation values 8 - 10 including all cultivated areas including sugar cane areas and demarcated high value agricultural areas with a priority rating of C and/or D.	Avoid where possible because it will lead to some disturbance and loss of existing or potential agricultural (or forestry) production. High sensitivity areas are still preservation worthy since they include land with an agricultural production potential and suitability for specific crops.	
Medium Land capability evaluation values 6 – 7. Likely to be very marginal arable land.	Re-route onto lower sensitivity agricultural land (where possible and where all other factors are equal) because it will lead to very minor disturbance and loss of existing or potential agricultural production.	
Low Land capability evaluation values 1 – 5.	Insignificant impact on agriculture. Likely to be non-arable land, and is therefore land onto which most development should be steered.	

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.6

Defence

CONTENTS

TABLES

MAPS

ABBREVIATIONS

DOD	Department of Defence
EGI	Electricity Grid Infrastructure
SAAF	South African Air Force
SACAA	South African Civil Aviation Authority
SAMHS	South African Military Health Service
SANDF	South African National Defence Force
SAPS	South African Police Service
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.6 Defence

4.2.6.1 Introduction and Scope

This chapter covers the potential impacts on defence facilities and features associated with the development of Electricity Grid Infrastructure (EGI) within the proposed expanded Eastern and Western EGI corridors. Given that the current Strategic Environmental Assessment (SEA) assesses the expansion of the Power Corridors gazetted in February 2018, the approach to the sensitivity analysis and the assessment of impacts as part of this SEA is the same as that undertaken for the 2016 Assessment (DEA, 2016[1]).

The subsequent sections are therefore predominantly based on the Defence Assessment (Part 3, Chapter 7: Defence of the 2016 EGI SEA Report) undertaken as part of the 2016 EGI SEA (DEA, 2016). The latter was desktop based and focused mainly on the interpretation of existing data. This assessment has also been supplemented with information gathered from discussions and meetings with the Department of Defence (DoD), ARMSCOR, South African Air Force (SAAF), South African Navy, South African Military Health Service (SAMHS), and the South African National Defence Force (SANDF).

The SANDF uses an extensive system of military airspace and land assets in order to prepare and train combat-ready forces. Furthermore, it also operates radar systems designed to protect the sovereignty of the national borders and to detect threats to national security. The SANDF falls under the DoD and comprises four armed services, namely: Army, Air Force, Navy and Military Health Service.

The various defence features to be taken into consideration when locating EGI are listed in Table 1 below.

4.2.6.2 Sensitivity Analysis and Mapping

In accordance with discussions with the military, DoD, ARMSCOR, SAAF, South African Navy, SAMHS, and the SANDF, areas of interest were mapped and appropriately buffered as shown in Table 1. The sensitivity map (Map 1) was delineated according to these criteria. Most of the sensitivity features noted in Table 1 below are military areas, where access is limited, and have been highlighted as a result of the potential impact of EGI on these features.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

Table 1: Defence Sensitivity Criteria

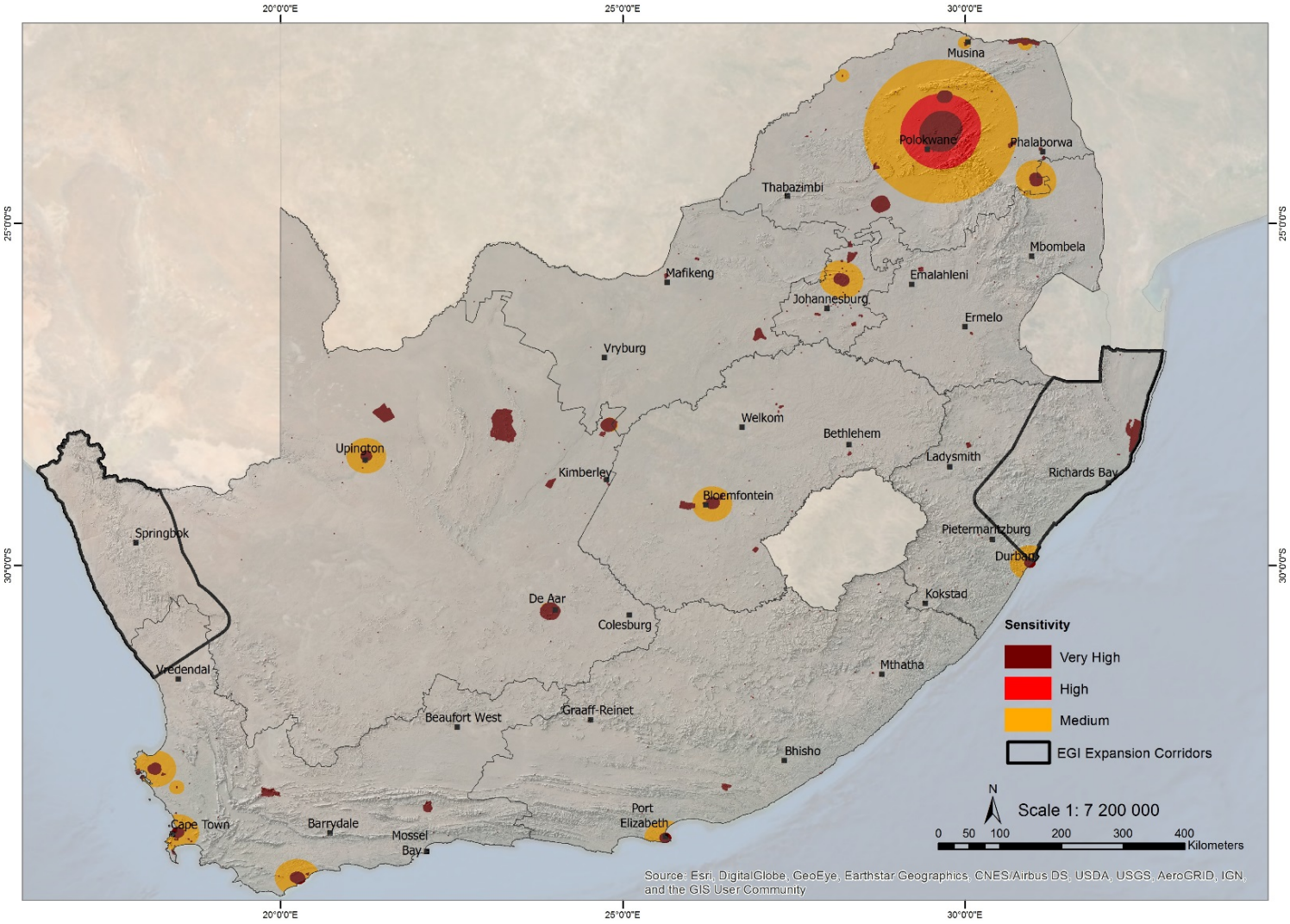
Sensitivity Feature	Data Source	Sensitivity Mapping Application
Forward Airfields	SANDF, 2017	Very High – 1 km buffer Medium – 10 km buffer
Air Force Bases -including air force training ranges	SANDF, 2017	Very High – 8 km buffer Medium – 28 km buffer
High Sites	SANDF, 2017	Very High – 1 km buffer
Operational Military Bases	SANDF, 2017	Very High – 1 km buffer
Military Training Areas	SANDF, 2017	Very High – 1 km buffer
Bombing Ranges	SANDF, 2017	Very High – 28 km buffer High – 28 – 56 km buffer Medium – 56 – 111 km buffer
Shooting Ranges	SANDF, 2017	Very High - 1 km buffer
Border Posts	SANDF, 2017	Very High – 1 km buffer
All Other DoD features (including Naval Bases, Housing, Offices, workshops etc.)	SANDF, 2017	Very High – 1 km buffer
Ammunition Depots	SANDF, 2017	Very High – 10 km buffer

4.2.6.3 Impact Description

Impacts of EGI on defence activities could result from interference with surveillance radars and communication systems, or if any structures associated with the EGI potentially create obstacles for military aviation or ground activities. The size and nature of power line infrastructure may furthermore lead to the blocking and cluttering of surveillance and communication signals. Any interference with SANDF surveillance radar would compromise the safeguarding of coastlines, national borders, military airspace or other militarily sensitive areas.

In South Africa, all structures taller than 15 metres above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). With power lines reaching heights of beyond 60 m above ground level in some instances, they present a real danger to aviation, especially if sited in close proximity to airfields. It is for this reason that the safeguarding of the areas around airfields is important.

The Seismicity Assessment study conducted as part of the EGI Expansion SEA (included in Appendix C.3 of the EGI Expansion SEA Report) mentions that seismicity in South Africa arises from both natural sources (e.g. plate tectonic forces, buoyant uplift of the continent after erosion) and human-induced sources (e.g. rock failure caused by mining-induced stresses, slip on faults causes by changes in load and pore fluid pressure during the filling of reservoirs, and vibrations produced by blasting for open pit mining, civil excavation and the disposal of expired munitions). The report further notes that ground vibrations produced by the disposal of expired munitions have been investigated by Grobbelaar (2017). Ground vibrations may also be produced by blasting in open pit mines and for civil excavations (e.g. road cuttings), and the disposal of expired military explosives. The effect of these blasts is local. Intensities strong enough to cause damage to sensitive structures are usually limited to distances of tens to hundreds of meters, or at most a kilometre or two from the source. Expired munitions are usually detonated on the surface, so relatively little energy is transmitted into the earth and little damage done. However, the shock wave travelling through the air may cause alarm, discomfort, and in some cases damage. The Seismicity Assessment includes additional information provided by the Council for Geoscience in terms of measurements of the ground motion produced by military explosives detonated on surface and their effects on buildings (B Manzunzu, pers. Comm., 2018).



Map 1: Defence sensitivity map for EGI Development in the Expanded Western and Eastern EGI Corridors

4.2.6.4 Interpretation of the Sensitivity Map

Proponents intending to develop EGI within high and very high sensitivity areas must ensure that the proposed development will not have an unacceptable negative impact on defence activities.

The Obstacle Evaluation Committee (OEC), under the chairmanship of the Senior Staff Officer Air Traffic Management of the Air Force, is responsible for streamlining and coordinating the approvals for the construction of potential aviation obstacles in the vicinity of military areas of interest. The OEC consists of members from both the Air Force and the South African Civil Aviation Authority (SACAA), and is mandated to make final recommendations to the Deputy Chief of the Air Force regarding the approval of obstacles that might affect Air Force activities. Due to the complexity of impacts potentially posed by obstacles on aviation, surveillance, communication, and other military activities, all proposed EGI must be evaluated by this committee. Even in instances where the distance from the nearest area of military interest may seem far enough for it not to have an impact, there is still potential for interference with communication, surveillance, or other military services.

The sensitivity map illustrated in this section (Map 1) does not indicate where development can or cannot proceed. Instead, the main objective of this section is to identify high risk areas for development in the context of defence features. This way, developers are able to plan to avoid sensitive defence related features at the earliest stage of development planning, and in so doing, minimise the risk of project delays or increased project costs as a result of the potential interference of the proposed development with defence services.

Table 2/...

Table 2: Interpretation of defence sensitivity map

Sensitivity Class	Interpretation	Recommendations at project level
Very High (dark red)	In Very High sensitivity areas there is a high likelihood for significant negative impacts on the defence installation or vice versa. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	The proponent must request a comment in writing from the OEC and/or from the SACAA, which may include inputs from the OEC confirming no unacceptable impact on military areas of interest. Inputs from the OEC/SACAA, if provided within prescribed timeframes in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, will be considered by the relevant competent authority for decision making. If no inputs are provided by the OEC within the prescribed timeframes, then the Environmental Assessment Practitioner (EAP) must provide evidence of engagement with the relevant officials at the OEC and timeous requests for inputs.
High (red)	In High sensitivity areas there is potential for negative impacts on the defence installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
Medium (orange)	In Medium sensitivity areas there is a low potential for negative impacts on the defence installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	No additional requirements
Low (green)	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.7

Civil Aviation

CONTENTS

TABLES

MAPS

ABBREVIATIONS

EGI	Electricity Grid Infrastructure
SAAF	South African Air Force
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulations
SACATS	South African Civil Aviation Technical Standards
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.7 Civil Aviation

4.2.7.1 Introduction and Scope

This chapter covers the potential impacts on civil aviation associated with the development of Electricity Grid Infrastructure (EGI) within the proposed expanded Eastern and Western EGI corridors. Given that the current Strategic Environmental Assessment (SEA) assesses the expansion of the Power Corridors gazetted in February 2018, the approach to the sensitivity analysis and the assessment of impacts as part of this current SEA is the same as that undertaken for the 2016 Assessment (DEA, 2016[1]).

The subsequent sections are therefore predominantly based on the Civil Aviation Assessment (Part 3, Chapter 6: Civil Aviation of the 2016 EGI SEA Report) undertaken as part of the 2016 EGI SEA (DEA, 2016). This study was desktop based and focused mainly on the interpretation of existing data.

Civil aviation is governed by the Civil Aviation Act (Act 13 of 2009) and the South African Civil Aviation Authority (SACAA) is mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. All proposed developments or activities in South Africa that potentially could affect civil aviation must thus be assessed by SACAA in terms of the South African Civil Aviation Regulations (SACARs) and South African Civil Aviation Technical Standards (SACATS) in order to ensure aviation safety. The Obstacle Evaluation Committee (OEC) which consists of members from both the SACAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approval of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest. The OEC is chaired by the Senior Staff Officer Air Traffic Management of the Air Force. With both being national and international priorities, the OEC is responsible for facilitating the coexistence of aviation and EGI development, without compromising aviation safety.

The various civil aviation features to be taken into consideration when locating EGI are listed in Table 1 below. It is anticipated that other features identified in the Defence Assessment (Part 4.2.6 of the EGI Expansion SEA Report) study are not applicable in the case of civil aviation.

4.2.7.2 Sensitivity Analysis and Mapping

Based on the sensitivities defined in Table 1, areas of interest were mapped and appropriately buffered. A sensitivity map (Map 1) was delineated according to these criteria.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

Table 1: Civil Aviation Sensitivity Criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application
Major Airports	SACAA	Very High – 8 km buffer Medium – 15 km buffer
Landing Strips	SACAA	Very High – 2 km buffer
Other Civil Aviation Aerodromes (Small Aerodromes)	SACAA	Medium – 8 km buffer
Civil Aviation Radars	SACAA	High – 4.6 km Medium – 15 km
Air Traffic Control and Navigation Sites	ATNS	Medium – 5 km
Danger and Restricted Airspace	SACAA	High - as demarcated

4.2.7.3 Impact Description

Regulation 19.01.30 (3) of the Civil Aviation Regulations (2011) states that “buildings or other objects which will constitute an obstruction or potential hazard to aircraft moving in the navigable air space in the vicinity of an aerodrome, or navigation aid, or which will adversely affect the performance of the radio navigation or instrument landing systems, must not be erected or allowed to come into existence without the prior approval of the Director” of the SACAA.

The Civil Aviation Act (Act 13 of 2009) refers to an “obstacle” as “all fixed or mobile objects (whether temporary or permanent) or parts thereof, that are located on an area intended for the surface movement of aircraft; or extend above a defined surface intended to protect aircraft in flight; or stand outside those defined surfaces and that have been assessed as being a hazard to air navigation”.

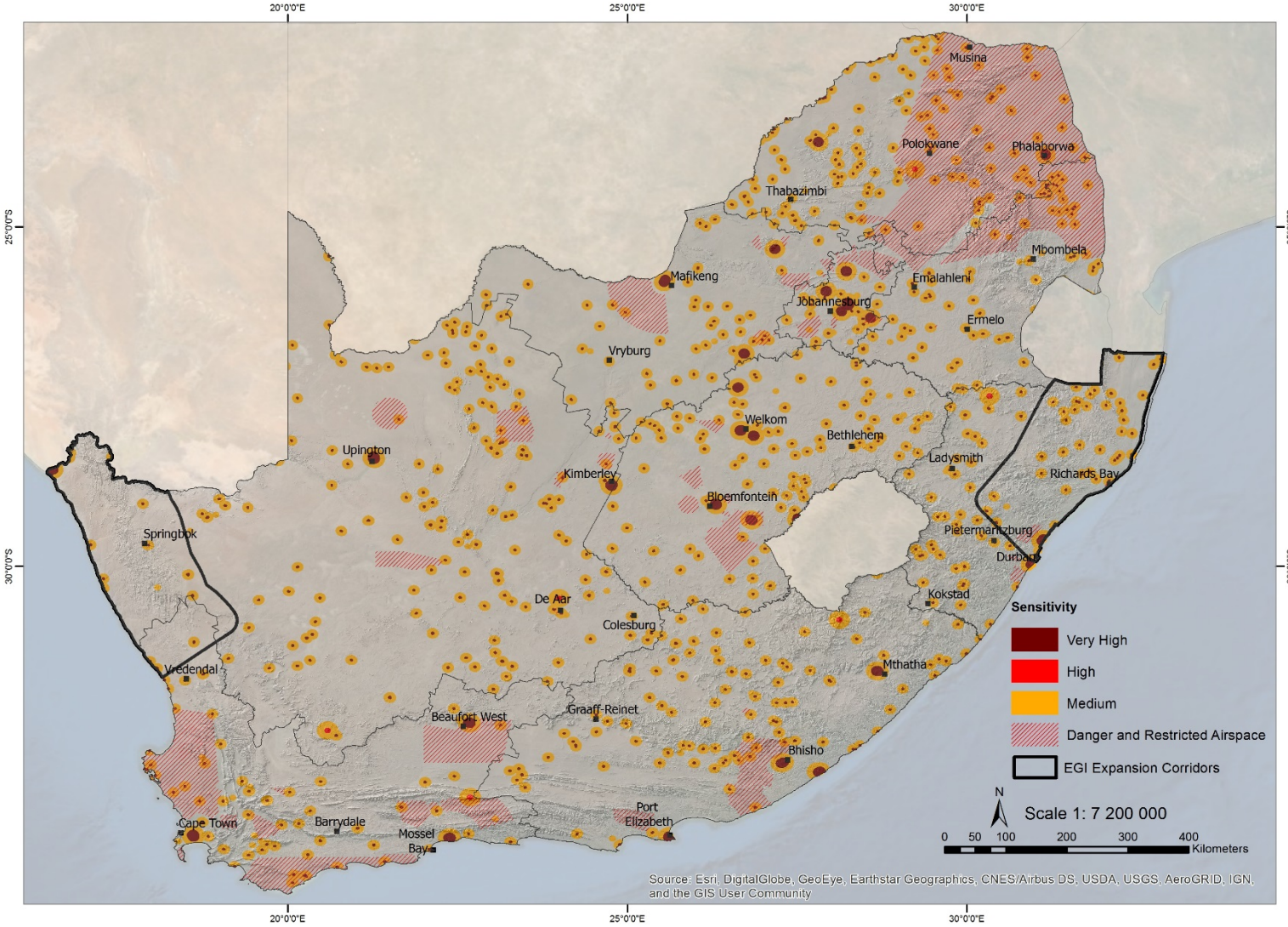
This is also linked to Regulation 91.01.10 (1) of the Civil Aviation Regulations (2011), which states that "No person shall, through any act or omission endanger the safety of an aircraft or person therein, or cause or permit an aircraft to endanger the safety of any person or property".

Therefore, it is a requirement in terms of the Civil Aviation Regulations (2011) to submit an application for approval to the SACAA for any development that includes obstacles that could pose a hazard to aviation.

Impacts of EGI on civil aviation activities could result from interference with surveillance radars and communication systems, or if any structures associated with the EGI potentially create obstacles for aviation activities. The size of power line infrastructure, sometimes protruding greater than 60 m above ground level, poses a physical obstacle risk for aviation, especially in the Air Force’s low flying areas. The size and nature of power line infrastructure may furthermore lead to the blocking and cluttering of surveillance and communication signals.

In South Africa all structures taller than 15 metres above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). With power lines reaching heights of beyond 60 m above ground level in some instances, they present a real danger to aviation, especially if sited in close proximity to aerodromes. It is for this reason that the safeguarding of the areas around aerodromes is important and that specific safety requirements (e.g. lighting and markings) are applicable to power lines considered a danger to aviation.

The main potential impact of EGI would be the height and routing of power lines in the vicinity of aerodromes, especially where these may cross through the approach or departure paths.



Map 1: Civil Aviation sensitivity map for EGI Development in the Expanded Western and Eastern EGI Corridors

4.2.7.4 Interpretation of the Sensitivity Map

The OEC is mandated to make final recommendations to the Deputy Chief of the Air Force regarding the approval of obstacles that might affect Air Force activities. Due to the complexity of impacts potentially posed by all obstacles on aviation, surveillance, communication, and other military activities, all proposed EGI facilities must be evaluated by this committee.

Therefore, without being able to guarantee that any development will not be found to have an unacceptable impact on military features without confirmation by OEC, the sensitivity map illustrated in this section (Map 1) does not indicate where development can or cannot proceed. Instead, the main objective of this section is to identify high risk areas for development in the context of civil aviation features. This way, developers are able to plan to avoid sensitive civil aviation related features at the earliest stage of development planning, and in so doing, minimise the risk of a negative decision, project delays or increased project costs as a result of the potential interference of the proposed development with civil aviation services.

Table 2: Interpretation of civil aviation sensitivity map

Sensitivity Class	Interpretation	Recommendations at project level
Very High (dark red)	In Very High sensitivity areas there is a high likelihood for significant negative impacts on the civil aviation installation or vice versa. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	Proponents intending to develop EGI anywhere in South Africa that triggers the need for an environmental assessment process must ensure that the proposed development will not have an unacceptable negative impact on civil aviation activities. In order to do so, the proponent must request a comment in writing from the OEC and/or from the SACAA, which may include inputs from the OEC confirming no unacceptable impact on civil aviation areas of interest. Inputs from the OEC/SACAA, if provided within prescribed timeframes in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, will be considered by the relevant competent authority for decision making. If no inputs are provided by the OEC within the prescribed timeframes, then the Environmental Assessment Practitioner (EAP) must provide evidence of engagement with the relevant officials at the OEC and timeous requests for inputs.
High (red)	In High sensitivity areas there is potential for negative impacts on the civil aviation installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
Medium (orange)	In Medium sensitivity areas there is a low potential for negative impacts on the civil aviation installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	*No further requirements*
Low (green)	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.8

Heritage

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TABLES

MAPS

ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
ECPHRA	Eastern Cape Provincial Heritage Resources Authority
EIA	Environmental Impact Assessment
EGI	Electricity Grid Infrastructure
HWC	Heritage Western Cape
NEMA	National Environmental Management Act (Act 107 of 1998)
NHRA	National Heritage Resources Act (Act 25 of 1999)
PHRA	Provincial Heritage Resources Authority
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.8 Heritage

4.2.8.1 Introduction and Scope

This chapter covers the potential impacts on heritage associated with the development of Electricity Grid Infrastructure (EGI) within the proposed expanded Eastern and Western EGI corridors. Given that the current Strategic Environmental Assessment (SEA) assesses the expansion of the Power Corridors gazetted in February 2018, the approach to the sensitivity analysis and the assessment of impacts as part of this current SEA is the same as that undertaken for the 2016 Heritage Assessment as part of the EGI SEA (DEA, 2016[1]).

The subsequent sections are therefore predominantly based on the Heritage Assessment (Appendix C.4 of the 2016 EGI SEA Report) undertaken as part of the 2016 EGI SEA (DEA, 2016). This study was desktop based and focused mainly on the interpretation of existing data. Information for this assessment was mainly sourced from the latest heritage resources dataset (December 2018) provided by South African Heritage Resources Agency (SAHRA). Further consultations with relevant authorities such as the SAHRA was undertaken to confirm applicable buffers and sensitivities. A meeting was also held with SAHRA and Department of Environmental Affairs (DEA) in May 2019 to discuss heritage related aspects of the SEAs commissioned by the DEA, such as data usage and SAHRA's requirements.

4.2.8.2 Approach: Data Sources, Legislation, Assumptions and Limitations

The main source of information is data on heritage sites provided by SAHRA in February 2019. This data includes national and provincial data, as well as local data up to December 2018. The list of updated data used in this current EGI Expansion SEA is indicated in Table 1 below. Assumptions and limitations applicable to this assessment are provided in Table 2.

Table 1: Heritage Datasets

Data title	Source and date of publication	Data Description
Mapped Heritage Features	SAHRA, 2018	Heritage sites and features curated by SAHRA
World Heritage Sites and related buffer zones	South African Protected Areas Database (SAPAD) - Q4, 2017	World Heritage Sites
Geological Features and Substrates of Palaeontological Importance, Geology Layer	Council for Geosciences, 2014	Specific geological types of potential heritage importance

Table 2: Assumptions and limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Data availability	Latest dataset provided by SAHRA was used (data up to December 2018) but a large amount of published and	Field verification of datasets and outcomes, and extensive local expert consultation. The study	Data provided by SAHRA comprises the majority of the data potentially available.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
	unpublished data has not been included.	area is widely scattered.	
Unavailability of the palaeosensitivity map to include in the sensitivity analysis	-	Further field assessment and/or desktop work to verify and correct the sensitivity levels described	The palaeosensitivity map contains the most updated information and currently needs to be accessed online.

The relevant regulatory instruments are listed in Table 3 below.

Table 3: Applicable Legislation for Heritage

Instrument	Key objective	Feature
International Instrument		
Unesco Convention on the Protection of World Cultural and Natural Heritage, 1972 (applicable in all corridors)	Protection of natural and cultural heritage sites which demonstrate importance for all the people of the world	Declared World Heritage Sites: Cape Floral Region Protected Areas[2]
National Instrument		
National Heritage Resources Act 25 of 1999 (applicable in all corridors)	Identification, management, protection, conservation and promotion of the national heritage resources within the country	All heritage sites except for World Heritage Sites
National Environmental Management: Protected Areas Act 57 of 2003	Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascape	World Heritage Sites
Integrated Coastal Management Act 24 of 2008	Promotion, conservation and sustainable development of the coastal environment	Heritage sites within 1 km of the coastline
National Environmental Management Act 107 of 1998, as amended (NEMA)	Environmental governance within the country	Heritage sites identified during the environmental process
Provincial Instrument		
KwaZulu-Natal Heritage Act 4 of 2008 and KwaZulu-Natal Amafa and Research Institute Act (Act 5 of 2018) (applicable in part of the Expanded Eastern EGI Corridor falling within KZN).	Conservation, protection and administration of both the physical and the living or intangible heritage resources of the Province of KwaZulu-Natal	Heritage sites falling within the boundaries of KZN

[2] The Cape Floral Region Protected Areas is declared as a 'natural' heritage site by Unesco but it is not subjected to the same treatment as other heritage sites in South Africa by Heritage Western Cape and SAHRA.

The National Heritage Resources Act (Act 25 of 1999) (NHRA) is considered most relevant, as it protects many heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Section 38 (1) of the NHRA states the following:

- Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:
    - (a) the construction of a road, wall, **powerline**, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
    - (b) the construction of a bridge or similar structure exceeding 50 m in length;
    - (c) any development or other activity which will change the character of a site — (i) exceeding 5 000 m^2 in extent; or (ii) involving three or more existing erven or subdivisions thereof; or (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
    - (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
    - (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority;

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted by the Applicant to the relevant Heritage Authority. This is usually the case for EGI development. Therefore, since a specific HIA will be required prior to development of EGI on a project specific basis, a dedicated HIA was not undertaken at this SEA level. Instead, a review of existing literature captured for the previous SEAs, as well as a general sensitivity analysis has been undertaken for this current SEA.

Grading of sites is necessary for heritage management as it is a legal requirement towards the formal protection of sites and informs the requirements for the management of generally protected sites. Any heritage site which is part of the national estate as defined in Section 3 of the NHRA should be graded according to its significance. In South Africa, grading has three associated components, namely the geographical range of a site's significance (international, national, provincial/regional or local), the level of significance (High, Medium or Low) and the heritage authority with the delegated powers to manage the site. The grading of heritage sites which form part of the national estate is specified in Section 7 of the NHRA as follows:

- (a) Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
- (b) Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- (c) Grade III: Other heritage resources worthy of conservation.

Grade III sites have three subcategories according to their level of local significance i.e. IIIa (high), IIIb (medium) and IIIc (low). These sites are significant at the local level and the type of mitigation allowed at these sites varies from destruction (IIIc) or extensive mitigation (IIIb) to general avoidance and minimal

modification (IIIa). Grade IIIa sites are of such a high local significance that they should be protected and retained. Grade IIIb sites are heritage resources rated with medium local significance. They should preferably be retained where possible, but, where developments cannot be realigned or moved, mitigation is normally allowed. Grade IIIc sites are of low local significance. These resources must be recorded satisfactorily before destruction is allowed.

SAHRA is the national authority and manages Grade I sites only; and Provincial Heritage Resources Authorities (PHRAs) manage Grade II and Grade III sites. Only one municipality, the City of Cape Town Metropolitan Municipality, has obtained limited powers to manage Grade III resources from Heritage Western Cape (HWC). As part of the review of the Draft SEA Report, SAHRA noted that the HWC, Eastern Cape Provincial Heritage Resources Authority (ECPHRA) and Amafa KwaZulu-Natal have been assessed as competent to perform functions in terms of Sections 8, 26, 27-30, and 34-37 of the NHRA. SAHRA further indicated that the Northern Cape, North West, Gauteng, Limpopo, Mpumalanga and the Free State PHRAs are only competent to provide permits for heritage resources as per Section 34 of the NHRA, or under Section 27 (only for sites defined as structures as per Section 34). For sites managed under Section 27, if the site is defined as an archaeological or palaeontological site, or a meteorite (Section 35), or as a burial ground and grave (Section 36), these sites are managed and permitted by SAHRA.

The majority of the Provincial Heritage Sites were declared as National Monuments under the National Monuments Act of 1969. These sites are mainly buildings located within the urban edge of various towns and cities across the country.

There are two useful guides which explain the grading process in more detail:

- the HWC Short Guide to and Policy Statement on Grading issued in 2012[3]
- the SAHRA Minimum Standards for Archaeological and Palaeontological Impact Assessments issued in 2007[4] (It is noted that these Minimum Standards are currently being updated by SAHRA, and thus the requirements of an HIA process may change).

The 2012 Minimum Standards on Palaeontological Components of Heritage Impact Assessments is also considered useful in terms of the above.

Refer to Section 5 of the 2016 Heritage Assessment Report (DEA, 2016) for a detailed description of the study methodology, assumptions and limitations undertaken as part of the 2016 EGI SEA. It must be noted that detailed sensitivity analysis was not undertaken as part of this current SEA given that, regardless of the sensitivity of the site, the developer will be required to carry out, at least, a Phase 1 HIA.

The list of data used in this current EGI Expansion SEA is indicated in Table 1.

4.2.8.3 Impact Description and Mitigation

The information presented in this section is based on the 2016 Heritage Assessment Report (DEA, 2016).

The integrity and significance of heritage resources can be jeopardized in two ways i.e. by natural forces such as erosion or anthropogenic forces such as development activities. EGI developments have the potential to impact on heritage resources through physical disturbance during construction or by changing the wider landscape context.

Physical impacts to heritage resources in the context of EGI development can take the form of excavations for pylons, substations or in some cases new roads. The potential physical impacts are greatly dependent on the micro-siting of the infrastructure. Although it is possible to identify and protect known and above ground heritage resources (e.g. cultural sites and historical structures), it is more challenging to assess the

[3]https://www.westerncape.gov.za/other/2012/9/grading_guide_&_policy_version_5_app_30_may_2012.pdf
[4] http://www.sahra.org.za/sahris/sites/default/files/website/articledocs/ASG2-2%20SAHRA%20A%26PIAs%20MIN%20STDS%20Ph1-2%2016May07.pdf

potential impacts on unknown and underground heritage resources (e.g. the potential presence of fossils or middens). Even at a project level it is difficult to identify and confirm such heritage resources prior to excavation.

4.2.8.4 Sensitivity Analysis and Mapping

Given the diverse nature of impacts presented by EGI to heritage resources, heritage sensitivity inside the Expanded EGI Corridors was delineated according to two heritage categories, namely: 1) Palaeontological and 2) Non-Palaeontological (referring to archaeology and other heritage resources e.g. graves). The heritage features that would be impacted by EGI development and their relative sensitivities are indicated in Table 4. Landscapes were considered separately in the Visual Assessment study, the key findings of which are summarised below in terms of landscapes, heritage resources and scenic routes. The complete Visual Assessment is included in Appendix C.2 of the EGI Expansion SEA Report.

Palaeontological resource sensitivity was largely inferred through the use of geological maps depicting formations likely to contain fossils. Features taken into consideration to create the four-tier sensitivity palaeontological map are:

- Palaeontological sites with buffers as indicated below; and
- South African Heritage Resources Information System (SAHRIS) palaeosensitvity map consisting of a range of six sensitivity levels and related recommendations.

The occurrence of Non-Palaeontological resources is much less predictable and cannot be discounted through desktop assessment alone, unless the area has already undergone a detailed HIA (however it is acknowledged that an HIA previously conducted in an area may not have identified all heritage resources present, and over time erosion may uncover subsurface heritage resources that were not present during the previous HIA etc.). Features taken into consideration to create the four-tier sensitivity map are:

- The heritage sites (excluding palaeontological sites) as provided by SAHRA (dated December 2018).

Natural features such as rivers, wetlands and pans; as well as Koppies, mountainous areas and coastlines are often foci of prehistoric and historic settlement and may therefore contain important heritage resources. These natural features, although potentially important location for heritage resources, have not been included in this sensitivity map given that the proposed sensitivity zones (buffers) around those natural features were found to be of similar magnitude (and often smaller) in comparison to those set as part of the environmental sensitivity analysis.

On 9 May 2018, the SAHRA provided the following feedback with regards to sensitivity zones for heritage sites to be used for the EGI Expansion SEA mapping exercise. The feedback from SAHRA serves as guidance for the delineation of the EGI Expansion project with regards to sensitivity zones surrounding heritage resources, and does not constitute a legal exclusion zone as per Sections 27, 28, 29, 31, 34, 35, 36 and 37 of the NHRA. In addition, the recommended buffer zones noted below only apply to heritage resources under the jurisdiction of SAHRA. SAHRA has recommended that guidance on sensitivity buffer zones for heritage resources that fall under the jurisdiction of the PHRAs must be sought from the relevant PHRAs.

The proposed sensitivity zones for heritage resources apply to:

- officially graded heritage resources as per Section 7 of the NHRA;
- officially declared sites as per Section 27 of the NHRA; and
- sites provided a field rating as per the 2007 SAHRA Minimum Standards: Archaeological and Palaeontological components of Impact Assessments.

The proposed sensitivity zones (buffers) around identified heritage resources, as recommended by SAHRA, are as follows:

- Grade 1: 2 km from either the official point or official boundary of the site;
- Grade 2: 1 km from either the official point or official boundary of the site;
- Grade 3a: 150 m from the provided point;
- Grade 3b: 100 m from the provided point;
- Grade 3c: 50 m from the provided point; and
- Ungraded/no field rating provided: 100 m from the provided point.

According to SAHRA, the above sensitivity zones do not exclude development occurring within those areas however, should development be planned to occur in the area, more intensive mitigation measures may be necessary. Depending on the sensitivity of the heritage resources, the development in or near the proposed buffer zones will be subject to footprint amendments based on the findings of a HIA.

SAHRA noted that the various heritage site taxonomy i.e. archaeological sites, palaeontological sites, built environment sites, burial grounds and monuments, underwater heritage sites, were not used to further separate the categories of heritage, as the variable involved with the sites are too large to employ at the current high-level mapping exercise.

The EGI Expansion Corridors were mapped separately for Palaeontological sensitivity and Non-Palaeontological sensitivity. The two mapping outputs were then integrated into a combined mapping output, by retaining the highest sensitivity rating between the two sensitivity maps for all areas within the corridors. The combined sensitivity map is symbolic of overall heritage sensitivity inside of each EGI Expansion Corridor.

Sensitivity maps (Palaeontological resources and non-palaeontological resources) were produced for the Eastern and Western Expanded EGI Corridors according to the criteria set out in Table 4 to classify heritage sensitivity spatially into four tiers namely, Very High, High, Medium and Low (Map 5).

From a heritage perspective, Grade 1, 2, and 3 sites have been considered as sites that have a mapped heritage feature present, and these areas will be avoided during EGI design, construction and maintenance.

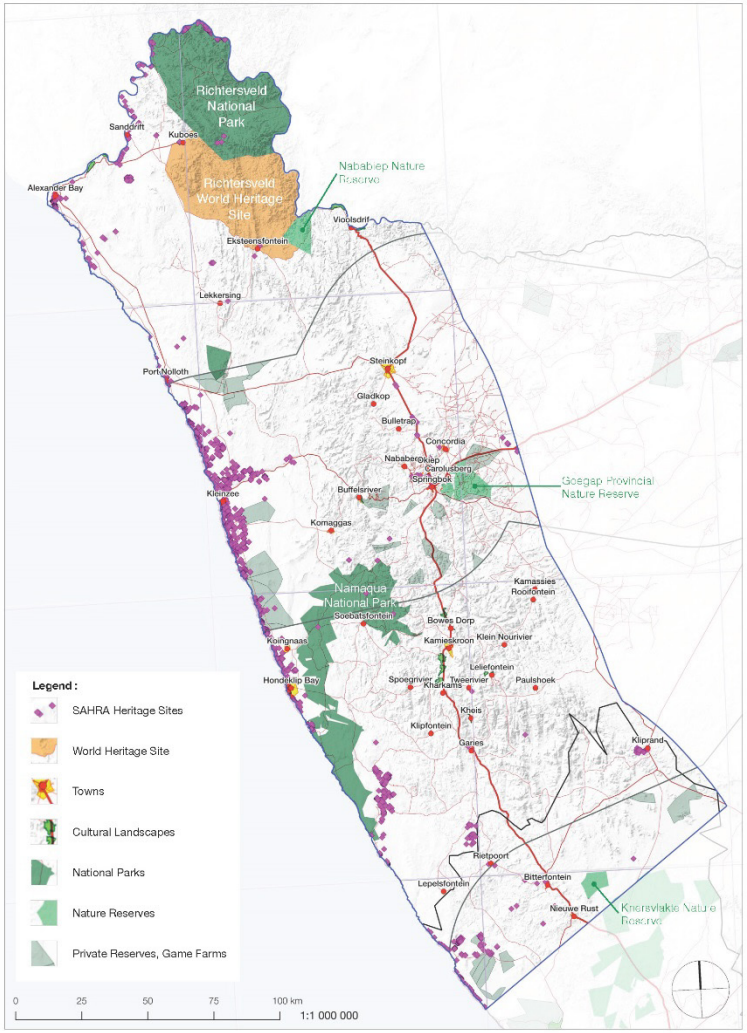
4.2.8.4.1 Visual Assessment – Summary of Findings

The Visual Assessment was undertaken by Quinton Lawson and Bernard Oberholzer. A summary of the key findings of the Visual Assessment is included in Part 4.2.2 of the EGI Expansion SEA Report.

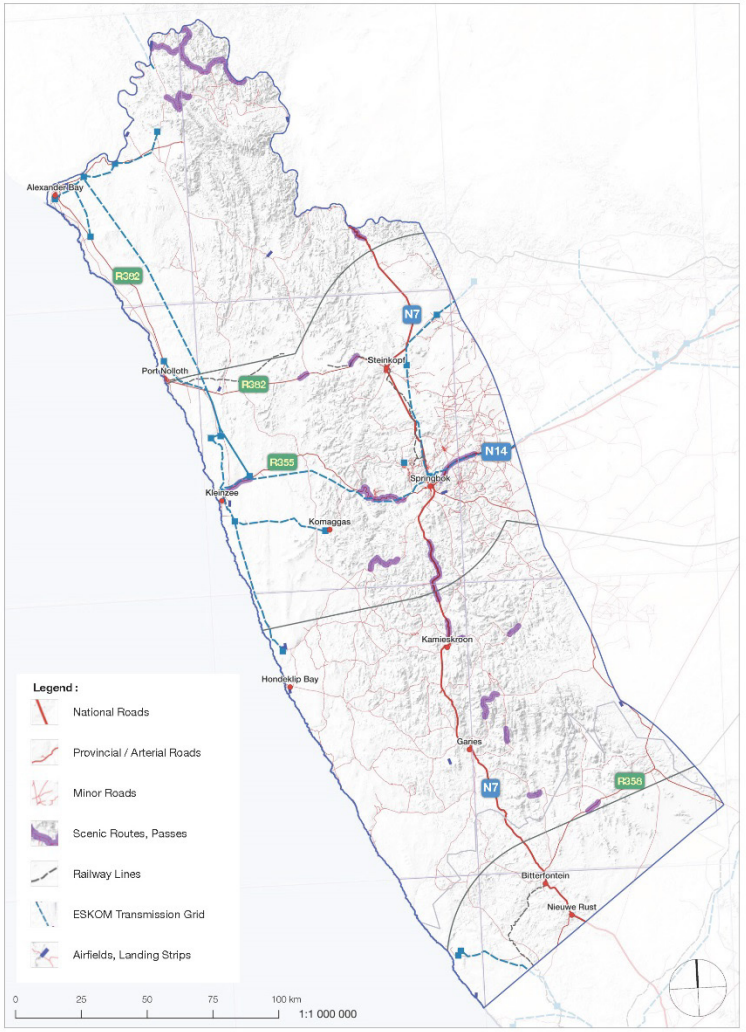
In terms of landscapes, the Expanded Western EGI Corridor includes the Kamiesberg Mountains, which are particularly scenic, although much of the escarpment between the coastal plain and the inland plateau has scenic value, e.g. when viewed from the Spektakel Pass between Springbok and the coast. The Namaqua National Park, west of Kamieskroon, and the Goegap Nature Reserve near Springbok are known for their spring flowers. The Richtersveld Transfrontier Park, part of which is a World Heritage Site (listed as the Richtersveld Cultural and Botanical Landscape) is also located in the far north of the Expanded Western EGI Corridor. The Corridor is bounded in the north by the Orange River, which is a major scenic and recreational attraction. From the perspective of mission settlements, historical towns and other heritage sites, the corridor includes the Steinkopf and Rietpoort mission settlements, historical mining towns (i.e. Nababeep, Okiep,and Concordia) and other historical settlements/sites (Map 1). With regards to national/arterial and scenic routes or mountain passes, the corridor includes the N7 national road, particularly between Kamieskroon and Springbok, parts of the N14 east of Springbok, as well as the Spektakel Pass west of Springbok, and other smaller routes or passes (Map 2).

The area within the Expanded Eastern EGI Corridor owes its scenery mainly to the sandstone table-lands and doleritic landforms. Scenically prominent features of the Expanded Eastern EGI Corridor include the mountainous terrain around Greytown, Kranskop and Nkandla, the deep, steep-sided river gorges, the high dunes with coastal forest, and the St Lucia wetlands (a World Heritage Site). To the north of this corridor, scenic features include the Lebombo Mountains, Pongolopoort Dam (Lake Jozini), Lake Sibaya, and Kosi Lake. The corridor also includes numerous historic towns and settlements, and heritage sites including battle sites and gravesites (Map 3). With regards to national, arterial and scenic routes, the corridor includes the N2 national road, particularly along the coast and across estuaries. It also includes the Pongola *poort* to Jozini, and numerous scenic routes and passes in rural areas (Map 4).

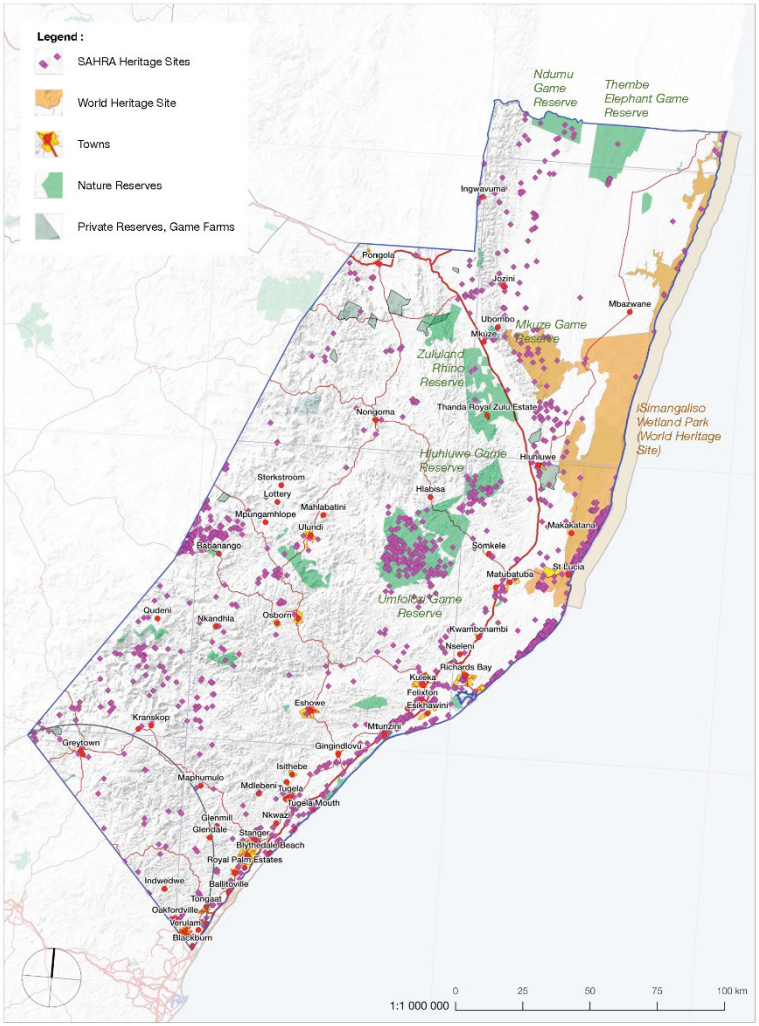
Maps 1 and 2/...



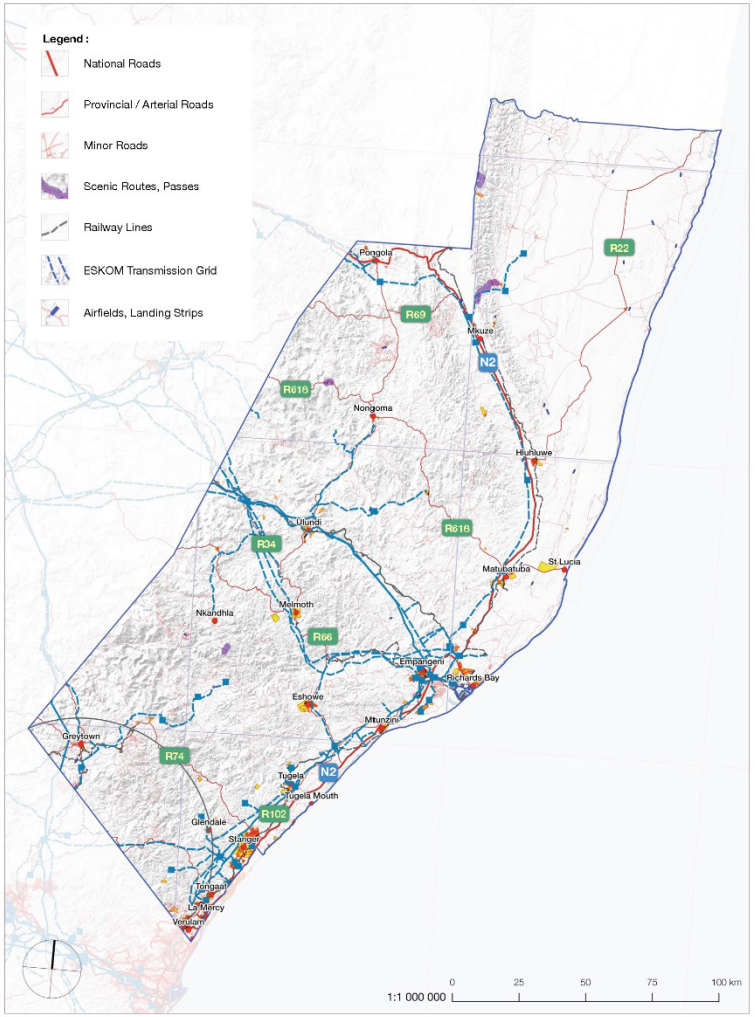
Map 1: Heritage Features and Protected Areas in the Expanded Western EGI Corridor (Data Sources: SAHRA, 2017; and DEA (SAPAD), 2017).



Map 2: Routes (including Scenic Routes) and Transmission Lines in the Expanded Western EGI Corridor (Data Sources: Map Studio of South Africa; and Eskom, 2018).



Map 3: Heritage Features and Protected Areas in the Expanded Eastern EGI Corridor (Data Sources: SAHRA, 2017; and DEA (SAPAD), 2017).



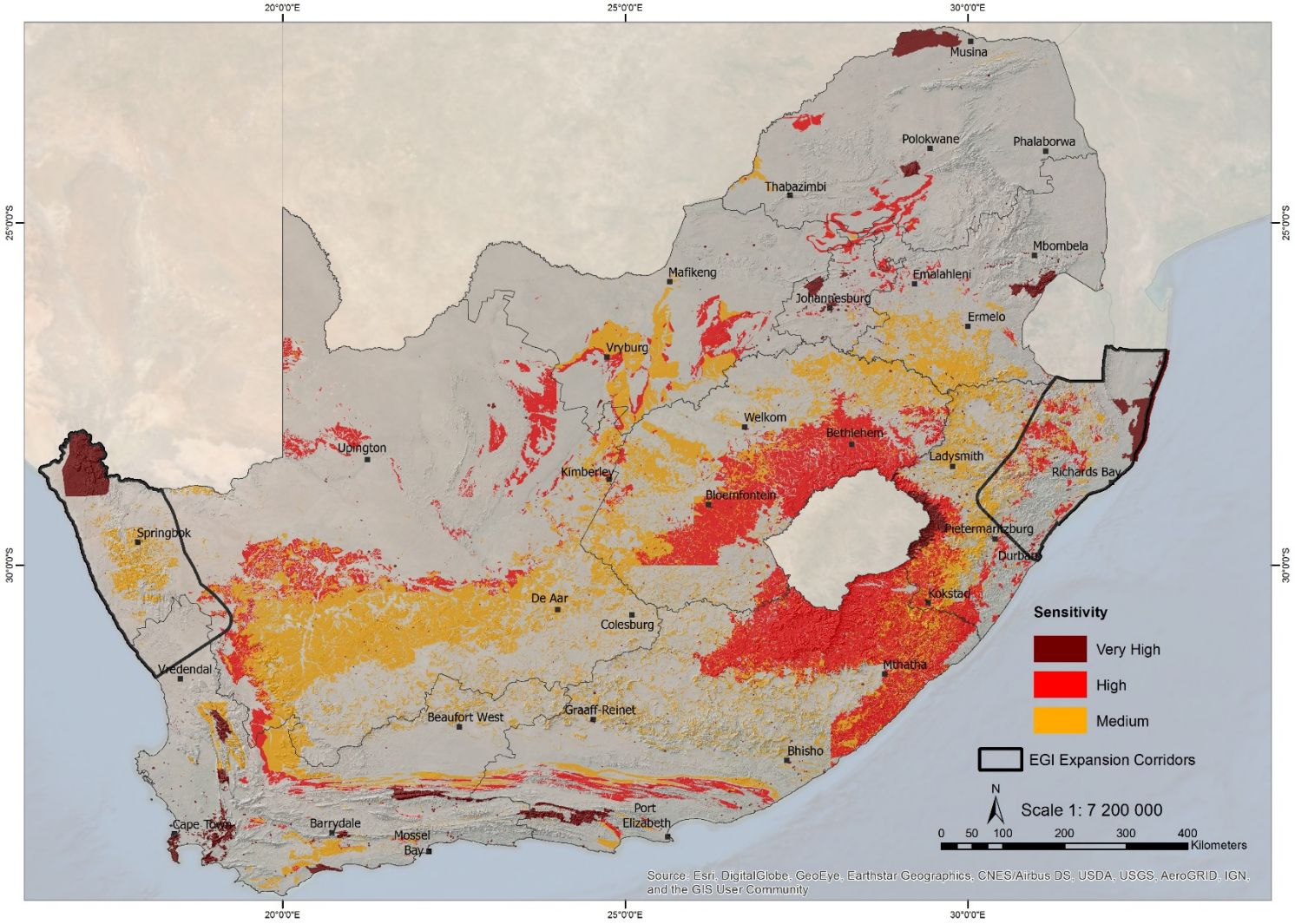
Map 4: Routes (including Scenic Routes) and Transmission Lines in the Expanded Eastern EGI Corridor (Data Sources: Map Studio of South Africa; and Eskom, 2018).

Table 4: Summary of sensitive heritage (including palaeontology) features, datasets and process of preparing data

Sensitivity Feature	Data Source and Date of Publications	Data Preparation and Processing	Sensitivity
World Heritage Sites and related buffer zones	SAPAD - Q4, 2017	Union between World Heritage Sites[5] as part of the SAHRA, 2018 layer and SAPAD - Q4, 2017. Buffer and core areas used as is in the data set.	Very High - within defined buffer zone
Grade I sites	Mapped Heritage Features, SAHRA, 2018	As extracted from the SAHRA, 2018 layer	Very High – 2 km buffer
Grade II sites	Mapped Heritage Features, SAHRA, 2018		Very High – 1 km buffer
Grade IIIa sites	Mapped Heritage Features, SAHRA, 2018		High – 150 m buffer
Grade IIIb sites	Mapped Heritage Features, SAHRA, 2018		High – 100 m buffer
Grade IIIc sites	Mapped Heritage Features, SAHRA, 2018		High – 50 m buffer
Ungraded sites	Mapped Heritage Features, SAHRA, 2018		Very High – 100m buffer
Battlefields (Grade IIIb)	Mapped Heritage Features, SAHRA, 2018		Very high – 5 km buffer
SAHRIS PalaeoSensitivity map - Formations of very high sensitivity (red)	SAHRIS PalaeoSensitivity Map	These features were not made available to the Project Team at the time of completion of this SEA Process. It should be noted that the information is currently only available online (via the SAHRIS website). The DEA and SAHRA are in the process of obtaining the datasets from the Council for Geosciences.	Very High
SAHRIS PalaeoSensitivity map - Formations of high sensitivity (orange/yellow)			High
SAHRIS PalaeoSensitivity map - Formations of moderate and unknown sensitivity (green/white)			Medium
SAHRIS PalaeoSensitivity map - Formations of low and insignificant sensitivity (blue)			Low
Palaeontological Substrate and Heritage Resources: High Sensitivity Areas: • ADELAIDE • ASBESTOS HILLS • BOEGOEBERG DAM • BOTHAVILLE • KOEGAS • KUIBIS • MATSAP • MOLTENO • PRINCE ALBERT • SCHMIDTSDRIF • SCHWARZRAND • STALHOEK • SULTANAOORD • TARKASTAD	Geology – Known to potentially have Palaeontological features from previous assessments Council for Geosciences, 2014	As extracted from geology layer	High

[5] It is understood that World Heritage Sites are managed by the DEA and not SAHRA, except, when a National Heritage Site has been declared a World Heritage Site, in which case both entities are responsible for the co-ordination of the management of these sites.

<table>
<tr><th colspan="3">Sensitivity Feature</th><th>Data Source and Date of Publications</th><th>Data Preparation and Processing</th><th>Sensitivity</th></tr>
<tr><td>• BRULSAND
• CAMPBELL RAND
• CLARENS
• DRAKENSBERG
• DWYKA
• ECCA</td><td>• RIETGAT
• ELLIOT
• ENON
• GHAAP</td><td>• VRYBURG
• WHITEHILL
• WITTEBERG
• KAMEELDOORNS</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Palaeontological Substrate and Heritage Resources: Medium Sensitivity Areas:</td><td rowspan="2">Geology – Known to potentially have Palaeontological features from previous assessments
Council for Geosciences, 2014</td><td rowspan="2">As extracted from geology layer</td><td rowspan="2">Medium</td></tr>
<tr><td>• ACHAB
• ALLANRIDGE
• BIDOUW
• BREDASDORP
• CERES
• CONCORDIA GRANITE
• DWYKA
• FORT BROWN
• GESELSKAPBANK
• GLADKOP
• GRAHAMSTOWN
• HARTEBEEST PAN
• GRANITE</td><td>• KOOKFONTEIN
• KORRIDOR
• MESKLIP GNEISS
• MODDERFONTEIN
• GRANITE/GNEISS
• NAAB
• NABABEEP GNEISS
• HOOGOOR
• KALAHARI
• KAMIESKROON GNEISS
• KAROO DOLERITE
• KHURISBERG
• KONKYP GNEISS</td><td>• NAKANAS
• NARDOUW
• NUWEFONTEIN
• GRANITE
• RIETBERG GRANITE
• SKOORSTEENBERG
• STINKFONTEIN
• STYGER KRAAL
• SYENITE
• TABLE MOUNTAIN
• TIERBERG
• VOLKSRUST
• WATERFORD</td></tr>
</table>



Map 5: Heritage (including palaeontology) sensitivity map for EGI Development in the Expanded Western and Eastern EGI Corridor (Data Sources: Council for Geosciences, 2014; SAHRA, 2018; and DEA (SAPAD), 2017).

4.2.8.5 Interpretation of Sensitivity Maps

The four-tier sensitivity map (Map 5) identified the presence of known heritage resources and the areas in which the likelihood of longer and more expensive HIAs involving mitigation of heritage resources is higher. It should be noted that a HIA is required when it is anticipated that there will be impacts on significant heritage resources for a particular development proposal. With regards to EGI, applications for the development of 132 kV and larger power lines will require a HIA; and depending on the findings of the HIA, further monitoring of the ground clearance and pylon excavations (by a specialist) will be required. Smaller power lines will be assessed on a case-by-case basis. Given the large size of South Africa, most HIAs incorporate a heritage survey but the two activities are not necessarily synonymous. All HIAs must include a field based survey in line with the requirements of Section 38 (3) of NHRA. A Heritage Scoping Assessment Report or Heritage Desktop Assessment may or may not contain a field survey. The four-tier sensitivity map does not account for areas already thoroughly surveyed (either through research or during HIAs). Depending on the development proposal, a HIA may or may not be required in these areas (DEA, 2016). It is understood that all development proposals that undergo a NEMA Environmental Authorisation Process will require an assessment of the impacts to heritage resources is undertaken (i.e. Section 24 (4) (b) (ii) of NEMA and Section 38 (8) of the NHRA). Here below is a short summary of the explanation of the combined four-tier sensitivity map.

Table 5: Interpretation of Heritage Sensitivity Maps

Sensitivity Class	Interpretation	Implementation and additional assessments at project level (*)	Permit requirements (if any)
Very High	This category includes • Grade I and II Heritage sites; • World, National and Provincial Heritage Sites with their related buffer zones, i.e. a buffer zone of 2 km and 1 km implemented around these sites respectively. World Heritage Sites have their own defined buffer zones; • The proposed site is located on areas of Very High sensitivity as indicated by the SAHRIS palaeontological sensitivity map (red areas). These areas are formally protected areas under the NHRA and the World Heritage Convention Act (Act No. 49 of 1999) and should be avoided.	Areas of very high sensitivity are areas which are formally protected under the NHRA and the World Heritage Convention. An Archaeological/Palaeontological Impact Assessment must be undertaken within these areas and their prescribed buffer zones. Areas of very high palaeosensitivity require a PIA during the design phase, inclusive of a field assessment.	Permit required under Section 27 of NHRA from: • SAHRA for any possible impact on Grade I National Heritage Sites; and • PHRAs for impact on Grade II Provincial Heritage Sites. Additional permit from the Management Authority of the Fossil Hominid Sites of South Africa. Additional permit from SANParks, where required.
High	High sensitivity represents areas which are or have the potential to be highly sensitive in terms of heritage resources because either:	A general avoidance strategy should be taken but mitigation might be allowed under certain circumstances if avoidance is not possible.	Note no permits are required for surveys.

Sensitivity Class	Interpretation	Implementation and additional assessments at project level (*)	Permit requirements (if any)
	• Previous assessment of the area has identified palaeontological/archaeological heritage resources which are classified as being of high significance; or • The proposed site is located on areas of High sensitivity as indicated by the SAHRIS palaeontological sensitivity map (orange/yellow areas); or • There is a high probability of encountering a significant heritage resource; or • There is the potential to include cultural heritage resources which will require conservation or lengthy mitigation.	It is expected that HIAs or PIAs will then be required for proposed developments in these areas and that some sites may be identified which will require mitigation, thereby increasing costs and lengthening the timeframes of the applications. PIA: Desktop study during design phase and walk through sensitive areas of selected route and report before excavation activities (by respective specialist).	For sites of significance identified during future surveys, permits under Section 35 of the NHRA will normally be required from the relevant heritage authority if impacts are envisaged[6].
	Sites of high significance: IIIa sites with 150m buffer zone.		For significant sites already recorded or identified during future surveys, permits will normally be required from the relevant heritage authority if impacts are envisaged.
Medium	Medium sensitivity represents areas which are, or have the potential to be, sensitive to development in terms of heritage resources because either: • Previous assessment of the area has identified heritage resources which are considered to be of medium significance; or • The proposed site is located on areas of moderate and unknown sensitivity in the SAHRIS palaeontological sensitivity map (green/white areas); or • There is a moderate probability of encountering	It is expected that HIA/PIA will be required for proposed developments in these areas and that some sites may be identified which will require mitigation, thereby increasing costs and lengthening the timeframes of the applications. However, such sites are expected to be less sensitive or extensive than in high sensitivity areas. Areas of moderate and unknown palaeontological sensitivity will require desktop studies during the design phase.	Note no permits are required for surveys. For sites of significance identified during future surveys, permits under Section 35 of the NHRA will normally be required from the relevant heritage authority if impacts are envisaged.

[6] See previous footnote about HWC's process for handling the permitting process under Section 38 of the NHRA. Note that Heritage Western Cape currently does not require 'permits' for generally protected heritage resources under the NHRA when developments trigger Section 38 of the NHRA. Instead, a work plan is required which is very similar to a permitting process.

Sensitivity Class	Interpretation	Implementation and additional assessments at project level (*)	Permit requirements (if any)
	significant heritage resources.		
	Sites of medium significance: IIIb sites with 100m buffer zone.		For significant sites already recorded or identified during future surveys, permits will normally be required from the relevant heritage authority if impacts are envisaged.
Low	Low sensitivity represents areas which are not likely to be sensitive to development in terms of heritage resources because either: • Previous assessment has revealed the area to contain no resources or resources of low significance; or • The proposed site is located on formations of low sensitivity in the SAHRIS palaeontological sensitivity map (blue areas); or • There is a low probability of encountering significant heritage resources.	For sites known to contain no resources, no further assessment is necessary for the proposed development in these areas. In areas where there is a low chance of finding heritage material of significance (the majority of the lowlands and areas already fully assessed), a HIA is required but it is expected that no material of significance requiring extensive mitigation will be identified. In areas of low palaeontological sensitivity, a palaeontological chance find procedure should be requested to be included in the EMPr and reviewed by a specialist.	For sites of significance identified during future surveys, permits will normally be required from the relevant heritage authority if impacts are envisaged.
	Sites of low significance: IIIc sites with 50 m buffer zone.	Where Grade IIIc sites occur, and these sites have generally been recorded sufficiently and are of low significance – no further mitigation is normally required for these sites.	No permit is required for development to proceed in these areas.

(*) NOTE: Motivating for exemption from a PIA/HIA - A PIA/HIA may not be required if such motivation is included in the initial notification prepared by a competent heritage specialist. In order to motivate for a PIA/HIA not to be required the inputs from a heritage specialist is required as part of the notification. Site visits to inform the notification may also be necessary to motivate for a PIA/HIA not to be required, and are up to the discretion of the specialist providing input to the notification. In most cases, it will be sufficient for only the heritage specialist preparing the notification to visit the site before an exemption from further assessment can be motivated. If exemption from further assessment is motivated, the notification must contain proposed mitigation measures for inclusion in the EMPr.

4.2.8.6 Conclusions and General Recommendations

The following general recommendations for the management of heritage resources have been identified, and additional detail will be provided in the EMPr:

- In general, important heritage sites that are small in spatial extent need to be protected through implementation of buffers, as noted above.

- Where significant heritage resources are known to occur or have been identified in an HIA, Environmental Control Officers (ECOs) will need to be appointed and need to be trained by an archaeologist or palaeontologist, depending on the nature of the finds, to identify any sub-surface heritage resources during construction, in order to prevent loss of highly significant palaeontological, archaeological and palaeoanthropological resources.

- Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance. Monitoring of excavations, especially in highly sensitive fossil areas, will prevent loss of data and greatly contribute to the scientific understanding of these heritage resources.

- In general, following the routes of existing power lines will reduce cultural landscape impacts to a degree (however the findings of all relevant specialist studies need to be taken into consideration in order to determine if potential cumulative impacts are acceptable).

- Shell middens and artefact scatters have scientific value and should be avoided during pylon and road construction. Rock art sites, historic farmhouse complexes, and built environment and historic sites are much more visually sensitive and should be buffered. Such buffering will ensure protection of the sites and their contexts.

- Structures older than 60 years and not located in formal towns, such as farmsteads and the trees surrounding farm houses, and the surrounding homesteads are an integral part of the South Africa's colonial rural landscape. These historical landscapes will also require assessment and possible buffering.

- Identify, demarcate and prevent impact to all known sensitive heritage features on site.

- All work must cease immediately, if any human remains and/or other archaeological, palaeontological and historical material are uncovered. Such material, if exposed, must be reported to the nearest museum, archaeologist/ palaeontologist (or the South African Police Services), so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to remove/collect such material before development recommences.

- During the construction phase, consultation with affected and surrounding communities will be important in terms of grave finds and management of heritage sites. It is also important to consult with affected communities during the planning stage to identify the location of any informal burial grounds. In this regard, preliminary consultation with the affected communities regarding any heritage resource close to and within the power line servitude must be undertaken and included in the HIA.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.9

Climate Change

CONTENTS

TABLES

FIGURES

ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
EGI	Electricity Grid Infrastructure
FHI	Flood Hazard Index
IPCC	Intergovernmental Panel on Climate Change
MSL	Mean Sea Level
NCA	National Coastal Assessment
RCP	Representative Concentration Pathways
SLR	Sea Level Rise
WMO	World Meteorological Organisation

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.9 Climate Change

4.2.9.1 Introduction and Scope

It is estimated that devastating impacts of weather-induced natural hazards – such as flooding, heatwaves, droughts, coastal flooding, wildfires and storms – will continue intensifying. According to the Intergovernmental Panel on Climate Change (IPCC) (2007), climate change will cause low-lying coastal areas to be inundated, thereby resulting in potential impacts on coastal infrastructure (Boko et al., 2007 in Council for Scientific and Industrial Research (CSIR), 2011). Satellite data indicates that the sea level rise from 1993 to 2006 was 3.3±0.4 mm per year (Theron, 2011 in CSIR, 2011). It is predicted that even with the stabilisation of greenhouse gas concentrations, sea level rise will continue to occur (IPPC, 2007 in CSIR, 2011).

When considering the development of linear infrastructure, it is important to understand the impact of climate change on the intensity and magnitude of these hazards, as this may ultimately affect the location and the design of such infrastructure. From an operational perspective, a drier climate is generally not a concern for Electricity Grid Infrastructure (EGI). However, if the climate gets wetter, stability issues may prevail; requiring additional design measures, such as reinforcement of pylon bases, to address the constraint. If the air temperature increases or decreases within a few degrees Celsius (and not in the extreme), it is unlikely that this will be a concern for the EGI. As noted in Part 3 of the EGI Expansion SEA Report, areas with a high incidence for lightning strikes; fire; wind; flooding; and snow conditions have been identified as engineering constraints. Should EGI be constructed within these high incidence areas, additional reinforcement of the cables and/or pylon structures would be required to address these constraints. In the case of fires, additional cost would be required to ensure that the power line is raised to a sufficient height in order to prevent the risk of damage or trips as a result of potential fires.

This section is essentially based on information extracted from the Green Book compiled by the CSIR between 2016 and 2019 (CSIR, 2019). The Green Book seeks to "*facilitate the integration of climate change adaptation into local government planning instruments and processes, in support of the development of climate resilient cities and settlements*". As such, a number of projects were undertaken to investigate the anticipated impact that a changing climate and growing urban population will have on the settlements and key resources of South Africa.

While it is acknowledged that the Green Book's main function is to assist local municipalities in integrating climate change adaptation measures into their planning processes; for the purpose of this study, information from the online tool is used to identify high risks areas in terms of extreme rainfall events, inland flooding, coastal flooding, and fire risks when developing EGI. This information is therefore only to be used as a guideline for the identification of high risks areas. Projections on drought have been included in Appendix A of this chapter for information purposes only.

Climate change projections are usually evaluated under four different mitigation scenarios (known as the Representative Concentration Pathways (RCP)). The projections presented in the Green Book are for the following two mitigation scenarios, namely:

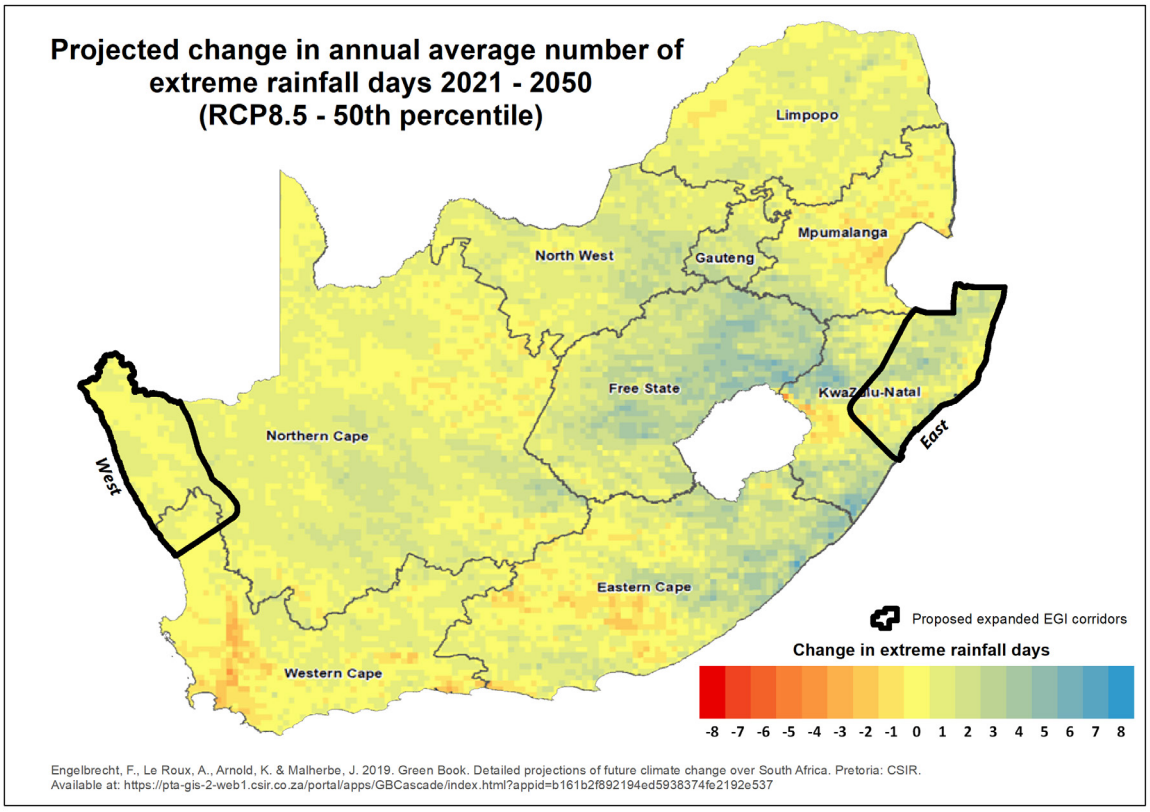
- RCP 8.5 – where low mitigation is implemented (worst case scenario); and
- RCP 4.5 – where high mitigation is implemented.

The following sections depict the projected change in the magnitude of the hazards identified above in relation to the location of the proposed Expanded EGI corridors.

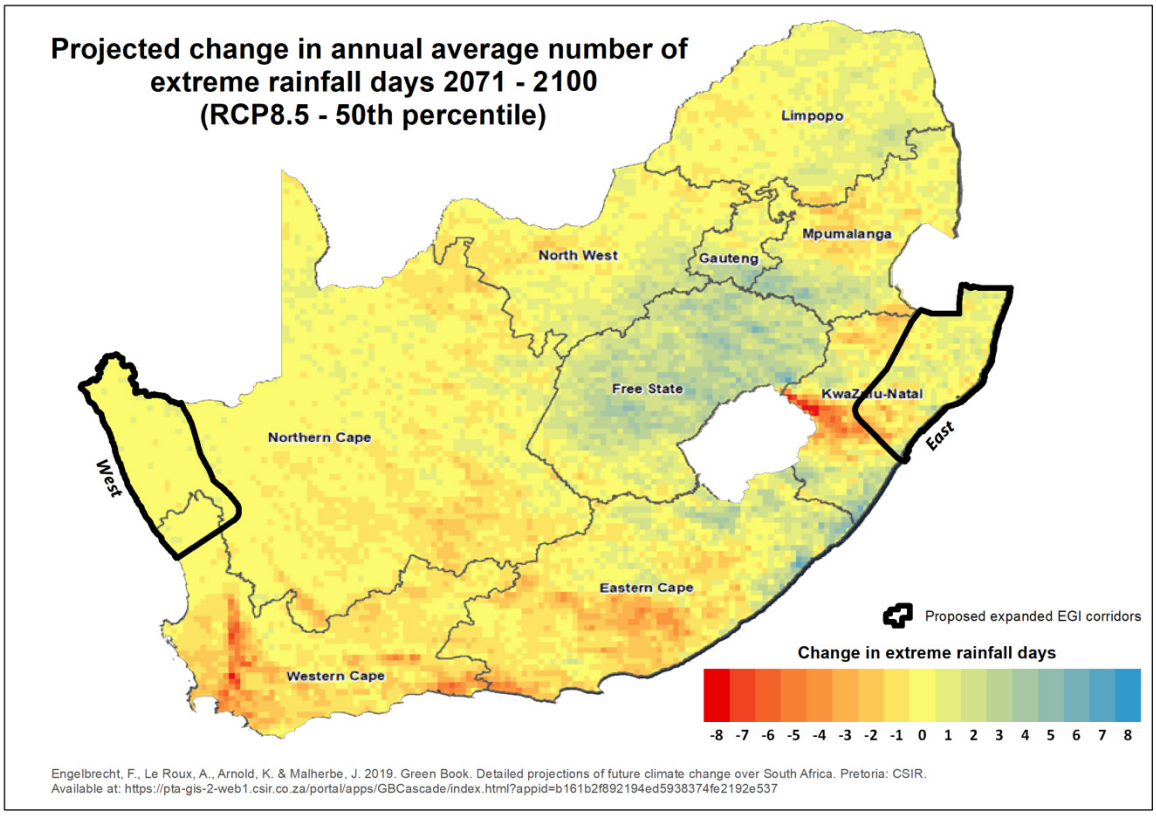
4.2.9.2 Extreme rainfall days

The following section is extracted from the Green Book (Engelbrecht et al., 2019).

Figures 1a and b show the projected change in the annual average of extreme rainfall days by 2050 and 2100 respectively, under an RCP 8.5 low mitigation (worst case) scenario (Engelbrecht et al., 2019). An extreme rainfall event (including severe thunderstorms and lightning) is defined as 20 mm of rain occurring within 24 hours over an area of 64 square kilometres (Engelbrecht et al., 2019). A value above 1 shows an increase in the annual average of extreme rainfall days. Most of the country shows some level of increase in extreme rainfall days, while some provinces (in particular Western Cape, Eastern Cape and Mpumalanga) are anticipated to experience a decrease in extreme rainfall days in some areas. There is however a general tendency towards a decrease in the annual average of extreme rainfall days for most provinces (with the exception of the Free State and Gauteng, and its surroundings) by 2100 (Figure 1b).



a)



b)

Figure 1: Projected change in annual average number of extreme rainfall days (50th percentile[1]): 2021-2050 (a) and 2071-2100 (b).

Based on Figure 1 above, the following can be established:

- The Expanded Eastern and Western EGI Corridors will experience a slight increase in annual average number of extreme rainfall days in the short term (2021-2050);
- There are extremely small areas in the Expanded Eastern EGI Corridor that are expected to experience a decrease in annual average number of extreme rainfall days until 2050; and
- Some areas in the Expanded Eastern EGI Corridor will experience a decrease in the annual average of extreme rainfall days in the long-term (2071-2100).

4.2.9.3 Floods

The following section is extracted from the Green Book (Le Maitre et al., 2019).

Inland flooding, caused by surface water, consists of flash flooding as well as river and groundwater flooding. Le Maitre et al. (2019) developed a Flood Hazard Index (FHI) based on the catchment characteristics and design rainfall, and averaged at the quinary catchment level. As depicted on Figure 2, the FHI at a national level is rated as medium for the majority of the country. Namaqualand, the Kalahari, parts of the Karoo, the Limpopo valley and the Zululand coast have been shown to display low to very low FHI, while some areas in KwaZulu-Natal and the Eastern Cape display a very high FHI.

[1] 50th percentile: A percentile is a statistical measure to indicate the value below which a given percentage of observations in a group of observations falls. For example, the 50th percentile is the value below which 50% of the observations fall.

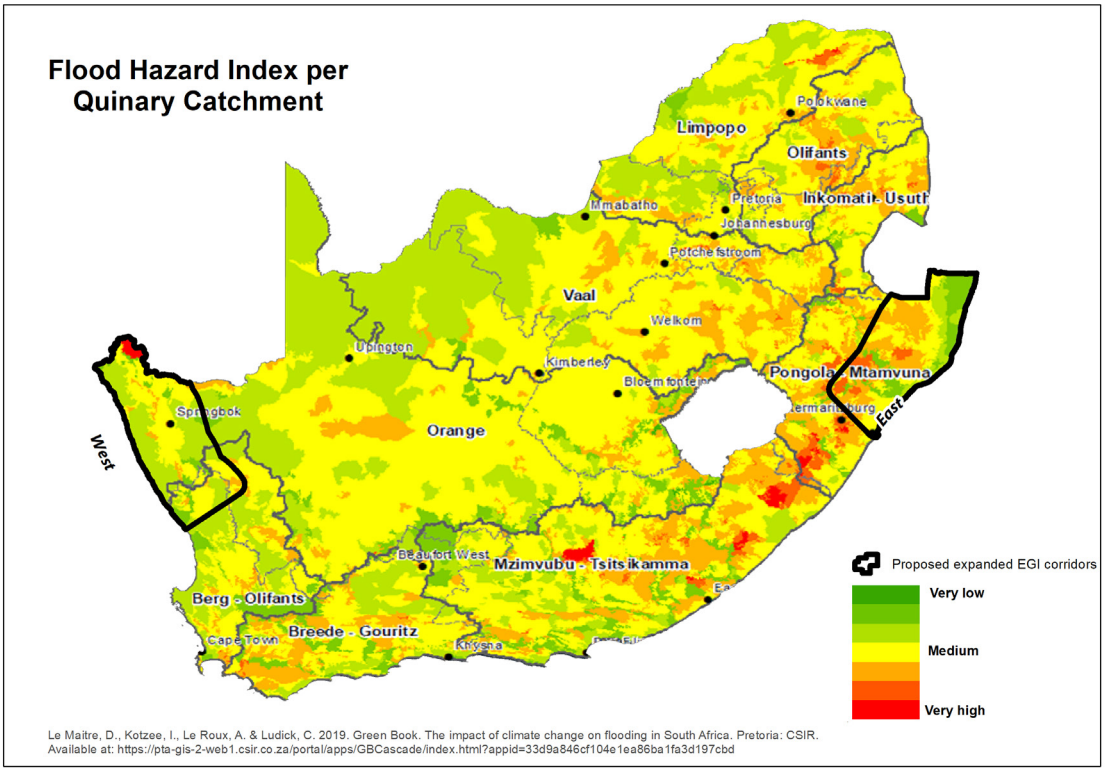


Figure 2: Mean Flood Hazard Index per Quinary Catchment in relation to the Expanded EGI corridors (Le Maitre et al.; 2019).

It must be noted that this flooding assessment only provides an overview of relative flood hazards and risks for a range of settlements in South Africa and a more detailed assessment will be required at project level once a specific route has been identified.

4.2.9.4 Coastal Flooding

The following section is extracted from the National Coastal Assessment Draft Report (CSIR, 2018).

Coastlines are expected to be influenced by climate change in a number of different impacts. Sea level rise will cause flooding of low-lying coastal areas, especially where there are no structures in place for protection of these areas (IPCC-5, 2013). Storm surges and wave run up will also influence coastal flooding as a result of increased storm frequency and intensity for parts of the South African coast. In addition, more intense wave action is expected to have a greater impact on coastal sediment dynamics, which is likely to lead to increased rates of coastal erosion (and local sedimentation) (Lück-Vogel et al., 2019).

Coastal flooding and erosion are, while not the only threats, the most significant abiotic threats to coastal environments. An estimation of the physical coastal vulnerability (combining flood and erosion risks) was determined as part of the National Coastal Assessment (NCA) undertaken by the CSIR in 2018. Table 1 lists the parameters that were used to determine coastal flood risks and erosion risks. Risks were classified in five risk classes ranging from 1 (very low) to 5 (very high).

Note 1: Quantified wave run-up (including storm related wave run-up and other extreme inshore water level components) were omitted from the flood risk analysis due to the lack of suitable data at higher resolution.

Table 1: Parameters used for flood, erosion and comprehensive physical hazard risk analysis. Source: NCA (CSIR, 2018).

	Aspect	Input Parameter	Details
Physical hazard risk assessment	Flood risk	Elevation (topography)	Risk classes based on LiDAR and SUDEM data.
		Distance to coast	Euclidian distance calculated from National_Coast_Types shape file, and reclassified into risk classes.
	Erosion risk	Geomorphology	Risk classes based on coast attributes in National_Coast_Types.shp, which were then projected inland.
		Ground Cover	Risk classes based on SA Land Cover 2013-14 data.
		Bathy slope	Parameter calculated based on Bruun's rule using nautical chart contours (slopes) as proxy for SLR vulnerability, which were then projected to the nearshore inland and classified into risk classes.
		Coastal protective structures	Structures digitised from Google Earth, projected inland and classified into risk classes.
		Foredune volume	Calculated from LiDAR and SUDEM data and highest astronomical tide (HAT, as base level) per province, and classified into risk classes.

Note 2: Flooding through extreme water levels in the hinterland, e.g. through excessive rainfall and river flooding were not assessed at this stage, not were the potential flood risks through Tsunamis, land subsidence or landslides.

Tables 2 and 3 illustrate the risk classes used for elevation above sea level and distance from the coast respectively.

Table 2: Hazard risk categories for elevation above sea level

	Hazard Risk				
	Very low	Low	Medium	High	Very high
	1	2	3	4	5
Elevation (above MSL)	**>20 – 30 m**	**>10 – 20 m**	**>5 – 10 m**	**>3 – 5 m**	**0 – 3 m**

Accepted sea level rise (SLR) scenarios provided by IPCC-5 (2013) show an expected rise between 0.55 and 1.2 m globally by 2100. The areas expected to be affected by SLR are therefore located in the "very high" risk class. In the final flood hazard class, SLR affected areas could be occurring in the very high to medium risk class.

Table 3: Hazard risk categories for distance from coast

	Hazard Risk				
	Very low	Low	Medium	High	Very high
	1	2	3	4	5
Distance from coast	**>1,000 m**	**>200 – 1,000 m**	**>50 – 200 m**	**>20 – 50 m**	**0 – 20 m**

Based on Tables 2 and 3, it is assumed that areas higher than 10 m above Mean Sea Level and further than 200 m from the coast are generally safe (low risks) from ocean-borne flooding.

An example of coastal flooding risk for Strand (False Bay, Cape Town) is depicted in Figure 3a.

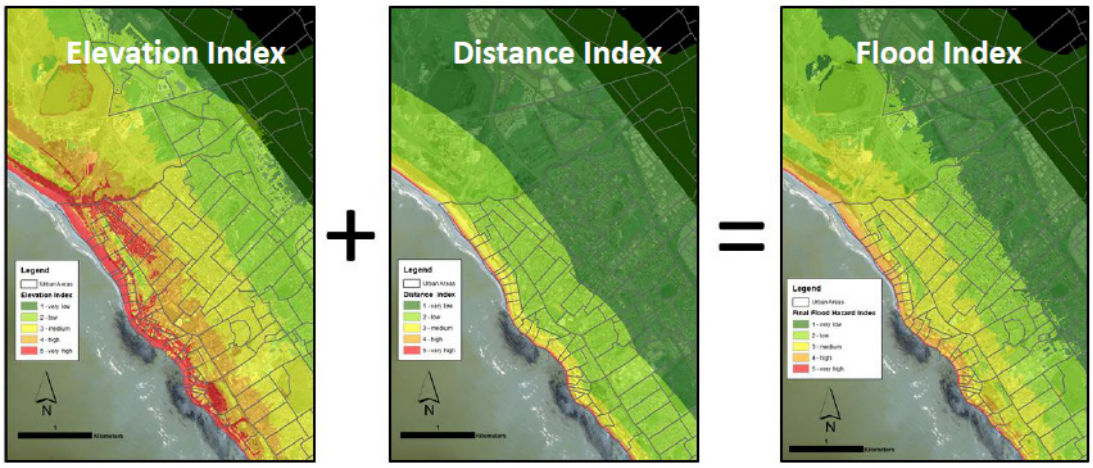


Figure 3a: Final flood risk index for Strand (False Bay, Cape Town). Source: NCA (CSIR, 2018).

The physical coastal vulnerability of an area is based on the coastal flooding risk and erosion risks. An example of physical coastal vulnerability risk for Strand (False Bay, Cape Town) is depicted in Figure 3b.

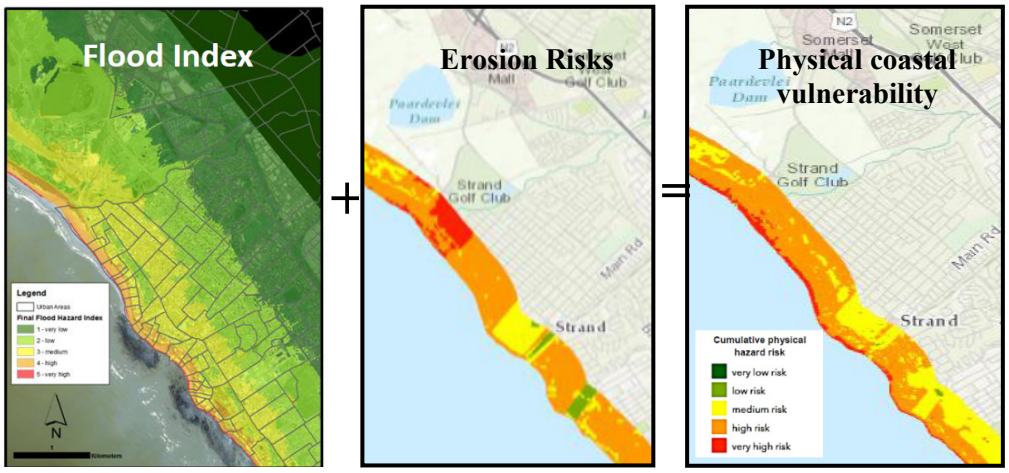


Figure 3b: Physical coastal vulnerability risk for Strand (False Bay, Cape Town). Source: NCA (CSIR, 2018).

From an engineering constraints perspective, it is understood that the atmosphere in coastal regions have polluting and corrosive properties, and therefore power lines to be placed in such areas would need to be reinforced with an engineering solution (such as painting the pylons etc.) to reduce the probability of corrosion of the infrastructure. The power line in these areas would also require increased insulation to mitigate against pollution related line faults. The final Expanded EGI Corridors considered in this study have been set back by a minimum of 10 km from the coast due to engineering constraints. Therefore, it is not expected that the final corridors would be exposed to coastal flooding or coastal erosion.

4.2.9.5 Fire Risks

The number of high fire danger days (Figure 4) is relatively low in most parts of the country (including the Expanded Eastern EGI Corridor), with the exception of the arid north-western parts of South Africa which depicts a very high number of high fire danger days (between 140 and 220 days), which includes part of the Expanded Western EGI Corridor.

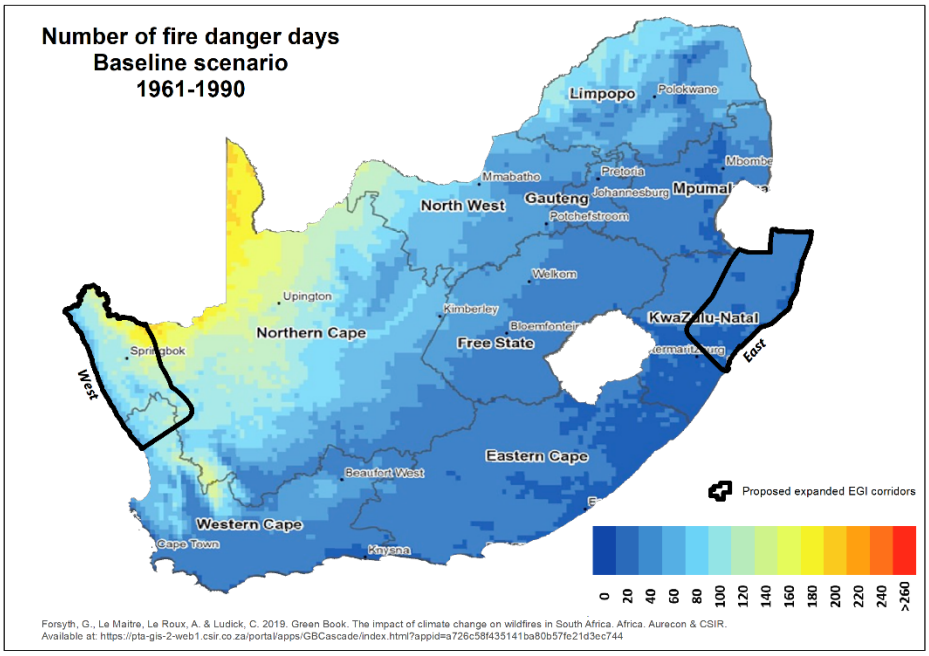


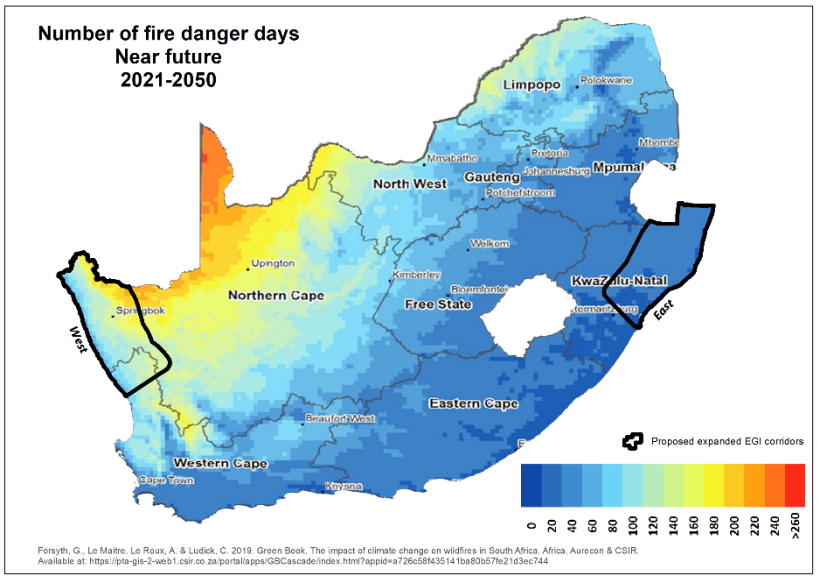
Figure 4: Number of high fire danger days - Baseline scenario (1961-1990)

It must however be noted that these calculations are based just on the climatic conditions and do not take the availability of fuel into account. For example, as shown in Table 4 below, most of the Northern Cape is covered by Karoo shrublands, which almost never experience fires. In contrast, there is a strip extending from the northern part of the Northern Cape through to Limpopo, that experienced 50 to 100 high fire danger days. This section comprises arid woodland and sweet grassland where fires can occur after growing seasons that have higher than normal rainfall. Sweet grassland and arid woodland require high rainfall to produce sufficient grass fuel for fires but when they do accumulate fuels, the fires can be extensive and the authorities need to be prepared for such fires. Sour grassland and moist woodland are areas where fires can occur annually and the grasses require fires every 2 to 5 years to regenerate themselves (Forsyth et al., 2019).

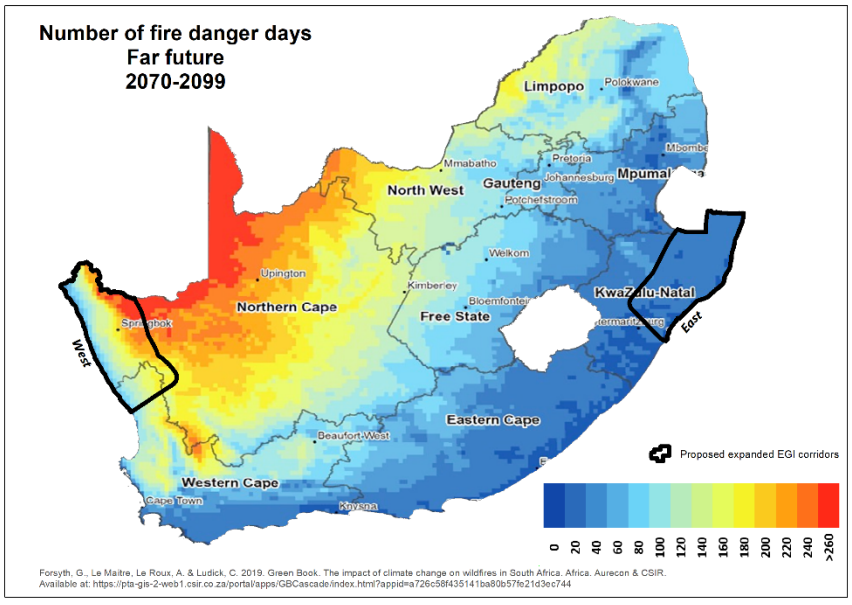
Table 4: Fire ecotype

Fire Ecotype	Fire sensitivity (values in the table are percentages of the column total)		
	Fire dependent	Fire independent	Fire sensitive
Arid Woodland	19.69%	0%	0%
Coastal Grassland	4.46%	0%	0%
Fynbos	11.14%	0%	0%
Moist Woodland	20.21%	0%	0%
Renosterveld	3.94%	0%	0%
Sparse Arid Woodland	0.3%	0%	0%
Sour Grassland	27.71%	0%	0%
Sweet Grassland	12.56%	0%	0%
Thicket	0%	35.43%	0%
Nama Karoo	0%	37.22%	0%
Succulent Karoo	0%	27.35%	0%
Grassy Nama Karoo	0%	0%	80.77%
Forest	0%	0%	19.23%
Water bodies	0%	0%	0%
Total number	**1346**	**223**	**26**

The projections for both the near future and the far future show a southward and eastward expansion of the occurrence of >25 high fire danger days per year and a contraction in the areas experiencing 0-25 days per year (Figure 5). There is also a large increase between the near and far future, which emphasises the importance of effective action to mitigate climate change. The most marked shifts in the future are projected to be in the Free State, Western and Eastern Cape, North West and Limpopo provinces, including the **Expanded Western EGI Corridor**.



a)



b)

Figure 5: Number of high fire danger days – a) Near future (2021-2050) and b) Far future (2070-2099)

4.2.9.6 Conclusion

Given the above and an increase population pressure on coastal urban areas (see urban projections in the Green Book, Le Roux et al. 2018), coastal development and management will have to be particularly aware of the hazards and potential risks arising therefrom.

The information presented above, as provided by the Green Book (CSIR, 2019) are based on all the assumptions noted in the tool. It is assumed that municipalities will use the Adaptation Actions Tool to adapt to the impacts of climate change, reduce exposure to hazards, and exploit opportunities for

sustainable development (CSIR, 2019). Such measures fall within the mandate of the municipality, and as such, the related climate change adaptation and hazard reduction requirements for potential EGI developments will be discussed with the project developer and affected municipalities on a project specific basis.

Therefore, it is important that during the project specific stage, the project developers consider climate change models developed at the time in order to plan for the infrastructure correctly.

4.2.9.7 References

Beraki, A.F., Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate change on drought. Pretoria: CSIR.Available at:*
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=a4f13438a8c04f45a5408ef646792a8b

Council for Scientific and Industrial Research (CSIR) (2011). Climate Risk and Vulnerability: A Handbook for Southern Africa. Council for Scientific and Industrial Research, Pretoria, South Africa, pp 92.

CSIR. 2019. *Green Book: Adapting South African settlements to climate change.* Available at: www.greenbook.co.za

Engelbrecht, F., Le Roux, A., Arnold, K. & Malherbe, J. 2019. *Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at:*
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537

Forsyth, G., Le Maitre, Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate change on wildfires in South Africa. Africa. Aurecon & CSIR.*
Available at:
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=a726c58f435141ba80b57fe21d3ec744

Intergovernmental Panel on Climate Change (IPCC) (2007). Climate Change 2007: Synthesis Report. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC-5 (2013): Church, J.A., P.U. Clark, A. Cazenave, J.M. Gregory, S. Jevrejeva, A. Levermann, M.A. Merrifield, G.A. Milne, R.S. Nerem, P.D. Nunn, A.J. Payne, W.T. Pfeffer, D. Stammer and A.S. Unnikrishnan, 2013: Sea level change. In: Climate change 2013: The physical science basis. Contribution of Working group I to the Fifth assessment report of the intergovernmental panel on climate change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.k. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge Press, Cambridge, United Kingdom and New York, NY, USA. Accessible online at https://www.ipcc.ch/report/ar5/

Le Maitre, D., Kotzee, I., Le Roux, A. & Ludick, C. 2019. Green Book. The impact of climate change on flooding in South Africa. Pretoria: CSIR. Available at:
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=33d9a846cf104e1ea86ba1fa3d197cbd

Le Roux A., Makhanya S., Arnold K., Mans G., van Tonder L & Wools. 2018. Green Book. Urban Projections.

Lück-Vogel, M., Le Roux, A. & Ludick, C. 2019. Green Book. The impact of climate changes on coastal zones. Pretoria.

APPENDIX A

Drought

Possible future changes in the state of drought (and flood) over South Africa under the low mitigation scenario (RCP 8.5) were estimated using the 6 climate projections in terms of SPI[2] (Beraki et al., 2019). Figures 6 a) and b) show the projected change in the drought (flood) tendency (i.e. number of cases exceeding near-normal per decade) over South Africa for the period 2015-2044 and 2035-2064 relative to the 1986-2005 baseline period. A negative value is indicative of an increase in drought tendencies per 10 years (more frequent than baseline). The annual mean was used as it represents the contribution of all the different climate regimes of South Africa (such as winter, summer and year-round rainfall regions).

According to projections, the south-western interior and parts of Limpopo are anticipated to be drier during the period of 2015-2044, which will mainly affect Expanded Western EGI Corridor. During the period of 2035-2064, a high likelihood of increased conditions of drought are projected to occur within the presence of a drastic increase in maximum temperature and very hot days (i.e. becoming even hotter and drier). The Expanded Western EGI Corridor will be mainly affected, with small portions of the Expanded Eastern EGI Corridor.

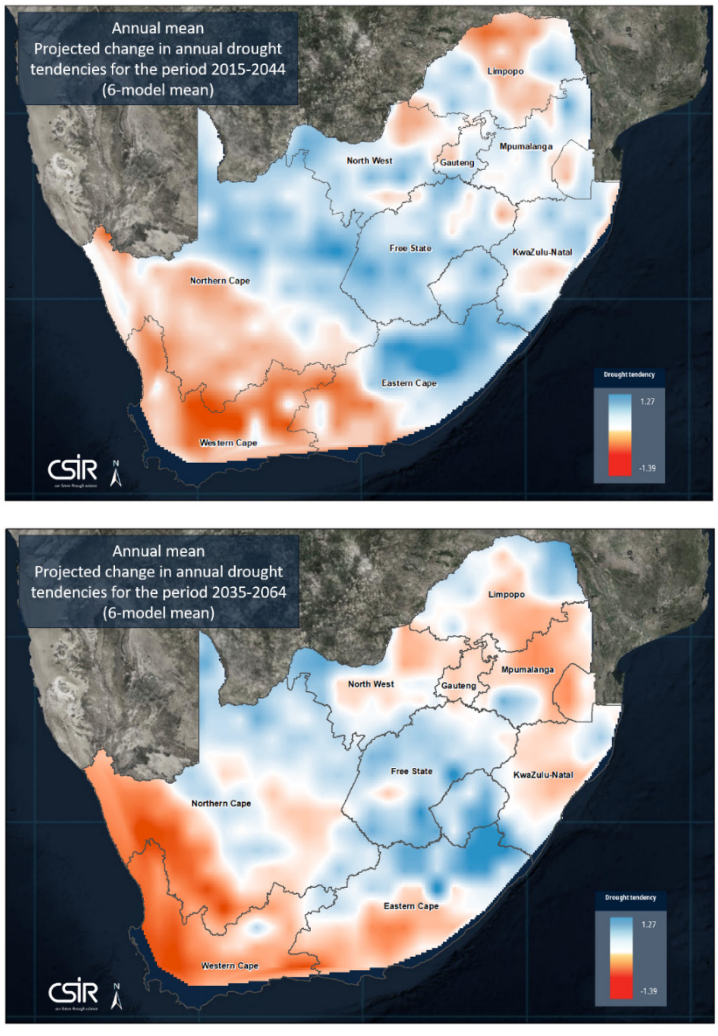


Figure 6: Projected change in annual mean drought tendency (6-model mean) for the period 2015-2044 (a) and 2035-2064 (b).

[2] SPI = Standardised Precipitation Index which is recommended by the World Meteorological Organisation (WMO) and is also acknowledged as a universal meteorological drought index by the Lincoln Declaration on Drought, to characterise the extent, severity, duration and time evolution of drought (flooding) over South Africa

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 4

Specialist Assessments

Part 4.2.10

Mining

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ABBREVIATIONS

CGS	Council for Geosciences
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
EGI	Electricity Grid Infrastructure
GDP	Gross Domestic Product
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002, as amended)
REDZ	Renewable Energy Development Zones
SEA	Strategic Environmental Assessment

PART 4. SPECIALIST ASSESSMENTS

Part 4.2.10 Mining

4.2.10.1 Introduction and Scope

This chapter covers the potential impacts of the development of Electricity Grid Infrastructure (EGI) within the proposed corridors on mining operations as well as the impact of mining on potential EGI (i.e. engineering constraint).

With access to some of the world's largest mineral reserves, the mining industry in South Africa has been, and still is, a major contributor to national economic growth and job creation (Map 1). In a media statement[1] issued on 3 September 2019, the National Department of Mineral Resources (DMR) (now operating as the Department of Minerals and Energy) noted that the mining sector increased by 14.4% and contributed 1.0% point to the Gross Domestic Product (GDP) in the second quarter, with iron ore, manganese and coal mainly contributing to the growth. Mining in South Africa is governed by the Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002, as amended). The DMR serves as the Competent Authority.

The subsequent sections of this report are predominantly based on the Mining Scoping Level Assessment undertaken as part of the 2015 Phase 1 Renewable Energy Development Zones (REDZ) Strategic Environmental Assessment (SEA) (Department of Environmental Affairs (DEA), 2015[2]), which was desktop based and focused mainly on the interpretation of existing data.

4.2.10.2 Relevant Legislation

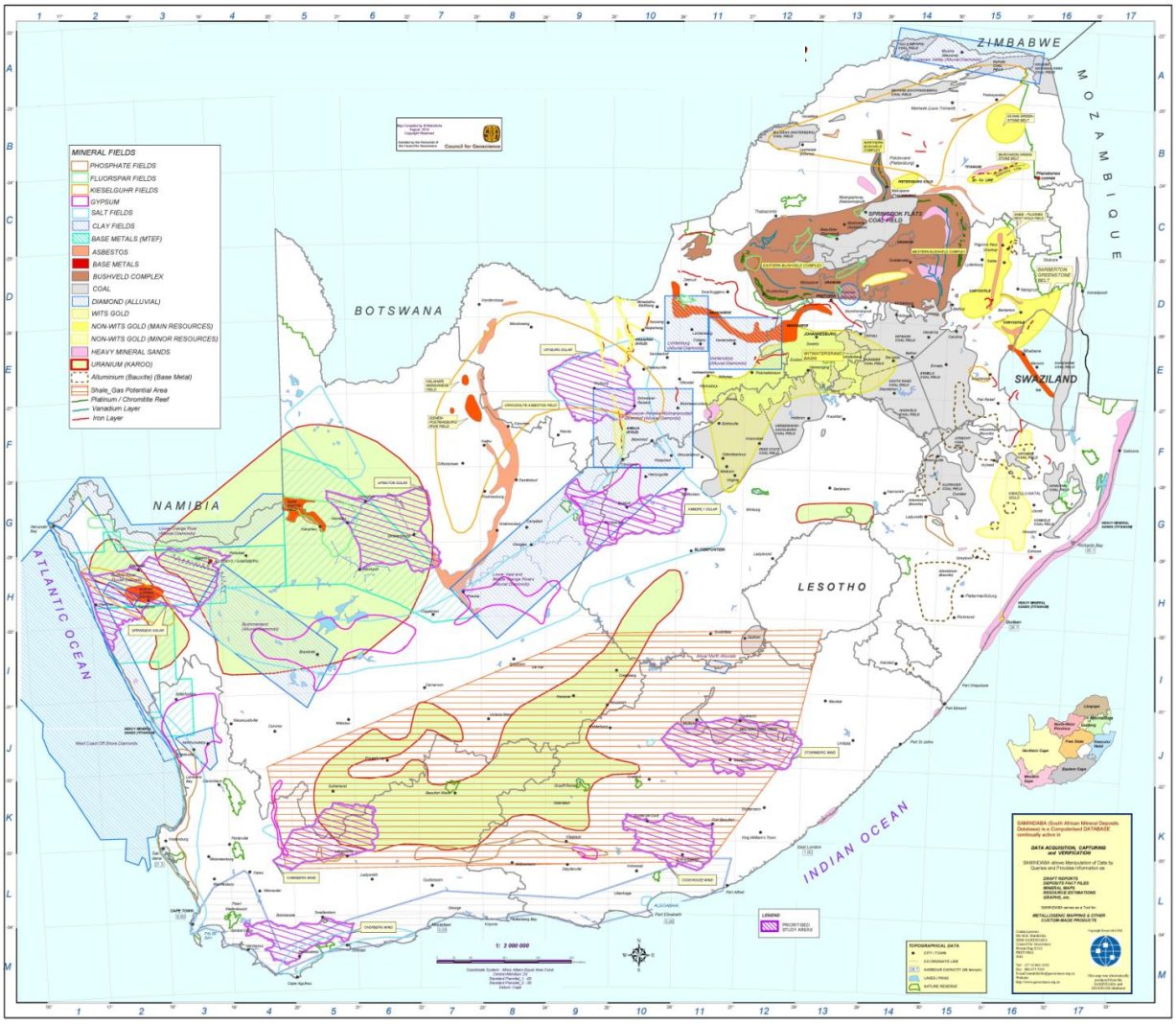
The MPRDA stipulates that mineral and petroleum resources are the common heritage of all the people of South Africa and that the State is the custodian thereof for the benefit of all South Africans. Some of the objectives of the MPRDA are to:

- recognise the internationally accepted right of the State to exercise sovereignty over all the mineral and petroleum resources within the Republic;
- promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa;
- promote economic growth from mineral and petroleum resources development in the Republic;
- provide for security of tenure in respect of prospecting, exploration, mining and production operations;
- give effect to section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development; and
- ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating.

Chapter 4 of the MPRDA deals with the regulation of minerals and the environment, and details the processes to follow for applications for reconnaissance permits, prospecting rights, mining rights, mining permits, and retention permits, as well as communications with Interested and Affected Parties. Chapter 6 of the MPRDA separately deals with petroleum exploration and production, and it makes provision for two permits (i.e. reconnaissance permits and technical co-operation permits) and two rights (exploration rights and production rights).

[1] Department of Mineral Resources, 2019. Media Statement: Mining Strongest Performer in the Second Quarter. Accessed 4 September 2019 [online]: https://www.dmr.gov.za/news-room/post/1813

[2] Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.



Map 1: Mineral and Petroleum Resource Potential Areas (Council for Geosciences (CGS), 2014)

4.2.10.3 Assumptions, Limitations and Data Sources

During the data gathering process, difficulties were experienced in sourcing, accessing, and interpreting datasets on mining. To ensure data processing accuracy and a true allocation of constraint levels, the location of existing mines and their status in terms of whether they are active, dormant or abandoned was imperative. The assumptions and limitations applicable to this study are listed in Table 1.

Table 1: Assumptions and Limitations to the Mining Study

Limitation	Included in the Scope of this Study	Excluded from the Scope of this Study	Assumption
Resource availability	Only existing, published datasets used with limited desktop verification	Field verification of datasets and outcomes, and extensive local and authority expert consultation	Reasonable accuracy of the data layers used, and a detailed desktop assessment was undertaken to refine the datasets used using ArcGIS 10.4. Field verification and interaction with the Competent Authorities (i.e. DMR) will take place on a site-by-site basis prior to development.

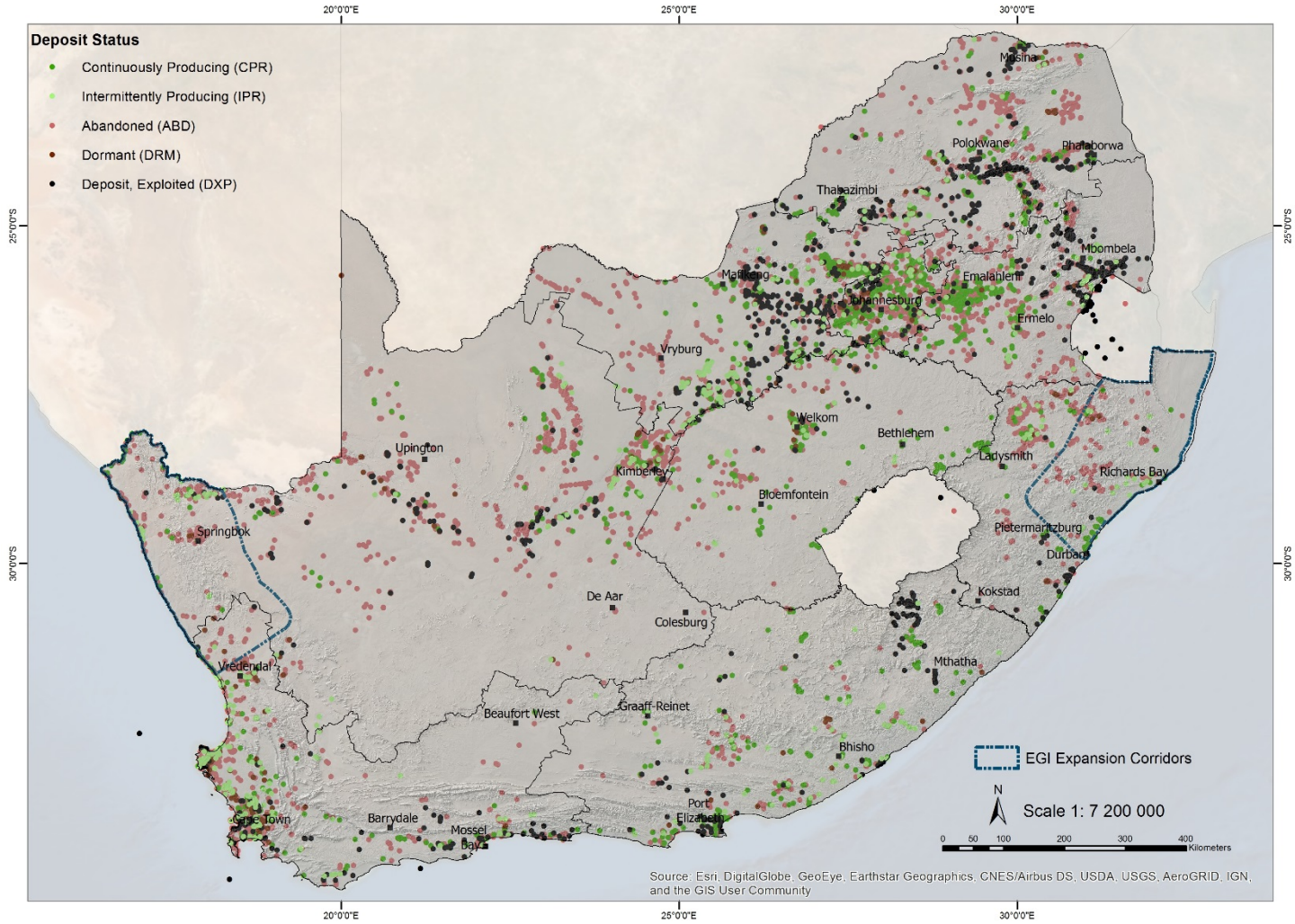
The list of data used for the Mining Study as part of the EGI Expansion SEA is indicated in Table 2.

Table 2: Mining Data used in the EGI Expansion SEA as part of the Engineering Constraints Analysis

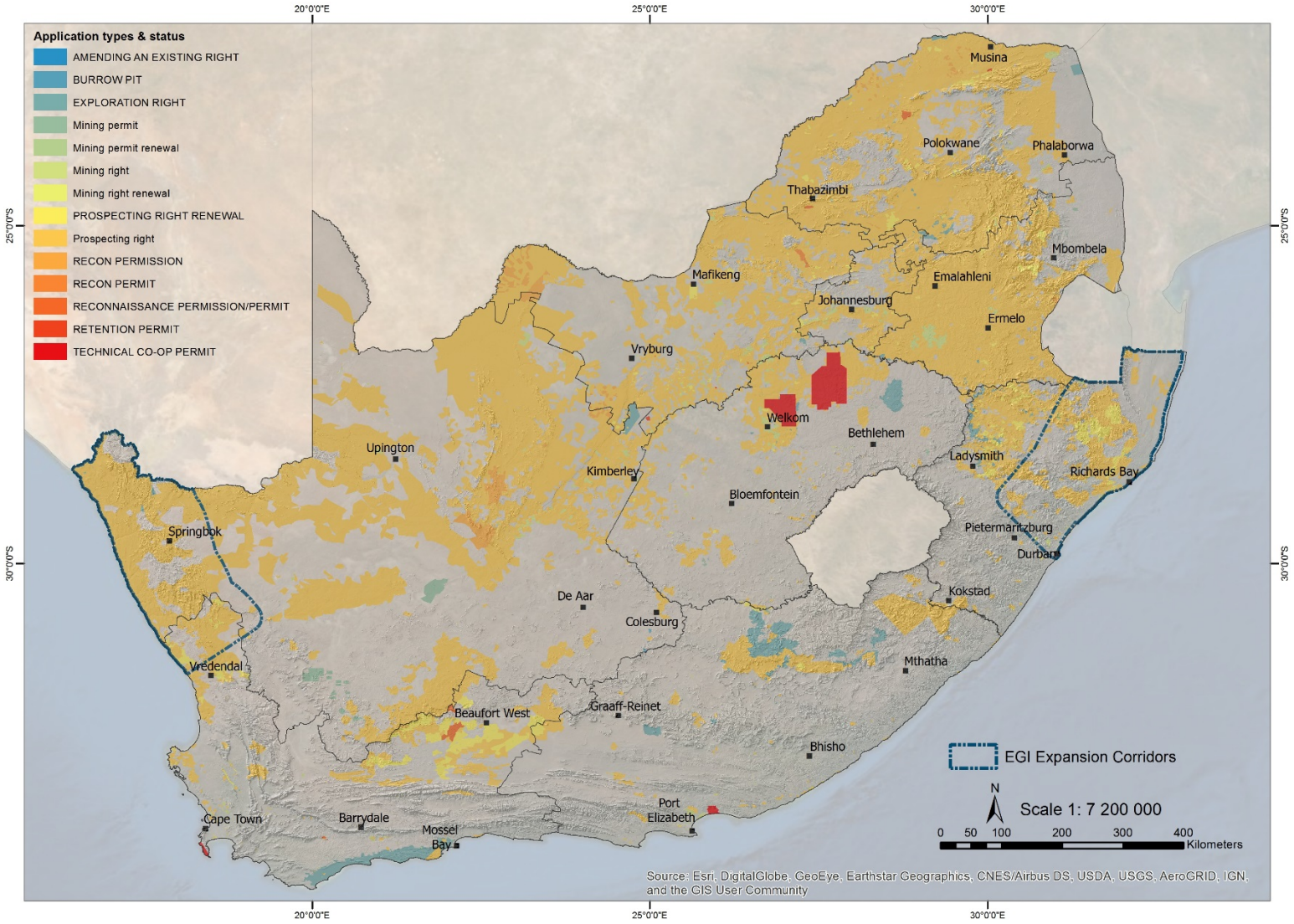
Dataset	Source and Date of Publication	Data Description	Data Preparation and Processing
Mineral Data: Active and Abandoned Mines in South Africa	CGS (Sourced directly by the DEA), 2012	The data delineates active and abandoned mines in point format per point locality. This includes all mineral commodities and range from small quarries and diggings to large open cast and underground mines, as well as shafts, adits, etc. The dataset includes: ▪ Mine, Continuously Producing; ▪ Mine, Intermittently Producing; ▪ Mine, Dormant; ▪ Mine, Abandoned; and ▪ Deposit, Exploited.	When rights are granted to either prospect or mine, they are based on an area or lease footprint. To convert the Active and Dormant/Abandoned mines point shapefile to a spatial footprint, the data was overlaid with the DMR 2019 dataset. All the areas where mining rights have been withdrawn were removed from the final mining layer. Further refinement was undertaken for the few areas where the leased footprint was too extensive. The mining lease areas with extensive footprints were refined by digitizing the actual operational area using Google Earth and ESRI base map imagery. In addition, all active mining areas that fall within the Protected Areas were removed from the final layer.
Application Commodity: Mining Application Types	DMR, 2019	The data delineates mined minerals in polygon format per lease footprint. The dataset includes: ▪ Amending an existing right; ▪ Burrow pit; ▪ Exploration right; ▪ Mining permit; ▪ Mining permit renewal; ▪ Mining right; ▪ Mining right renewal; ▪ Prospecting right; ▪ Prospecting right renewal; ▪ Reconnaissance permission/permit; ▪ Retention permit; and ▪ Technical co-operation permit.	

As indicated in Table 2, the two datasets represent different spatial information; and were sourced at different stages of the SEA Process. This influenced how the data was used, processed and analysed in the SEA. As a result, there was a need for the data to be refined and manipulated into a single layer that combined the two datasets to reflect up-to-date mining activities in the country. The data included in the CGS 2012 and DMR 2019 datasets are illustrated in Maps 2 and 3, respectively.

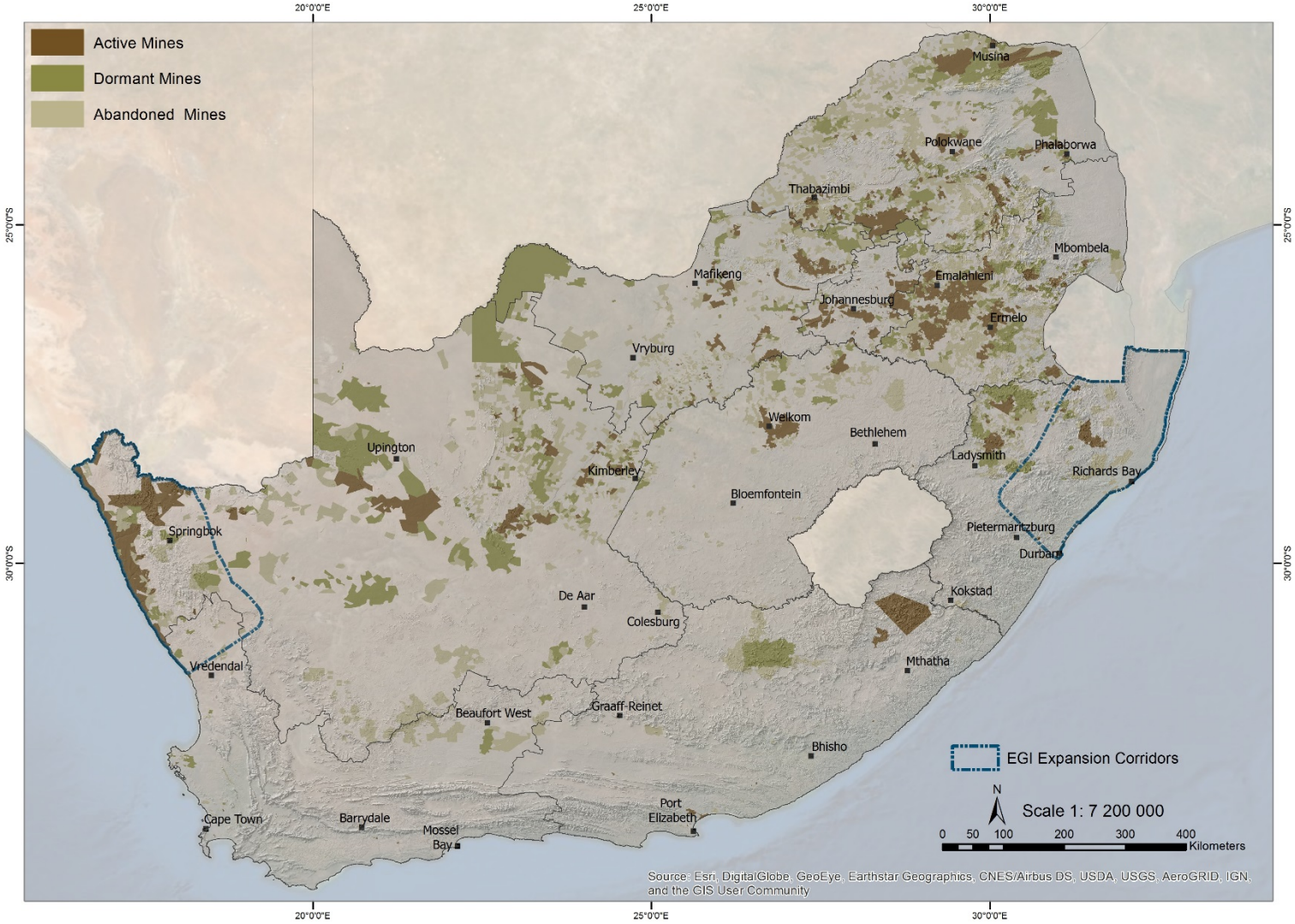
Map 4 illustrates the final refined mining feature layer used in this SEA.



Map 2: Active, Dormant and Abandoned Mines in South Africa, including a) Mine, Continuously Producing; b) Mine, Intermittently Producing; c) Mine, Dormant; d) Mine, Abandoned; and e) Deposit, Exploited. Sourced from the CGS, 2012.



Map 3: Various Mining Application Types in South Africa (e.g. Mining Rights, Mining Permits, and Prospecting Rights etc.). Sourced from the DMR, 2019.



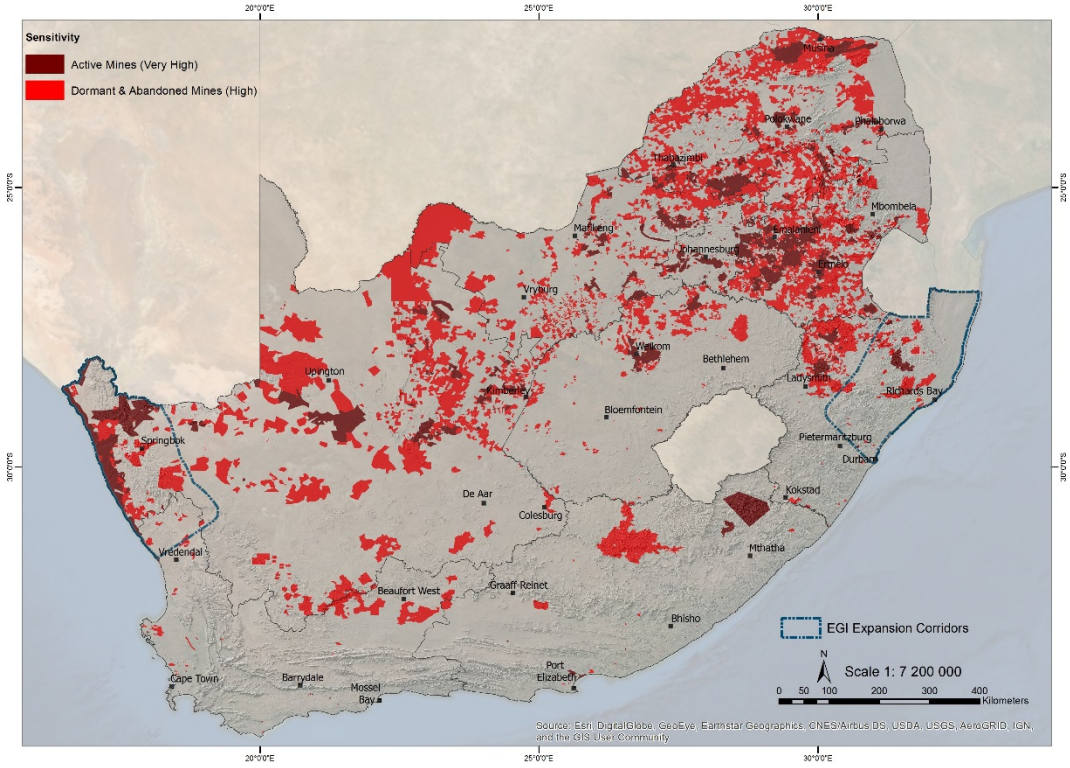
Map 4: Final Refined Mining Layer used in the EGI Expansion SEA.

4.2.10.4 Sensitivity Maps

A sensitivity map (Map 5) was produced for the Expanded EGI corridors according to the criteria set out in Table 3 to classify mining sensitivity spatially into four tiers namely, Very High, High, Medium and Low. From an engineering constraints perspective, active mining areas have been allocated a Very High sensitivity, whereas Dormant and Abandoned Mining Areas have been allocated a High sensitivity. Background on the rationale for these sensitivity allocations are provided in Section 4.2.10.5.

Table 3: Summary of the Engineering Constraints Analysis for the Mining Datasets

Sensitivity Feature	Data Source + Date of Publications	Sensitivity
Active Mining Areas	CGS (Sourced directly by the DEA), 2012; and DMR, 2019 refined into one layer.	Very High
Dormant and Abandoned Mining Areas		High



Map 5: Combined Mining Sensitivity Map for the EGI Expansion SEA.

As illustrated in Map 5, active, abandoned and dormant mining areas occur in the Expanded Western and Eastern EGI Corridors, particular in the Northern Cape. However, the majority of the active, abandoned and dormant mines fall outside of the Expanded EGI Corridors, mainly in Mpumalanga, North-West and Limpopo. The Expanded Western EGI Corridor contains more active mining areas than the Expanded Eastern EGI Corridor.

4.2.10.5 Impact Description and Mitigation

4.2.10.5.1 Impact of Mining on EGI

From an engineering constraints perspective, underground mining will lead to instability, subsidence, sinking and sinkholes, which are unfavourable and unsafe for power lines and substations, particularly if they are located within the zone of influence of the mining area. Abandoned and dormant mining areas are also considered a hazard due to potential instability and uncertainties. Open cast and sand mining are also not conducive to EGI development due to the level of surface disturbance. Any damage to the EGI due to mining activities may lead to incidents that constitute a risk to the surrounding environment, mining operations and personnel, and proximal settlements.

However, mining operations fundamentally require electricity in order to operate, and therefore require EGI to transmit the electricity to the mine. Linked to this, existing and future planned mining areas were also considered as a pull factor from a demand perspective in the SEA Process. Power lines and substations can be located close enough to mining areas; however, a suitable case-specific buffer between the mining operations and the infrastructure would need to be determined to ensure that there is no risk to the infrastructure, and surrounding environment and communities. In addition, the EGI must be stringently designed in order to protect it from mining operations, including blasting.

Linked to the above, the Mine Health and Safety Act (Act 29 of 1999, as amended) and its regulations, specify various requirements to ensure that hazards are identified and the risk to health and safety is eliminated, controlled and minimised. This includes various safety buffer zones that need to be respected with regards to mining and surrounding infrastructure, including power lines.

4.2.10.5.2 Impact of EGI on Mining

As noted above, supply of electricity is essential to mining operations. According to the 2019 Eskom Integrated Report (dated 31 March 2019), mining accounted for 13.9 % of Eskom's total sales in the 2018 – 2019 financial year, which was slightly surpassed by industry which accounted for 23.4 % (this excludes municipal sales) (Eskom 2019)[3]. The mining sales declined by 4.2 % since the previous financial year due to the "economic downturn leading to the closure of a number of mines and shafts, as well as several mines being placed in care and maintenance" (Eskom, 2019[3]).

Therefore, the provision of EGI will support and positively influence the mining sector. Additional detail regarding this positive impact is addressed in the Socio-Economic Assessment (i.e. Appendix C.4 of the EGI Expansion SEA Report).

Section 53 of the MPRDA notes that approval of the Minister of Mineral Resources is required for any land surface use that may be contrary to the objectives of the MPRDA. Such an application is required for all land uses other than:

- those within an approved town-planning scheme which has applied for and obtained approval from the Minister;
- farming and related land uses; or
- other land uses identified by the Minister as not requiring approval.

Notwithstanding the above, EGI developments (particularly substations) are considered to have the potential for temporarily preventing access to below ground mineral resources, and hence require approval in terms of Section 53 of the MPRDA. The consideration of Section 53 applications for EGI projects are complex and case specific. Furthermore, the presence of below ground mineral resources at a specific site can only be confirmed through exploration, and without such certainty, it is challenging to justify the prevention of EGI development on such a site by refusing a Section 53 application.

[3] Eskom SOC Limited, 2019. Integrated Report: 31 March 2019. Accessed 9 September 2019 [online]: http://www.eskom.co.za/IR2019/Documents/Eskom_2019_integrated_report.pdf

With the foregoing complexities requiring consideration when evaluating the potential impacts of proposed EGI developments on mining, the following principles are important:

- It is vital that mining impacts are considered on a project specific scale. The Project Developer must contact the relevant Competent Authority (e.g. DMR) during the power line route planning stage in order to confirm the location of mining areas based on the latest available information, and to discuss applicable constraints and sensitivities. This will inform the power line route selection process, and will ensure that the safety of the EGI, and surrounding mining operations and communities are taken into consideration and factored into the design.
- It is difficult to justify the sterilisation of land for EGI development based on mining sensitivities without some degree of certainty that there are indeed below ground mineral resources that can be affected. Furthermore, where an exploration or mining right has either lapsed or the relevant activities have not started within the stipulated timeframes, such unused rights do not justify the sterilisation of land for other land uses contributing to the national economy, such as EGI development.

Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa

PART 5

Final Corridors

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ABBREVIATIONS

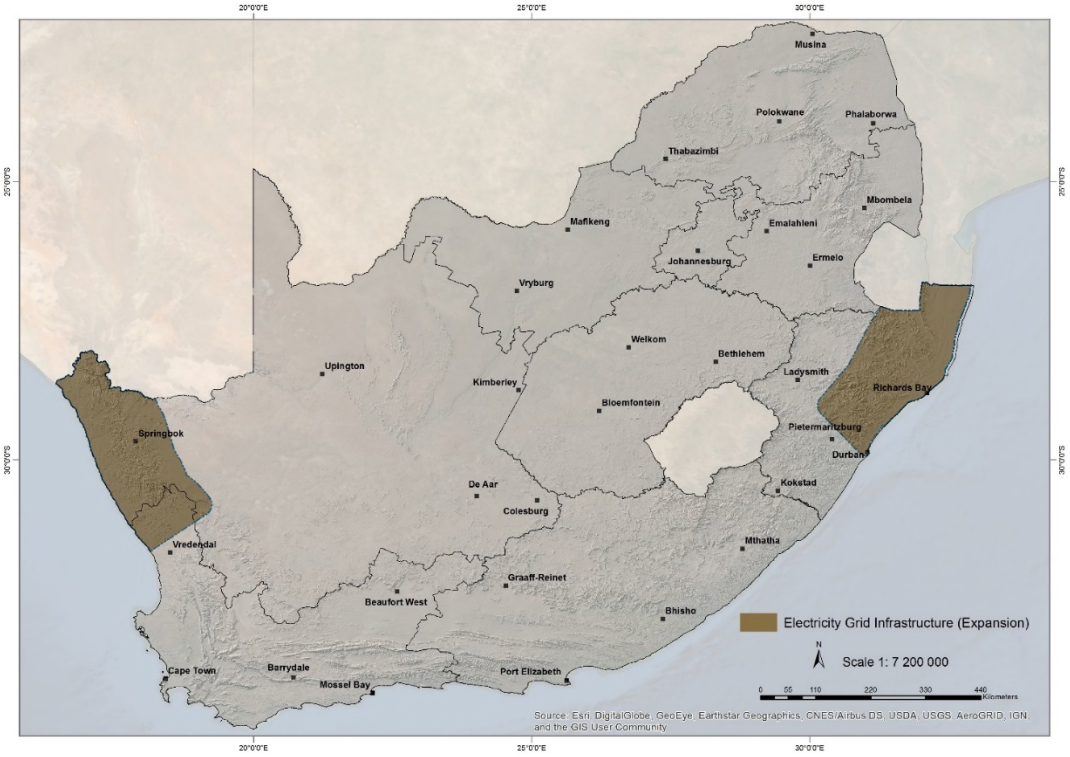
DAFF	Department of Agriculture, Forestry and Fisheries
DM	District Municipality
DTI	Department of Trade and Industry
EIA	Environmental Impact Assessment
EGI	Electricity Grid Infrastructure
ERG	Expert Reference Group
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IOCB	Indian Ocean Coastal Belt
KCAAA	Karoo Central Astronomy Advantage Area
LM	Local Municipality
MM	Metropolitan Municipality
NERSA	National Energy Regulator of South Africa
NFI	National Forest Inventory
PSC	Project Steering Committee
REDZ	Renewable Energy Development Zones
SANParks	South African National Parks
SAOGA	South African Oil and Gas Association
SACAD	South African Conservation Areas Database
SAPAD	South African Protected Areas Database
SAPVIA	South African Photovoltaic Industry Association;
SASTELA	Southern Africa Solar Thermal and Electricity Association
SAWEA	South African Wind Energy Association
SDF	Spatial Development Framework
SEZ	Special Economic Zone
SEA	Strategic Environmental Assessment
SIP	Strategic Infrastructure Projects
SKA	Square Kilometer Array
SWSA	Strategic Water Source Areas

PART 5. FINAL CORRIDORS

5.1 Introduction

This chapter (i.e. Part 5) of the Electricity Grid Infrastructure (EGI) Expansion Strategic Environmental Assessment (SEA) Report provides a detailed description on the process followed and analysis undertaken to refine and identify the **Final 100 km wide Expanded EGI Corridors**, which is an outcome of the **Final Pinch Point Analysis**. The **Final 100 km wide Expanded EGI Corridors** will be recommended for gazetting and adoption.

As discussed in Part 3 of the EGI Expansion SEA Report, 125 km wide corridors were identified following the completion of the **Draft Pinch Point Analysis** in Phase 3 of the SEA Process. These Draft Refined 125 km wide corridors were identified based on the best available data at the time, and were delineated based on environmental sensitivities and engineering constraints that were rated as **Very High** sensitivity following the Negative Wall to Wall mapping exercise (undertaken as part of Phase 1 of the SEA Process). The Draft Refined 125 km wide corridors (Map 1) were thereafter assessed by the Specialists during Phase 4 of the SEA Process.



Map 1: Draft Refined 125 km wide Expanded EGI Corridors identified during the Draft Pinch Point Analysis and assessed by the Specialists.

5.2 Final Pinch Point Analysis Methodology

As indicated in Figure 1, the **Final Pinch Point Analysis** considered the following main aspects in order to refine the Draft Refined 125 km wide Expanded EGI Corridors and to identify the **Final 100 km wide Expanded EGI Corridors:**

- Findings of the Spatial Energy Demand Mapping;
- Findings of the Spatial Energy Generation Mapping;
- Findings of the Specialist Assessments;
- Outcome of the Negative Wall to Wall Mapping; and
- Recommendations from stakeholders (as applicable).

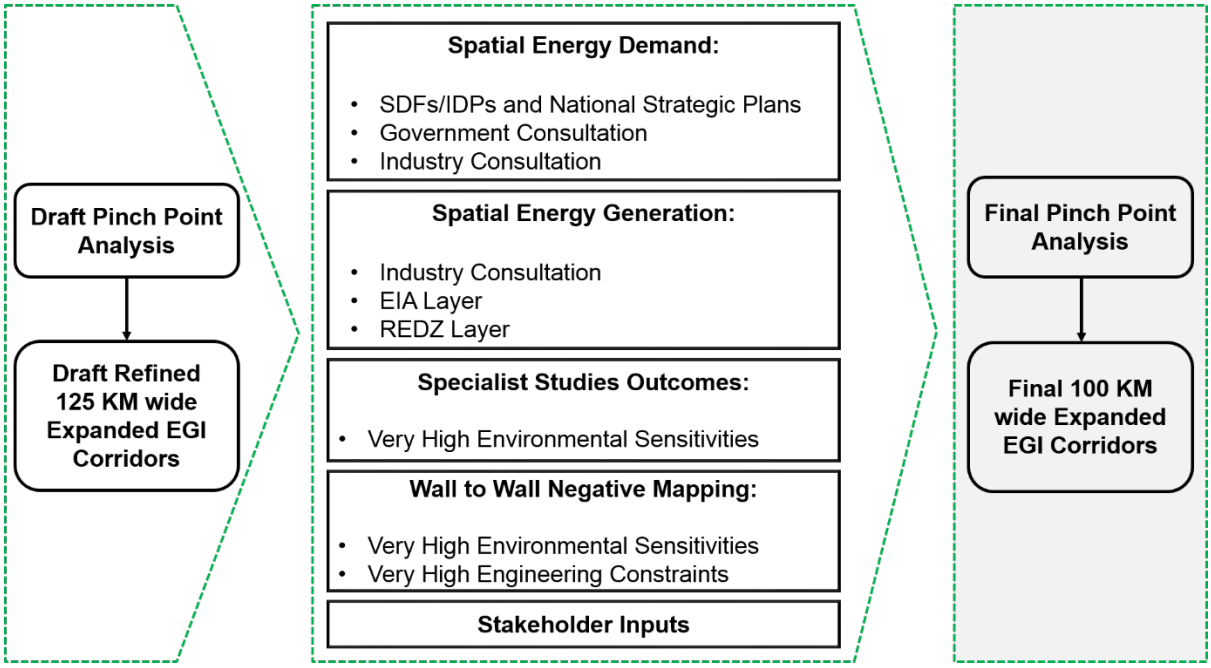


Figure 1: Factors considered in the Final Pinch Point Analysis.

The **first step** of the Final Pinch Point Analysis included the refinement of the Expanded EGI corridors from 125 km wide to 100 km wide based on the **Demand and Generation Mapping**, in order to ensure that the corridors are placed where there is the biggest demand and generation potential for electricity. These corridors are referred to as the "100 km wide Demand Mapping Corridors". The Demand and Generation Mapping Process (refer to Section 5.3) identified and considered various demand factors and opportunities for electricity transmission, also referred to as Pull Factors.

The **second step** of the Final Pinch Point Analysis including the shifting of the 100 km wide Demand Mapping Corridors, where necessary, based on the presence of environmental sensitivities and engineering constraints that were rated as **Very High** sensitivity (i.e. pinch points). These **Very High** sensitivity areas included updated sensitivities and data from the Negative Wall to Wall mapping exercise (undertaken as part of Phase 1 of the SEA Process), and stemming from the Specialist Assessments (undertaken as part of Phase 4 of the SEA Process) – refer to Section 5.4.

The Final Pinch Point Analysis also took into consideration the relevant recommendations made by stakeholders, where applicable. It should be noted that the recommendations from stakeholders were based on input received during the various Project Steering Committee (PSC), Expert Reference Group (ERG), Sector Specific, Focus Group, Authority Meetings, as well as Public Information Sharing Sessions held throughout the SEA Process, as well as during the Stakeholder Review of the Draft SEA Report (between April 2019 and June 2019).

The **last step** of the Final Pinch Point Analysis included the finalisation and demarcation of the **Final 100 km wide Expanded EGI Corridors**, based on the various factors discussed above, and illustrated in Figure 2.

The overall methodology adopted for the Final Pinch Point Analysis is illustrated in Figure 2.

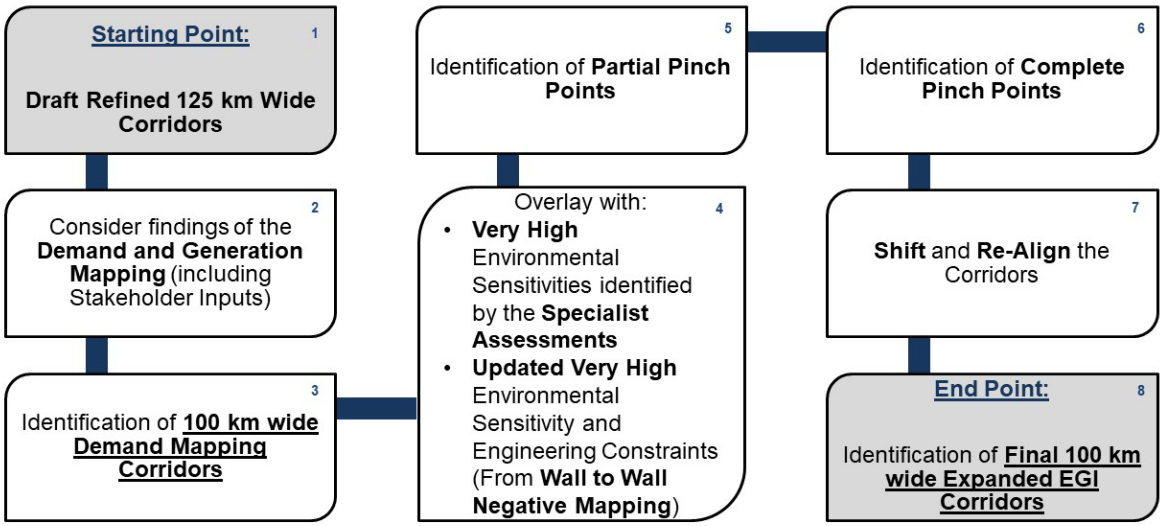


Figure 2: Process of the Final Pinch Point Analysis.

5.3 Step 1: Opportunities Mapping Process

The Demand and Generation Mapping Processes were undertaken during Phase 2 of the SEA Process, and involved mapping any existing and future energy intensive developments and activities within and close to the Draft Refined corridors The aim of this process was to determine where investment into the expansion and reinforcement of transmission infrastructure might be best utilised. Utilisation in the context of this study refers to the productive 'use' of transmission infrastructure. Transmission infrastructure supports the evacuation of electricity away from where it is generated and the delivery of electricity to where it is needed.

5.3.1 Spatial Energy Demand

The process considered key strategic geographical areas set aside for specifically targeted economic activities through national policy, plans and programmes. In particular, the mapping exercise considered Special Economic Zones (SEZs) identified by the Department of Trade and Industry (DTI) as incentivised sector-specific industrial development areas under the SEZ Act (2012). Consideration was also given to existing Industrial Development Zones (IDZ) and the spatial distribution of the relevant Strategic Integrated Projects (SIPs). The establishment and promotion of SEZs are at the centre of national industrial policy. Other energy intensive developments include areas for industrial expansion as well as priority mining areas (i.e. areas set aside for either existing or future mining activity operations).

Data for the Demand Mapping Process was obtained from the following sources, which are described in further detail in the following sub-sections:

- Review of provincial and municipal Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs);
- Review of national scale strategic development plans (e.g. SEZs, IDZs, and SIPs);
- Provincial and Municipal Feedback Exercises;
- Industry Feedback Exercises; and
- Feedback received during various meetings held during the SEA Process, including the Authority and Public Outreach Sessions.

5.3.1.1 Review of Spatial Development Frameworks, Integrated Development Plans and National Plans

A detailed review of SDFs of provincial, district and local municipalities located inside of the Draft Refined 125 km wide corridors was undertaken. The review involved mapping areas illustrated within relevant SDFs as being set aside either for future mining related activity, industrial expansion, transport developments, agriculture, tourism or for urban expansion. A number of the SDFs were not considered suitable for the purposes of this exercise, either because they were older than 5 years or did not contain spatial information concerning plans for industrial expansion and/or mining. In the absence of a suitable local municipal SDF, and where available, the relevant District Municipality SDF or Provincial SDF was reviewed instead. Where required, the relevant IDPs of municipalities were also considered. In addition, national strategic plans, such as the National SDF, National Gazetted Renewable Energy Development Zones (REDZ), and National Gazetted EGI Corridors were also considered.

5.3.1.2 Municipal Feedback Exercise

A dedicated consultation process was initiated in April 2018 until April 2019 with the affected District and Local Municipalities indicated in Table 1, which enabled them to actively engage with the mapping outputs from the SDF and IDP review process. The consultation exercise also enabled municipalities to provide feedback and request updates to the SDF and IDP mapping outputs based on more recent and unpublished draft SDFs as well as local and regional knowledge.

During this exercise, feedback was requested from these authorities on the details and spatial representation of municipal future energy intensive activities, such as industrial development, potential mining operations, urban expansion, priority tourism, priority agriculture. Table 1 provides a list of the District and Local Municipalities that were consulted with. To facilitate the feedback process, the planning departments of each affected District and Local Municipality were provided with the following:

- A cover letter to the Planning Department requesting the above feedback; and
- A 10 km x 10 km or 20 km x 20 km grid map of the province and feedback form to provide the requested feedback.

An example of the abovementioned letters to the District and Local Municipality Planning Departments, as well as the grid map and feedback form is included in Appendix A of the EGI Expansion SEA Report.

The italised font in Table 1 provides an indication of which District and Local Municipality submitted feedback. The Municipalities were requested to review each of grid maps created to determine whether the shaded cells are an accurate representation of spatial development plans in the municipality in terms of the abovementioned factors. They were also requested to identify what changes needed to be made to the maps i.e. which cells needed to be changed from ‘shaded to unshaded’ or ‘unshaded to shaded’. An example of the feedback received from the Matzikama Local Municipality is provided in Figure 3.

It is important to note that feedback was received via this feedback process, as well as during the various discussions and meetings held throughout the SEA Process. Specifically, a considerable amount of information was received from stakeholders during focus group, sector specific, ERG, PSC and Authority Meetings.

Table 1: List of District, Metropolitan, and Local Municipalities that formed part of the Municipal Feedback Exercise. Note that in this table, "DM" refers to District Municipality, "MM" refers to Metropolitan Municipality, and "LM" refers to Local Municipality; and that all ***italised*** font is an indication that feedback was received from these Municipalities.

Planning Departments	
District Municipalities	**Western Cape:** *West Coast DM*
	KwaZulu-Natal: *Ilembe DM*; *King Cetshwayo DM*; Umkhanyakude DM; *Zululand DM*; *UMgungundlovu DM*; *uThukela DM*; and *Umzinyathi DM*
	Northern Cape: *Namakwa DM*
	Mpumalanga: *Gert Sibande DM*
Local and Metropolitan Municipalities	**Western Cape:** *Matzikama LM (Note that feedback was also received from Bergriver LM, Cederberg LM; Saldanha LM; and Swartland LM, however they do not fall within the Expanded EGI corridors).*
	KwaZulu-Natal: Ethekwini MM; uMshwathi LM; Mpofana LM; Mkhambathini LM; Msunduzi LM; uMngeni LM; Alfred Duma LM; Inkosi Langalibalele LM; Endumeni LM; Nqutu LM; Msinga LM; Umvoti LM; eDumbe LM; uPhongolo LM; Abaqulusi LM; Nongoma LM; Ulundi LM; Umhlabuyalingana LM; Jozini LM; Big 5 Hlabisa LM; Mtubatuba LM; Mfolozi LM; City of uMhlathuze; *uMlalazi LM*; Mthonjaneni LM; Nkandla LM; Mandeni LM; KwaDukuza LM; Ndwedwe LM; and Maphumulo LM
	Northern Cape: Richtersveld LM; Nama Khoi LM; Kamiesberg LM; and Hantam LM
	Mpumalanga: Mkhondo LM

5.3.1.3 Industry Feedback Exercise

An Industry Feedback exercise was also commissioned in May 2018 to seek feedback from major energy users, industry stakeholders and generators in terms of:

- Future electricity demand to support development plans in South Africa up to 2040 (i.e. future/planned energy intensive activities); and/or
- Transmission infrastructure requirements to support future generation plans of electricity in South Africa up to 2040 (e.g. renewable projects and gas to power plants).

These stakeholders were issued a cover letter requesting the above feedback, as well as a Bulk User Feedback Form and Bulk Generator Feedback Form. Examples of these documents and forms are included in Appendix A of the EGI Expansion SEA Report. Table 2 provides a list of the major energy users, industry stakeholders and generators that were consulted with during this exercise. The italised font in Table 2 provides an indication of where feedback was received, either through this exercise process or discussions and meetings held throughout the SEA Process.

Table 2: List of Major Energy Users, Industry Stakeholders, and Generators that formed part of the Industry Feedback Exercise. Note that all italised font in this table is an indication that feedback was received from these stakeholders.

Major Energy Users, Industry Stakeholders and Generators
Business Unity South Africa; Chamber of Mines; Energy Intensive User Group of Southern Africa; South African Photovoltaic Industry Association (SAPVIA); South African Oil and Gas Association (SAOGA); Transnet; National Energy Regulator of South Africa (NERSA); Saldanha Bay IDZ; Coega IDZ; Richards Bay IDZ; Eskom; iGas; PetroSA; South African Wind Energy Association (SAWEA); Southern Africa Solar Thermal and Electricity Association (SASTELA); Council for Mineral Technology; Industrial Development Corporation; National Business Initiative; Business Leadership South Africa; South African Chamber of Commerce and Industry; National Development Agency; and Alexkor

PLEASE COMPLETE THE TABLE BELOW FOR GRID CELLS THAT MUST BE ACTIVATED FOR DEVELOPMENT.

GRID CELL REFERENCE NUMBER	SECTOR	ACTIVITY	COMMENTS
BA104, BA105, BB105, BB106, BB107, BC107, BC108, BD108, BD109, BE109, BE110, BF110, BF111, BG111, BG112, BG113, BG114, BG115, BF115, BF116, BG116, BG117	TRANSPORT	TOURISM	The N7 transport route which link Namibia, Northern Cape with the Western Cape and important economic markets/ports. The N7 is also an important link and distributer for tourism within the Matzikama municipal area.
BD109, BC109, BC110,	TRANSPORT	TOURISM	Important linkage road that connect Nuwerus with Koekenaap, Lutzville and Vredendal which is not only used by residents but also tourists.
BC113, BC114, BC115, BC116	TRANSPORT	TOURISM	Important linkage road that connect the towns of Lutzville, Lutzville-Wes, Ebenhaeser, Olifantsdrift, Papendorp, Strandfontein and Doringbaai and which is predominantly used by not only residents but also tourists.
BB113, BB114, BC111, BC112, BC113, BC114, BD113, BD114, BE113, BE114, BE115, BF114, BF115, BF116, BG115, BG116, BG117	AGRICULTURAL	AGRI-CROP FARMING / TOURISM	This corridor forms part of the Olifants River Agricultural Irrigation Scheme managed by the Lower Olifants River Water Users Association which includes the following towns, namely Trawal, Klawer, Vredendal, Lutzville, Koekenaap, Ebenhaeser and Papendorp where intensive agricultural crop farming takes place. With the current drought putting pressure on existing water sources many farmers are diversifying their agricultural practises with agri-tourism activities.
BC116	AGRICULTURAL	AGRI-PROCESSING AGRI-FISHING	Existing abalone hatchery and farm within Doringbaai and also further expansion of abalone farms north and south of Doringbaai. Existing harbour located within Doringbaai.
BB113	ELECTRICAL	ELECTRIFICATION	Existing Eskom Sere Wind Farm which needs to be connected with the national electricity grid.
BC115	ELECTRICAL	ELECTRIFICATION	Proposed Juno 140 MW wind energy facility (wind farm).
BB114, BB115	CONSERVATION	TOURISM	Proposed Olifants River Estuary Conservation area with a guest house and camping facilities at Papendorp.
AX109, AY109, AY110, AY111, AZ111, AZ112, BA112, BA113, BB113, BG113, BG114, BF114	MINING	MINING / PROSPECTING	Various mining companies such as Tronnox, MSR Tormin, Cape Lime.
BE114, BD113, BF115, BG115, BG113	CONSTRUCTION	RESIDENTIAL	Various residential developments (private and low cost)
BG113	CONSTRUCTION	INDUSTRIAL-LIGHT	Light industrial development.
BC113, BE114	AGRICULTURAL	AGRI-PROCESSING	With the Agri-Parks initiative various hubs (with a variety of facilities) are proposed within Vredendal and Ebenhaeser.
BE109, BE110, BE111, BE112, BF109, BF110, BF111, BF112, BG110, BG111	CONSERVATION	NATURE RESERVE	It is difficult to determine the exact grid cells but the area identified is more or less the area where the proclaimed Knersvlakte Nature Reserve (managed by Cape Nature) is located.
BC118, BC117, BC116, BC115, BC114, BD114, BD113, BE113, BF113, BF112, BF111, BG111, BG110, BH110, BH109, BI109	TRANSPORT	RAILWAY	MORE OR LESS THE LOCATION OF THE SHISHEN-SALDANHA RAILWAY.
ALL GRID CELLS	AGRICUTURAL	AGRI-ANIMAL FARMING	Farming with goats / sheep where practical.

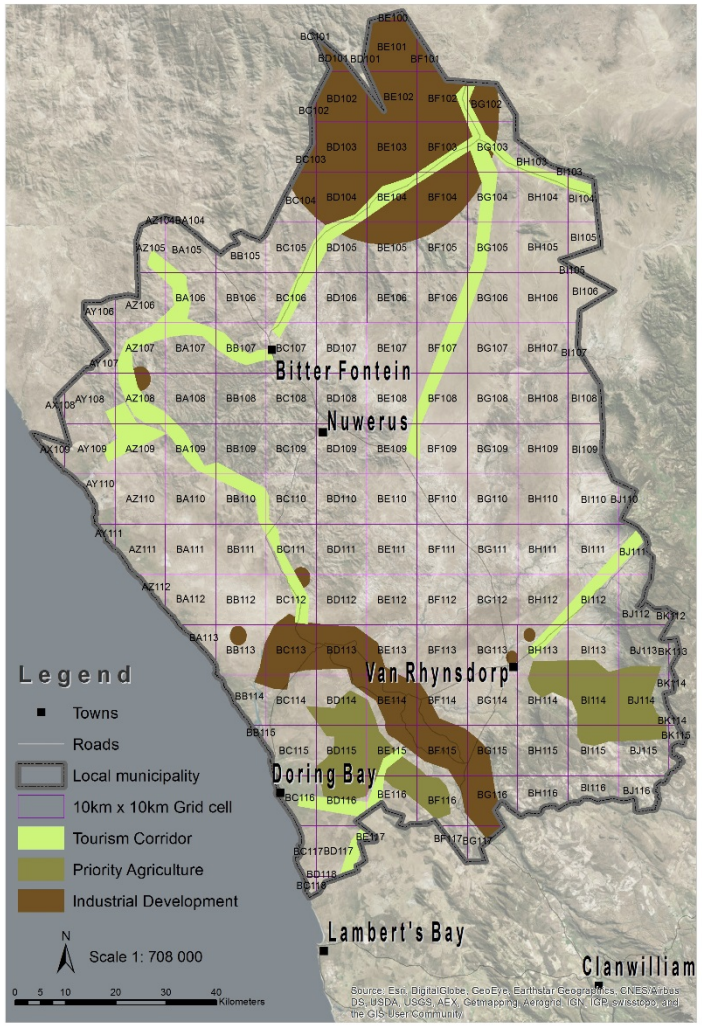


Figure 3: Example of the completed Feedback Form provided by the Matzikama Local Municipality, and annotated grid map provided to the municipality.

5.3.2 Spatial Energy Generation Potential

Data for the energy generation layer mapping process was obtained from three sources including industry consultation, active Renewable Energy Environmental Impact Assessment (EIA) Applications for Environmental Authorisation, as well as the Gazetted REDZ.

5.3.2.1 Industry Consultation

An Industry Consultation exercise was also undertaken during the 2016 EGI SEA (DEA, 2016) to enable developers to identify areas where grid expansion should be prioritised in order to support plans for renewable energy development in these areas. As part of the current EGI Expansion SEA, an additional industry consultation was undertaken and developers were requested to complete a survey including a map of the Buffered Corridors represented at a 10 km x 10 km grid cell resolution. Developers were required to select grid cells that were pre-determined on the map, and indicate the generation potential of the selected cell in MW.

The results of the Industry Consultation stemming from the 2016 EGI SEA (DEA, 2016) was also used in this current SEA. It highlights the potential need for energy in the next 5 to 30 years. The outcome of this survey was that most of the areas in the previously assessed corridors had less than 100 MW generation potential (as indicated by the green areas in Map 7).

5.3.2.2 Renewable Energy EIA Applications for Environmental Authorisation

Data captured through the consultation process was supplemented with information on project plans identified by Project Applicants, via the South African Renewable Energy EIA Application Database – Q2, 2019. Active applications were considered for all types of Renewable Energy technologies where applications for Environmental Authorisations had been submitted. Information on the spatial location, technology type and generation capacity (in MW) of each application, was recorded. This was, in turn, represented at a 10 km x 10 km grid cell level.

5.3.2.3 REDZ

The overall evacuation capacity in MW for wind and solar PV development within each REDZ was calculated using the recommended wind and solar PV development density limits proposed by the landscape specialist study as a guideline for development inside the REDZ. The estimation of the wind and solar PV development capacity assumed that the same land is available for both types of development. In order to avoid double counting when estimating the overall combined development capacity for each gazetted REDZ it was necessary to make assumptions with regard to what portion of the available land potentially could be used for each technology. The estimated development capacities for wind and solar PV were then adjusted accordingly before estimating the overall combined development capacity for each REDZ. Assuming a uniform development capacity at all positions within each REDZ, it was possible to calculate and map evacuation capacity for each REDZ at a 10 km x 10 km spatial resolution.

5.3.3 Consolidation of the Opportunities Mapping

All of the relevant information and data received from the sources above were reviewed, packaged, and digitised (where required). The Demand Mapping was initially undertaken at a 10 km by 10 km grid cell scale. However, where actual proposed and planned development boundaries were sourced from stakeholders, these were used instead of the grid system. The datasets used in the demand mapping is detailed in Appendix 5.1 of this chapter.

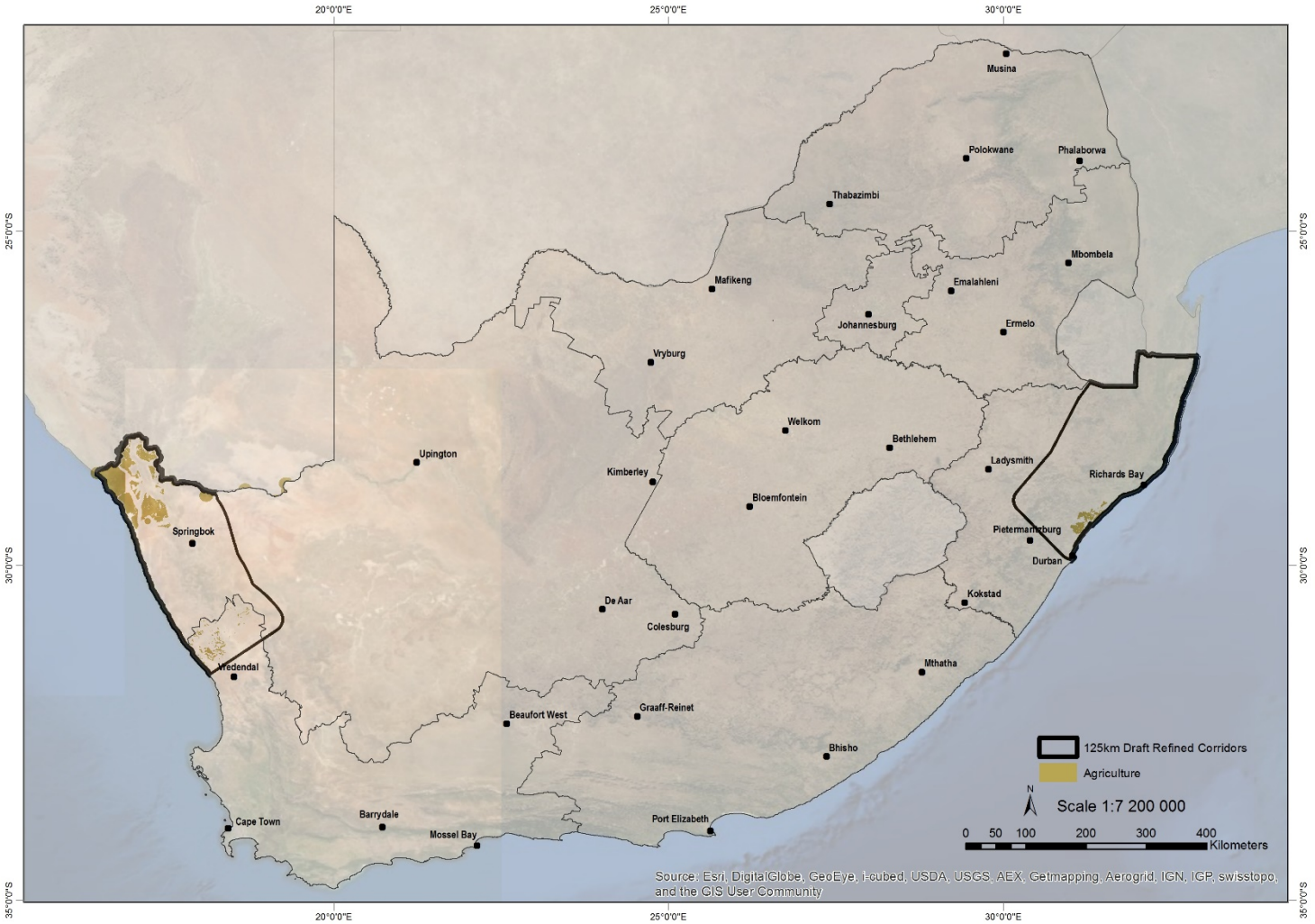
These features were used as pull factors to ensure that areas of high demand were considered in the corridor refinement. The following categories of data were mapped into separate layers and assessed as part of the Final Pinch Point Analysis:

- **Agriculture**: This includes commercial farming (intensive), agricultural investment areas, wildlife economy nodes, agricultural hubs, and areas of agricultural significance (Refer to Map 2);
- **Local Municipality SDF Potential EGI Demand**: This includes potential mining areas, priority agriculture, agricultural focus areas, industrial development and planned transport routes (Refer to Map 3);
- **Mining Areas**: This includes active mines, coal fields, mining belts, priority mining areas, and mining focus areas (Refer to Map 4);
- **Future Generation Potential**: This is based on the 2015 industry survey undertaken during the EGI SEA (DEA, 2016) for the potential need for energy in the next 5-30 years (Refer to Map 5); and
- **Industry**: This includes Aquaculture Development Zones (ADZs), SEZs, IDZs, strategic investment areas, rural development hubs, and industrial development that exist and are planned (Refer to Map 6).

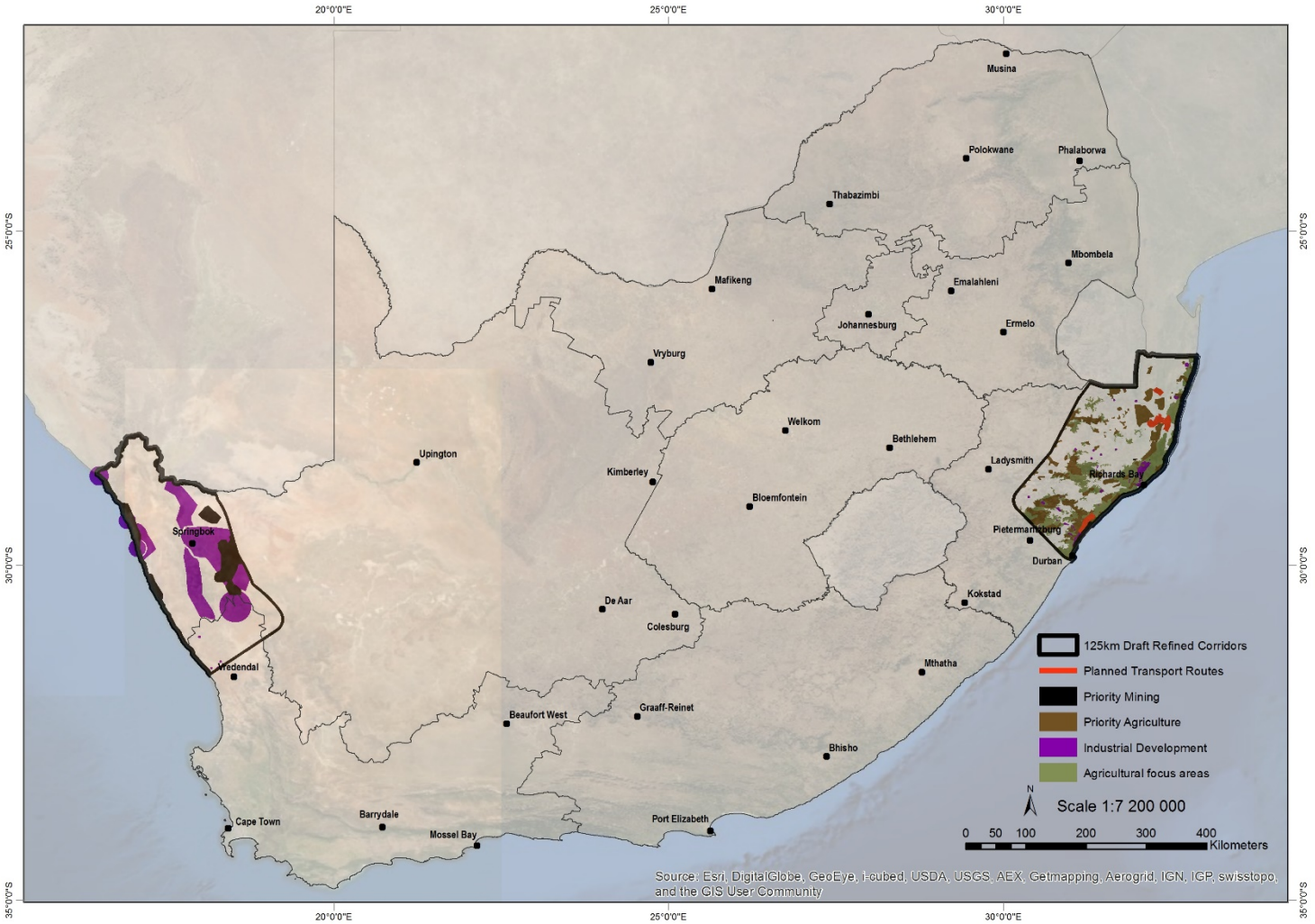
All the above demand factors and categories were thereafter combined to provide an overall spatial representation of the various demand for power and future generation potential within the Draft Refined 125 km wide corridors (Maps 7a and 7b). This facilitated the refinement and identification of the 100 km wide Demand Mapping Corridors.

The refinement focused on ensuring that the areas with the maximum amount of overlap of demand and generation potential layers were selected and included in the 100 km wide Demand Mapping Corridors initially. In addition, one of the key factors was ensuring that the 100 km wide Demand Mapping Corridors maintained connection with the gazetted EGI corridors (based on the 2016 EGI SEA (DEA, 2016).

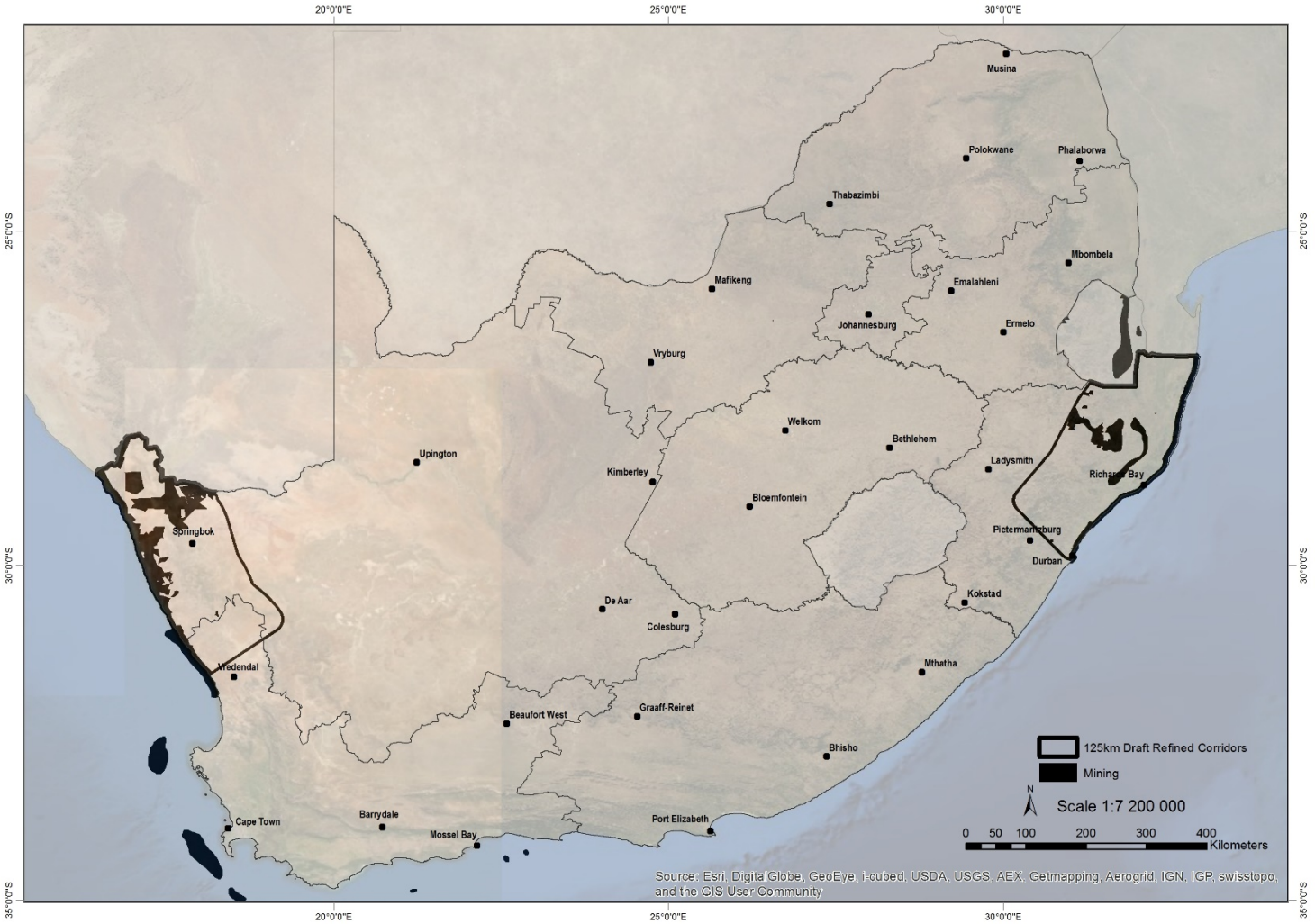
The 100 km wide Demand Mapping Corridors are presented in Maps 7a and 7b.



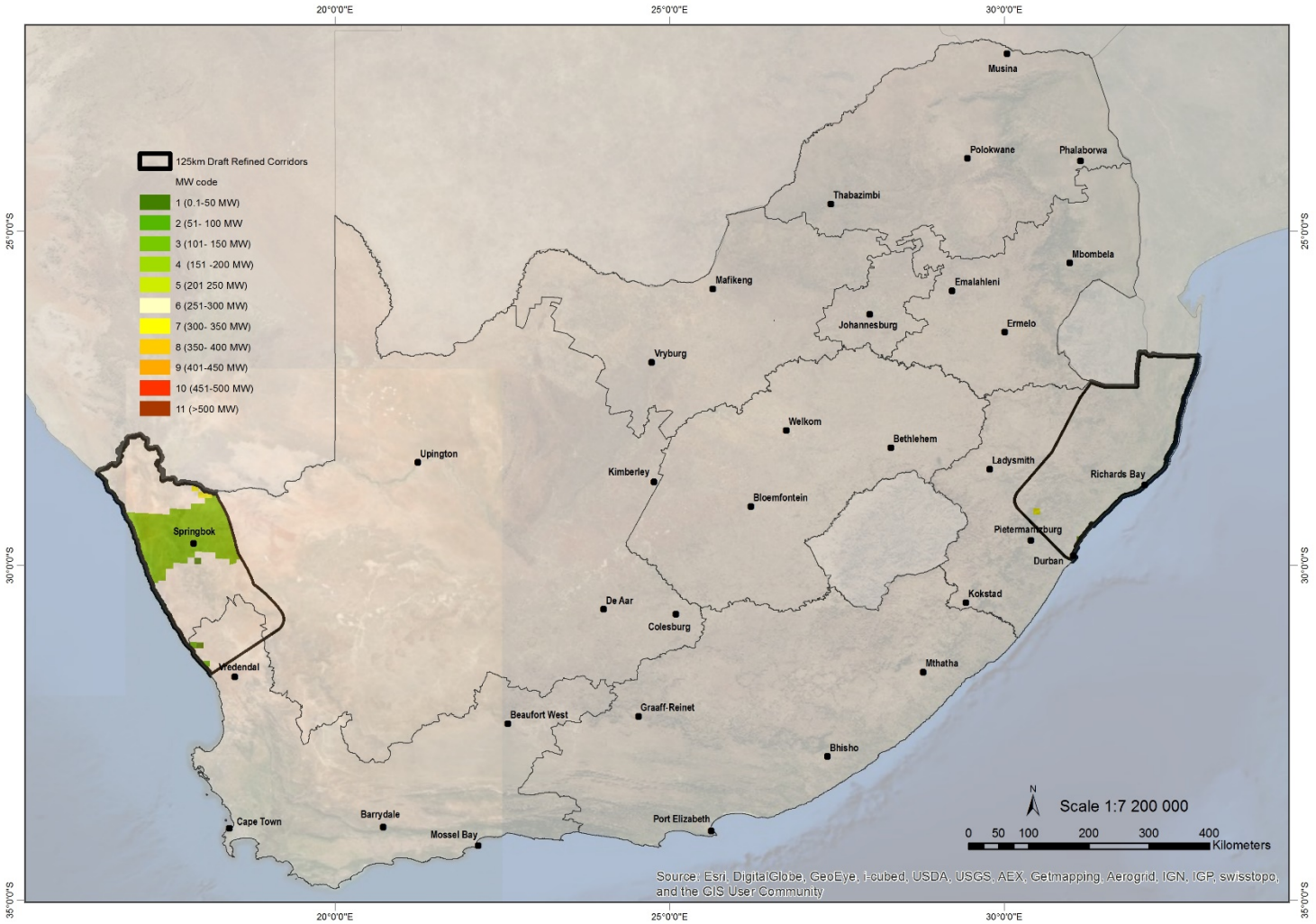
Map 2: Agricultural Areas captured in the Demand Mapping in relation to the Draft Refined 125 km wide Expanded EGI Corridors.



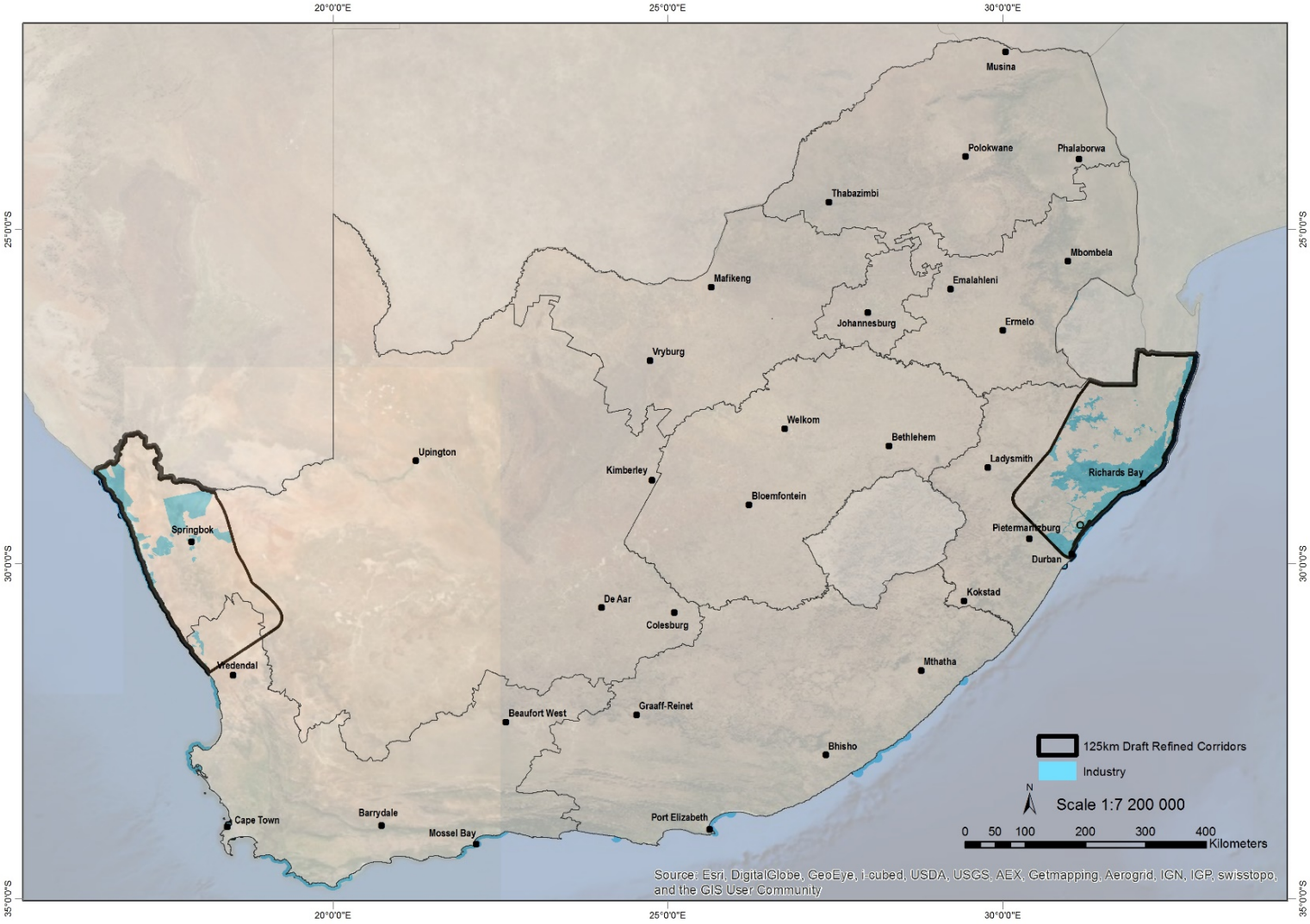
Map 3: Local Municipality SDF EGI Demand captured in the Demand Mapping in relation to the Draft Refined 125 km wide Expanded EGI Corridors. Potential mining areas are shown in black, priority agriculture areas are shown in brown, agricultural focus areas are shown in green, industrial development is shown in purple, and planned transport routes are shown in orange.



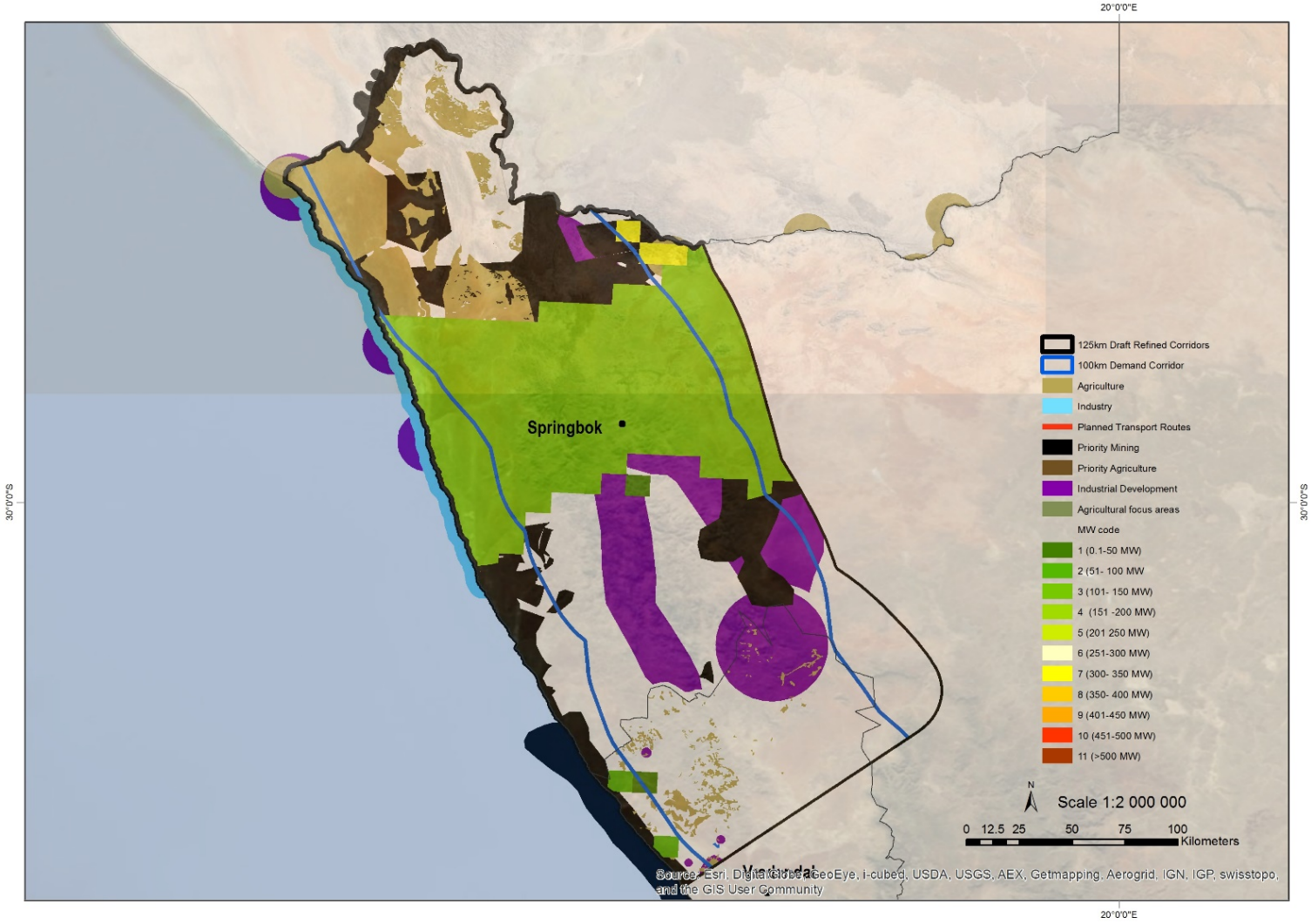
Map 4: Mining Areas captured in the Demand Mapping in relation to the Draft Refined 125 km wide Expanded EGI Corridors.



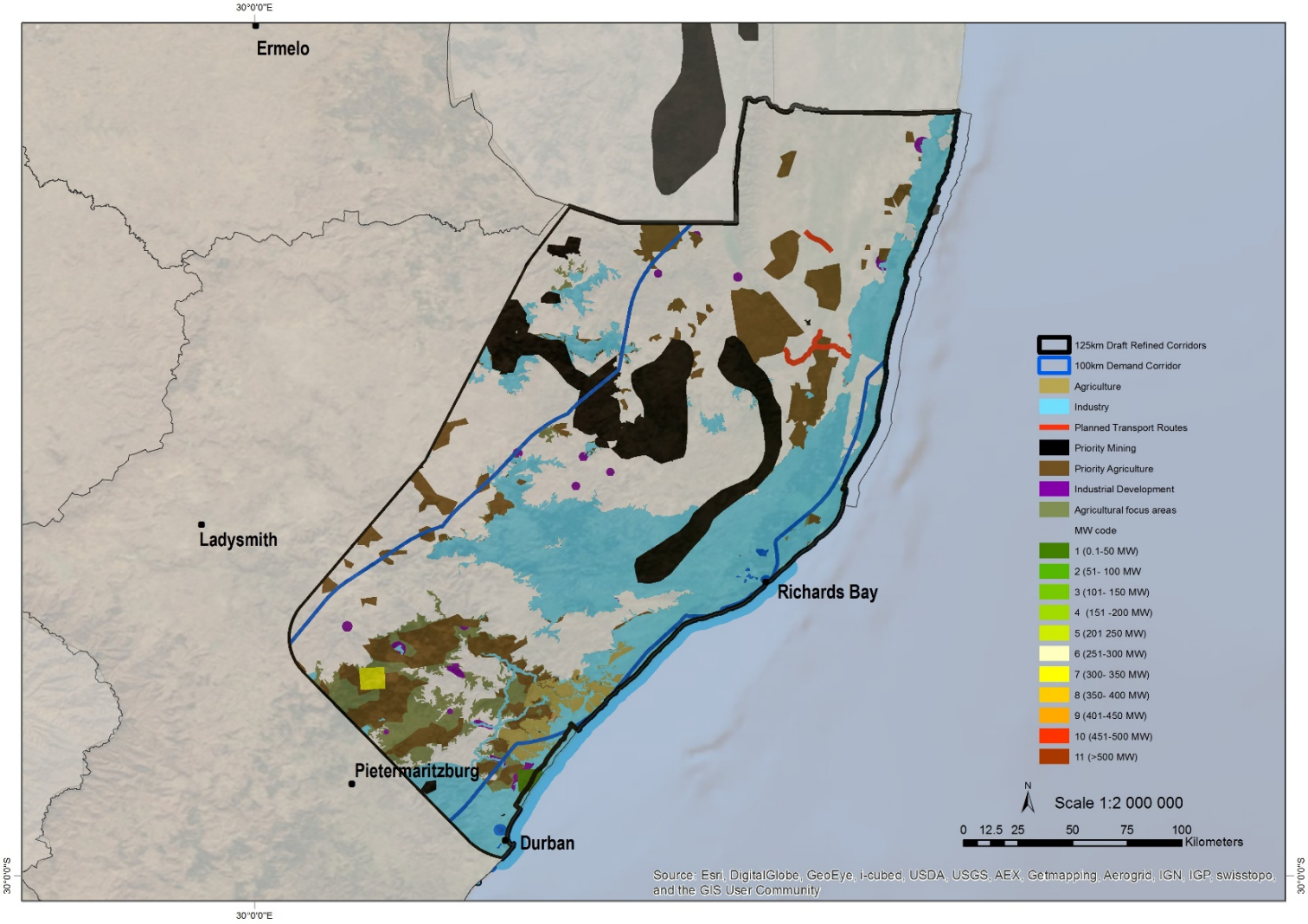
Map 5: Future generation potential based on the 2015 Industry Survey undertaken as part of the 2016 EGI SEA in relation to the Draft Refined 125 km wide Expanded EGI Corridors.



Map 6: Industrial Areas captured in the Demand Mapping in relation to the Draft Refined 125 km wide Expanded EGI Corridors.



Map 7a: Refined 100 km wide Demand Mapping Corridor for the Expanded Western EGI Corridor shown in blue based on all the Demand Mapping Features.



Map 7b: Refined 100 km wide Demand Mapping Corridor for the Expanded Eastern EGI Corridor shown in blue based on all the Demand Mapping Features.

5.4 Step 2: Updated Environmental Sensitivities and Engineering Constraints Criteria

For this step of the Final Pinch Point Analysis, all engineering constraints and environmental sensitivities that were allocated a **Very High** sensitivity were used to identify and locate both potential and partial pinch points within the 100 km wide Demand Mapping Corridors. Pinch points or bottle necks are defined, for the purposes of this exercise, as either complete or partial. Complete pinch points are areas within the corridors where there are **no cadastres or land parcels without areas of Very High sensitivity** (i.e. meaning that the 100 km wide Demand Mapping Corridors are only covered in Very High sensitivity areas). A partial pinch point is defined as areas in the corridor where there are less than five cadastres with potential routes across the corridor at that point based on the extent of **Very High** sensitivity features.

5.4.1 Updated Environmental Sensitivities

Very High sensitivity environmental data for this exercise was derived from the following two sources:

- Specialist Assessments; and
- Updated Wall to Wall Negative Mapping.

5.4.1.1 Data from Specialist Assessments

Areas identified as Very High sensitivity were extracted from the following Specialist Assessments:

- Integrated Biodiversity and Ecology Assessment (Terrestrial and Aquatic Ecosystems, and Species) – Appendix C.1 of the EGI Expansion SEA Report;
- Avifauna (Appendix C.1.7 of the EGI Pipeline SEA Report) and Bats (Appendix C.1.8 of the EGI Expansion SEA Report).
- Visual Assessment (Appendix C.2 of the EGI Expansion SEA Report),
- Seismicity Assessment (Appendix C.3 of the EGI Expansion SEA Report),
- Socio-economic Assessment (Appendix C.4 of the EGI Expansion SEA Report).

Furthermore, the Specialist Assessments were released to stakeholders for a comment period extending from 25 April 2019 to 24 June 2019 via the project website. Following this review period, where applicable, stakeholder comments were taken into consideration in the refinement of the draft refined corridors.

5.4.1.2 Data from Updated Wall to Wall Negative Mapping

Following the stakeholder consultation, sensitivity of features for themes that did not require further verification and refinement from the specialists, were extracted from the Wall to Wall mapping spreadsheet (as contained in Part 3, Table 2) and updated, where applicable. This included, for example, defence, civil aviation, heritage (including archaeology and palaeontology), agriculture, the Square Kilometer Array (SKA), the Karoo Central Astronomy Advantage Area (KCAAA), Natural Forests and Strategic Water Source Areas (SWSAs). This updated list is presented in Table 3.

Very High sensitive features were then extracted from this updated list shown in Table 3 and was used for the Pinch Point Analysis (refer to Table 4).

Table 3: Features and Data used to inform the Final Pinch Point Analysis – Updated Wall to Wall Negative Mapping – Environmental Sensitivity.

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/Buffer
Protected Areas	South African Protected Areas Database (SAPAD) - Q4, 2018, South African National Parks (SANParks) and Provincial	Marine Protected Areas	N/A	feature
		National Parks	Very high	feature
		Nature Reserves	Very high	feature
		World Heritage Sites (Core)	Very high	feature
		Mountain Catchment Areas	Medium	feature
		Protected Environments	Medium	feature
		Forest Nature Reserve	Very high	feature
		Forest Wilderness Area	Very high	feature
		Special Nature Reserve	Very high	feature
Protected Areas Buffers	SAPAD - Q4, 2018 and South African Conservation Areas Database (SACAD) - Q1,2017	10 KM buffer around National Parks or buffers received from SANParks	Medium	feature
		5KM buffer around Provincial Nature Reserves	Medium	feature
		1KM buffer around Local Nature Reserves	Medium	feature
		1KM buffer around Special Nature Reserves	Medium	feature
		Buffer around World Heritage Sites (Buffers are Site Specific)	Medium	feature
		5 km buffer around protected forests	Medium	feature
Conservation Areas	SACAD-Q1 2017 (DEA); Provincial Game Farm Data	Biosphere reserves (Buffer area of the biosphere reserve, core areas are already protected)	Medium	feature
		Botanical gardens	Medium	feature
		Ramsar Sites (not already protected)	Very high	feature
		1 km Buffer around National Botanical gardens	Medium	feature
		5km Buffer around Ramsar Sites	Medium	feature
	UNESCO Website / SAHRA	UNESCO tentative sites	Very high	1km
National Protected Areas Expansion Strategy	Priority Areas For Protected Area Expansion, 2017 (Including Updated Northern Cape Priorities) DEA	Protected areas expansion priority areas (Primary)	High	feature
Stewardship sites	Provincial Stewardship Data	Stewardship sites	High	feature

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/Buffer
Natural Forests	National Forest Inventory (NFI), sourced 2016, Department of Agriculture, Forestry and Fisheries (DAFF)	National forest inventory	Very high	1km (Medium)
Strategic Water Source Areas (SWSAs) - Surface and Groundwater	Council for Scientific and Industrial Research (CSIR), April 2018	SWSAs (Natural areas)	High	feature
Land Cover	National Land Cover 2013/2014, DEA, Habitat Modification Layer (Improved Land Cover) SANBI 2017	Natural areas	Low	feature
		Modified areas	Low	feature
		Old fields (mapped from imagery)	Low	feature
Agricultural Land Capability	Land Capability Layer, 2016, DAFF	Land capability features with values ranging from 11-15	Very high	feature
		Land capability features with values ranging from 8-10	High	feature
		Land capability features class 6 to 7	Medium	feature
		Land capability features class 1 to 5	Low	feature
Field Crop Boundaries	Field Crop Boundaries, 2017, DAFF	Irrigated Areas (Pivot Agriculture)	Very high	N/A
		Shadenet	Very high	feature
		Viticulture	Very High	feature
		Horticulture	Very High	feature
		Other cultivated areas	High	feature
Coastline	Coastline, 2015, SANBI and Department of Rural Development and Land Reform	Buffered coastline	Very high	1km
Karoo Central Astronomy Advantage Area (KCAAA)	KCAAA Footprint, obtained via CSIR (2017)	Karoo Central Astronomy Advantage Area	Medium	feature
Square Kilometre Array (SKA) Area	SKA Core Area, 2017, from SKA via CSIR	Square Kilometre Array (SKA) study area	Very high	feature
		SKA telescopes with 20km buffer	Very high	20km

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity	Feature/Buffer
Defence	Defence Data, 2017, South African National Defence Force	Forward Airfield	Very high	1km
			Medium	10km
		Air Force Bases	Very high	8km
			Medium	28 km
		High Sites	Very high	1km
		Operational Military Bases	Very high	1km
		Military Training Areas	Very high	1km
		Bombing Ranges	Very high	28km
			High	28 - 56km
			Medium	56-111km
		Shooting ranges	Very high	1 km
		Border Posts	Very high	1km
		Ammunition Depots	Very high	10 km
		All Other DoD features (Including Naval Bases, Housing, Offices etc.)	Very high	1km
Airports (Major, Landing Strips, Small Aerodromes)	REDZs 1 SEA dataset and EGI SEA dataset, 2017	Major Airports	Very high	8km
			Medium	15 km
		Landing strips	Very high	2km
		Other civil aviation aerodromes (small aerodromes)	Medium	8km
	SACAA	Civil Aviation Radars	High	4.6 km
			Medium	15 km
	ATNS	Air Traffic Control and Navigation Sites	Medium	5 km

Feature Category/Factor	Source/Dataset	Features		Mapping Sensitivity	Feature/Buffer
	SACAA	Danger and Restricted Airspace		High	As demarcated and show on the sensitivity maps
Heritage	**Mapped Heritage Features, SAHRA, 2018**	World Heritage Sites (Core)		Very high	feature
		World Heritage Sites (Buffer)		Medium	feature
		Grade I sites		Very high	2km
		Grade II sites		Very high	1km
		Grade IIIa sites		High	150m
		Grade IIIb sites		High	100m
		Grade IIIc sites		High	50m
		Ungraded		Very high	100m
		Battlefields (Grade IIIb)		Very high	5 km
Paleontological Heritage Resources - High sensitivity areas (*)	**Geological features and Substrates of Palaeontological Importance, Geology Layer, 2014, Council for Geosciences**	• Adelaide • Asbestos Hills • Boegoeberg Dam • Bothaville • Brulsand • Campbell Rand • Clarens • Drakensberg • Dwyka • Ecca • Elliot • Enon • Ghaap	• Kameeldoorns • Koegas • Kuibis • Matsap • Molteno • Prince Albert • Rietgat • Schmidtsdrif • Schwarzrand • Stalhoek • Sultanaoord • Tarkastad • Vryburg • Whitehill • Witteberg	High	feature

Feature Category/Factor	Source/Dataset	Features		Mapping Sensitivity	Feature/Buffer
Paleontological Heritage Resources - Medium sensitivity areas (**)	**Geological Features and Substrates of Palaeontological Importance, Geology Layer, 2014, Council for Geosciences**	• Achab • Allanridge • Bidouw • Bredasdorp • Ceres • Concordia • Granite • Dwyka • Fort Brown • Geselskapbank • Gladkop • Grahamstown • Hartebeest Pan • Granite • Hoogoor • Kalahari • Kamieskroon • Gneiss • Karoo Dolerite • Khurisberg	• Konkyp Gneiss • Kookfontein • Korridor • Mesklip Gneiss • Modderfontein • Granite/Gneiss • Naab • Nababeep Gneiss • Nakanas • Nardouw • Nuwefontein Granite • Rietberg Granite • Skoorsteenberg • Stinkfontein • Styger Kraal Syenite • Table Mountain • Tierberg • Volksrust • Waterford	Medium	feature

5.4.1.3 Environmental Sensitivity Map for the Final Pinch Point Analysis

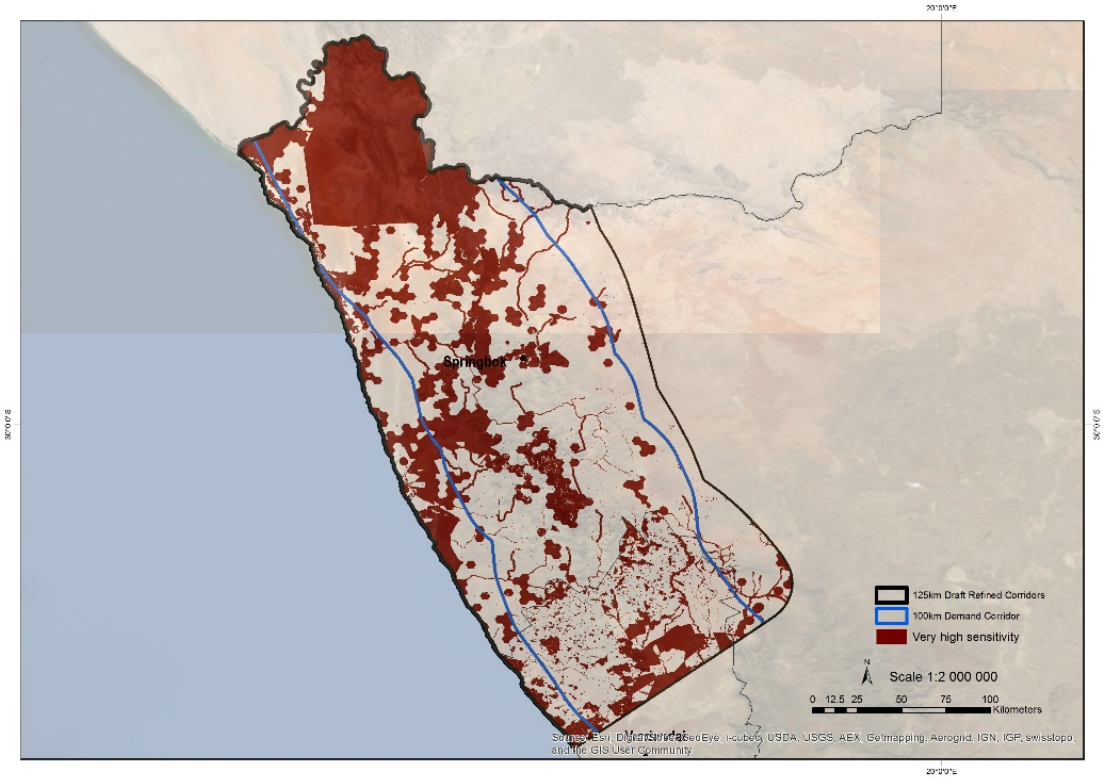
The features and datasets used to prepare the Environmental Sensitivity Map for the Final Pinch Point Analysis is included in Table 4 – these include the Very high sensitive features extracted from Table 3 as well as the Very High features identified through the specialist assessments. Maps 8a and 8b show the spatial footprint of the Very High sensitivity data from an environmental perspective within the 100 km wide Demand Mapping Corridors for the Expanded Western and Eastern EGI Corridors, respectively.

It must be re-iterated that High, Medium and Low sensitivity areas were not considered in the Final Pinch Point Analysis, based on the reasoning provided in Part 3 of the SEA Report.

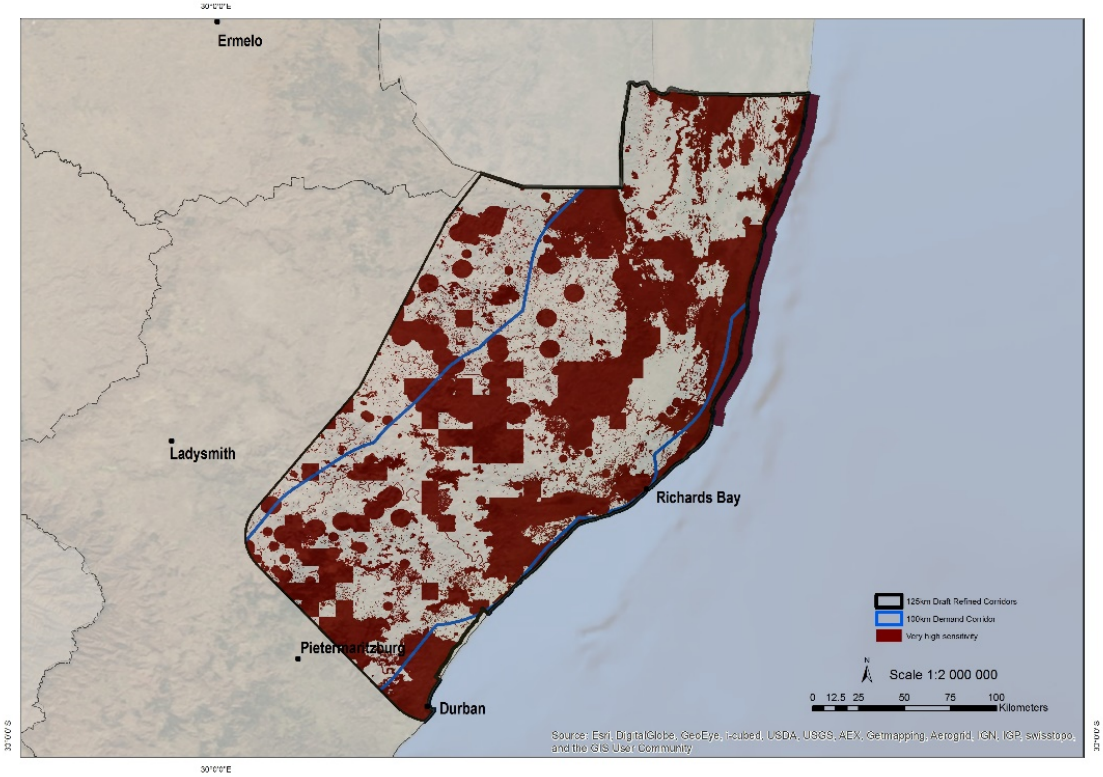
Table 4: Features and datasets used to prepare the Environmental Sensitivity Map for the Final Pinch Point Analysis

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
Source of Dataset: Updated Wall to Wall Environmental Sensitivities				
Protected Areas	South African Protected Areas Database (SAPAD) - Q4, 2018, South African National Parks (SANPARKS) And Provincial	National Parks	Very High	feature
		Nature Reserves	Very High	feature
		World Heritage Sites (Core)	Very High	feature
		Forest Nature Reserve	Very High	feature
		Forest Wilderness Area	Very High	feature
		Special Nature Reserve	Very High	feature
Natural Forests	National Forest Inventory (NFI), Sourced 2016, Department Of Agriculture, Forestry And Fisheries (DAFF)	National Forest Inventory	Very High	1km (Medium)
Agricultural Land Capability	Land Capability Layer, 2016, DAFF	Land Capability Features With Values ranging from 11-15	Very High	feature
Field Crop Boundaries	Field Crop Boundaries, 2017, DAFF	Irrigated Areas (Pivot Agriculture)	Very High	N/A
		Shadenet	Very High	feature
		Viticulture	Very High	feature
		Horticulture	Very High	feature
Coastline	Coastline, 2015, SANBI And Department of Rural Development and Land Reform	Buffered Coastline	Very High	1km
Square Kilometre Array (SKA) Area	SKA Core Area, 2017, from SKA via CSIR	SKA Study Area	Very High	feature
		SKA Telescopes With 20km Buffer	Very High	20km
Defence	Defence Data, 2017, South African National Defence Force	Forward Airfield	Very High	1km
		Air Force Bases	Very High	8km
		High Sites	Very High	1km
		Operational Military Bases	Very High	1km
		Military Training Areas	Very High	1km
		Bombing Ranges	Very High	28km
		Shooting Ranges	Very High	1 km

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
		Border Posts	Very High	1km
		Ammunition Depots	Very High	10 km
		All Other DOD Features (including Naval Bases, Housing, Offices etc.)	Very High	1km
Airports (Major, Landing Strips, Small Aerodromes)	REDZ 1 SEA Dataset And EGI SEA Dataset, 2017	Major Airports	Very High	8km
		Landing Strips	Very High	2km
Heritage	Mapped Heritage Features, SAHRA, 2018	World Heritage Sites (Core)	Very High	feature
		Grade I Sites	Very High	2km
		Grade II Sites	Very High	1km
		Ungraded	Very High	100m
		Battlefields (Grade IIIb)	Very High	5 km
Source Of Dataset: Specialist Assessments Outputs				
Nama And Succulent Karoo; And Desert Biomes	Specialist Studies	Sensitive features for the Nama and Succulent Karoo and Desert Biomes	Very High	feature
Fynbos Biome	Specialist Studies	Sensitive features for the Fynbos Biome	Very High	feature
Indian Ocean Coastal Belt Biome (IOCB)	Specialist Studies	Sensitive features for the IOCB Biome	Very High	feature
Grassland Biomes	Specialist Studies	Sensitive features for the Grassland Biome	Very High	feature
Savanna Biome	Specialist Studies	Sensitive features for the Savanna Biome	Very High	feature
Estuaries	Specialist Studies	Sensitive features for Estuaries	Very High	feature
Rivers And Wetlands	Specialist Studies (Masked with Land Cover (Non-Natural classes were masked only))	Sensitive features for Rivers and Wetlands	Very High	feature
Bats	Specialist Studies (Masked with Land Cover (Non-Natural classes were masked only))	Sensitive features for Bats	Very High	feature
Birds	Specialist Studies	Sensitive features for Birds	Very High	feature
Visual	Specialist Studies	Sensitive visual receptors and features	Very High	feature



Map 8a: Very High Sensitivity Environmental Features in relation to the 100 km wide Demand Mapping Corridor for the Expanded Western EGI Corridor.



Map 8b: Very High Sensitivity Environmental Features in relation to the 100 km wide Demand Mapping Corridor for the Expanded Eastern EGI Corridor.

5.4.2 Updated Engineering Constraints

Very High sensitivity data identified in the Engineering Constraints was also included in this step of the Final Pinch Point Analysis. This includes, but is not limited to, data relating to slopes, coastline, estuaries, gully erosion, mining and dams.

An updated list of the datasets used, as well as their corresponding sensitivities are included in Table 5 and has been spatially mapped in Map 9. Very High sensitive features were then extracted from this updated dataset contained in Table 5 for use in the Final Pinch Point Analysis (refer to Table 6). Map 10 shows a map of only the Very High sensitivity engineering features within the 100 km wide Demand Mapping Corridors.

5.4.3 Consolidation of Environmental Sensitivities and Engineering Constraints

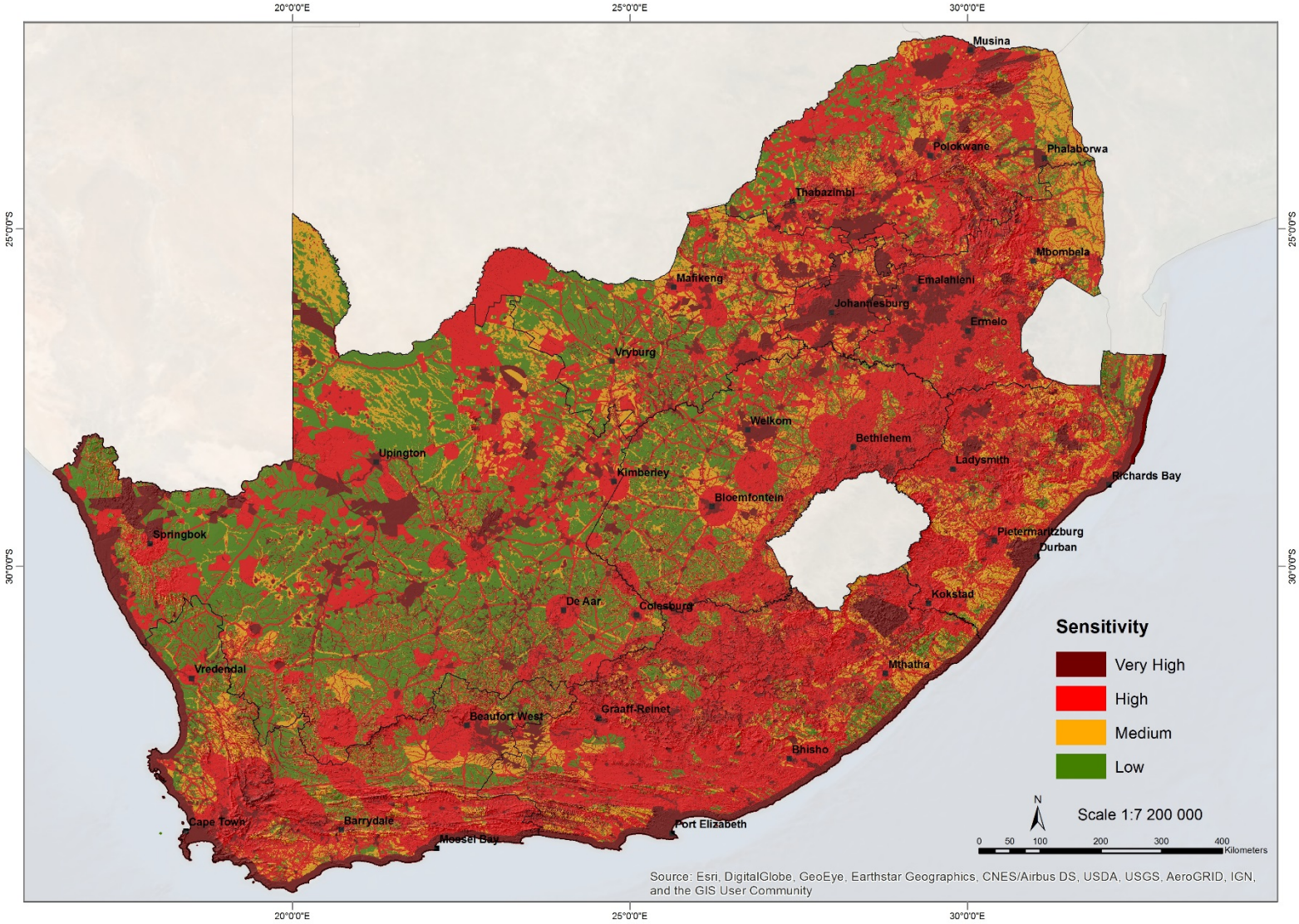
The Very High sensitivity features for both the engineering and environmental features within the 100 km wide Demand Mapping Corridors were then overlaid to identify where partial and complete pinch points are located. The combined engineering and environmental features are indicated in Map 11a for the Expanded Western EGI Corridor and in Map 11b for the Expanded Eastern EGI Corridor.

Table 5: Features and Data used to prepare the Updated Engineering Constraints Wall to Wall Map for the Final Pinch Point Analysis.

Factor To Include	Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)
Coastline (Including Estuaries)	SANBI 2004	Coastline & Estuaries	Very High	10 km
Slope	25m NGI DEM	>45◦	Very High	feature
		25-45◦	Low	feature
		15-25◦	Low	feature
		0-15◦	Low	feature
Access/Roads	NGI Roads Layer 2018	National and Provincial Roads	High	feature to 90 m
			Low (Nearest Mapped Road <2 km from site)	90 m to 2 km
		Other Roads	High	> 2 km
Geology	Council for Geoscience, 1997	Dolomite, Limestone and other Calcrete	High	feature
		Dolomite restricted to Gauteng and Mpumalanga	High	feature
Gully Erosion	DAFF, Gully Erosion	Footprint of erosion/gully > 500 m^2	High	feature
Soil Erosion	ARC, J le Roux, 2014	Distribution of sheet and rill erosions in South Africa	High	feature
Soil Erodibility	DAFF Soil Erosion Hazard Classes - South Africa and Lesotho, 2010	Hazard Class - High	High	feature
Settlements	AfriGIS Towns Layer	Towns, Villages And Settlement Spatial Footprints	Very High	feature
Railway Lines (All Railways)	DRDLR Topo, 2006 - Transnet	All	Medium	1 km
Industrial Areas	DEA, 2013/2014 Land Cover	Existing Industrial Areas	Low	feature
Industrial Expansion	SDFs, IDPs, and Consultation with Authorities	Planned Industrial Activities	Low	feature
Mining	DMR, 2018 (SAMRAD Mining Applications)	(Retention Permit, Reconnaissance Permission/Permit, Recon Permission, Prospecting Right, Prospecting Right Renewal, Mining Right, Mining	Very High	feature

Factor To Include	Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)
		Permit, Mining Right Renewal, Exploration Right, Burrow Pit, Amending an Existing Right)		
Landfill Sites	NGI, 2018	Digitised Landfill	High	feature
Major Dams	DWA Dams Data	Dams	Very High	feature
Wetlands	Wetland Data 2017	All Wetlands	Very High	feature
Rivers, Drainage Lines & Estuaries	NFEPA River Data 2010 and NGI mapped River Footprint Estuaries - National Biodiversity Assessment (NBA) 2017/18	Width > 500 m	Very High	feature
		Width Between 10 And 500 m	Low	feature
		Width <10 m	Low	feature
Rivers	NBA 2018 (South African Inventory of Inland Aquatic Ecosystems)	Valley Bottom Including Stream (Excluding Northern Cape)	Very High	feature
Wula Agreements	NFEPA River and Wetland Data 2010	Rivers And Wetlands	High	500 m buffer around feature
Water Stressed Catchments	South African Risk and Vulnerability Atlas, 2009	Water Stressed Catchments	Medium	feature
Natural Forests	Department of Agriculture, Forestry and Fisheries, 2017. NFI	Natural Forests	High	feature
Forestry Potential (Eastern Cape)	EC Parks and Tourism Agency 2014	Potential Areas For Forestry	Medium	feature
Thicket	Albany Thicket, SANBI Vegetation Map, 2017	National	High	feature
Sugar Cane	KZN Land Cover 2011 [Sugar cane farming and emerging farming data]	Sugar Cane Farm Boundaries	High	feature
Commercial Forestry	Data on Commercial Forestry provided by DAFF in June 2016	Daff Commercial Forests	High	feature
Field Crop Boundaries (Pivot >500 m Radius)	Agriculture Field Crop Boundary Data 2016	All	Very High	feature
Field Crop Boundaries (Vineyards And Orchards)	Agriculture Field Crop Boundary Data 2016	All	Very High	feature
High Incidence For Lightning Strikes	Eskom, July 2014	Highest 10% risk areas	Medium	feature
High Incidence For Fire	Eskom, November 2016 (2002-2017)	Highest 10% risk areas	Medium	feature
High Incidence For Wind	Eskom, July 2014	Highest 10% risk areas	Medium	feature

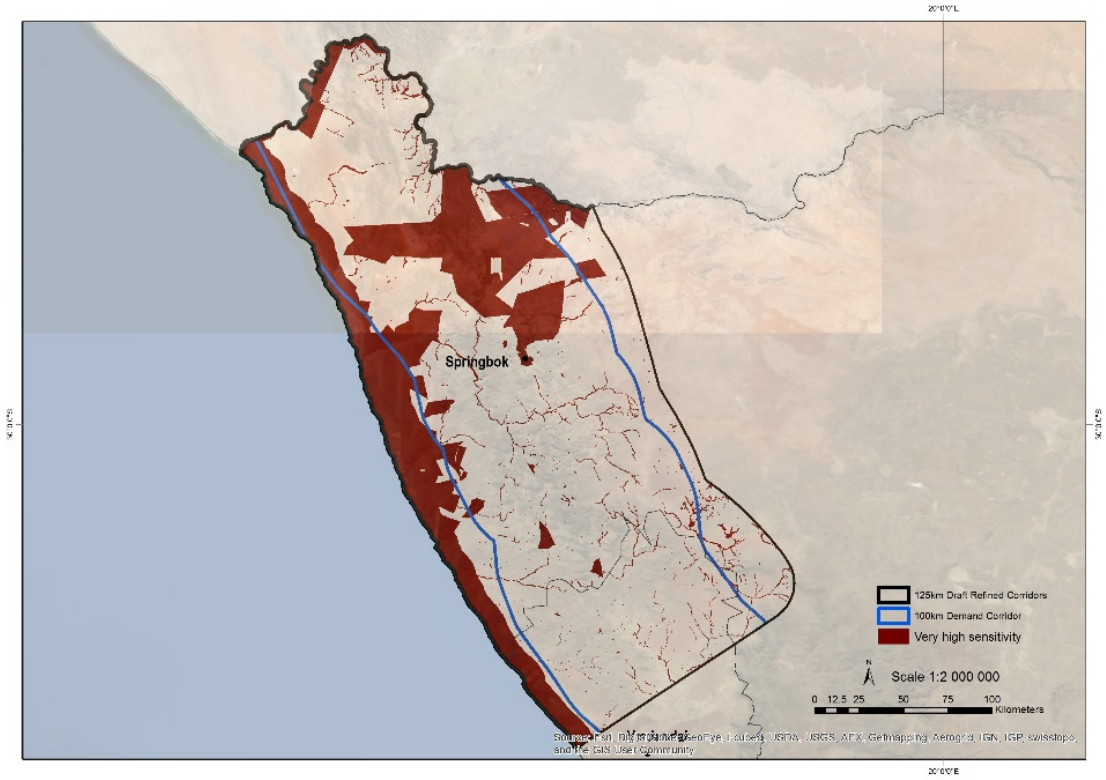
Factor To Include	Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)
High Incidence For Flooding	Eskom, 2015 (Sourced in 2018)	Highest 10% risk areas	Medium	feature
High Incidence For Snow Conditions	Eskom, July 2014	Highest 10% risk areas	High	feature
High Incidence For Pollution	Eskom, July 2014	Highest 10% risk areas	High	feature



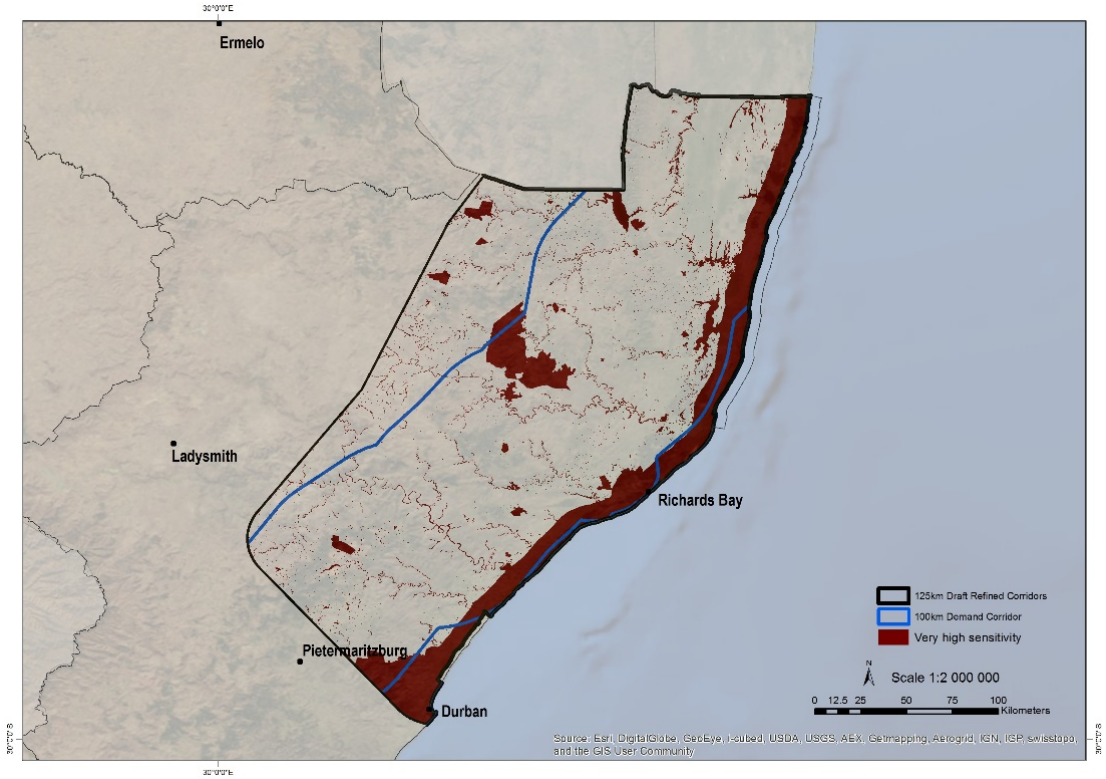
Map 9: Updated Draft Engineering Constraints Wall to Wall Map

Table 6: Features and datasets used to prepare the Engineering Constraints Map for the Final Pinch Point Analysis

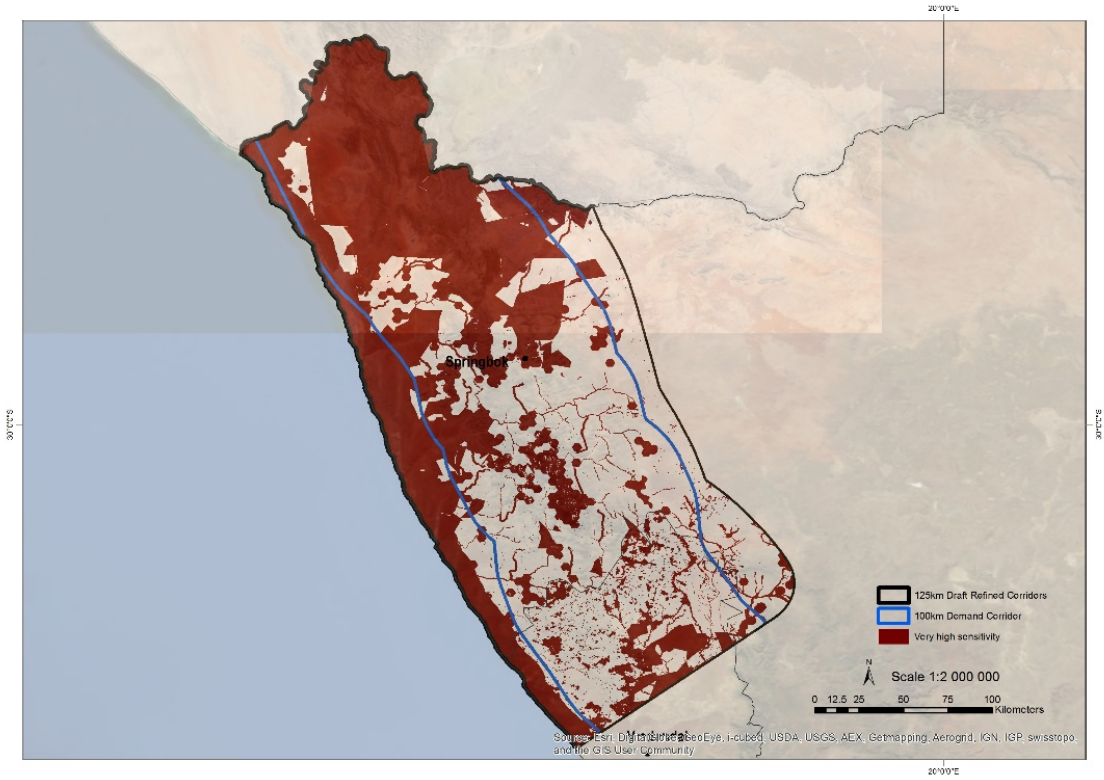
Factor to include	Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)
Coastline (including Estuaries)	SANBI 2004	Coastline & Estuaries	Very High	10 km
Slope	25m NGI DEM	>45◦	Very High	feature
Settlements	AfriGIS Towns Layer	Towns, Villages And Settlement Spatial Footprints	Very High	feature
Mining	DMR, 2018 (SAMRAD Mining Applications)	(Retention Permit, Reconnaissance Permission/Permit, Recon Permission, Prospecting Right, Prospecting Right Renewal, Mining Right, Mining Permit, Mining Right Renewal, Exploration Right, Burrow Pit, Amending An Existing Right)	Very High	feature
Major dams	DWS Dams Data	Dams	Very High	feature
Wetlands	Wetland Data 2017	All Wetlands	Very High	feature
Rivers, Drainage Lines & Estuaries	NFEPA River Data 2010 and NGI Mapped River Footprint Estuaries: National Biodiversity Assessment (NBA) 2017/18	Width > 500 m	Very High	feature
Rivers	NBA 2018 (South African Inventory of Inland Aquatic Ecosystems)	Valley Bottom including Stream (Excluding Northern Cape)	Very High	feature
Field Crop Boundaries (Pivot >500 m radius)	Agriculture Field Crop Boundary Data 2016	All	Very High	feature
Field Crop Boundaries (Vineyards and Orchards)	Agriculture Field Crop Boundary Data 2016	All	Very High	feature



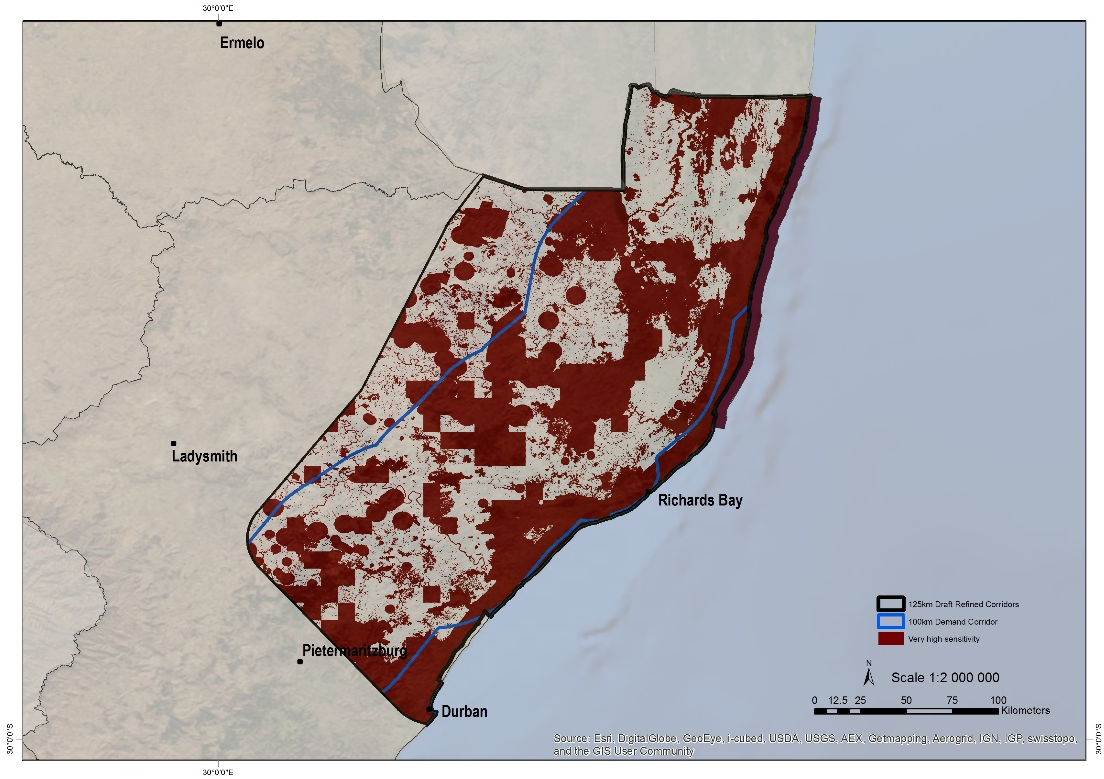
Map 10a: Very High Sensitivity Engineering Constraints in relation to the 100 km wide Demand Mapping Corridor for the Expanded Western EGI Corridor.



Map 10b: Very High Sensitivity Engineering Constraints in relation to the 100 km wide Demand Mapping Corridor for the Expanded Eastern EGI Corridor.



Map 11a: Combined Very High Sensitivity Environmental and Engineering Features in relation to the 100 km wide Demand Mapping Corridor for the Expanded Western EGI Corridor.



Map 11b: Combined Very High Sensitivity Environmental and Engineering Features in relation to the 100 km wide Demand Mapping Corridor for the Expanded Eastern EGI Corridor.

5.5 Identification of Pinch Points

The following pinch point was identified based on the **Very High** Environmental Sensitivities and Engineering Constraints:

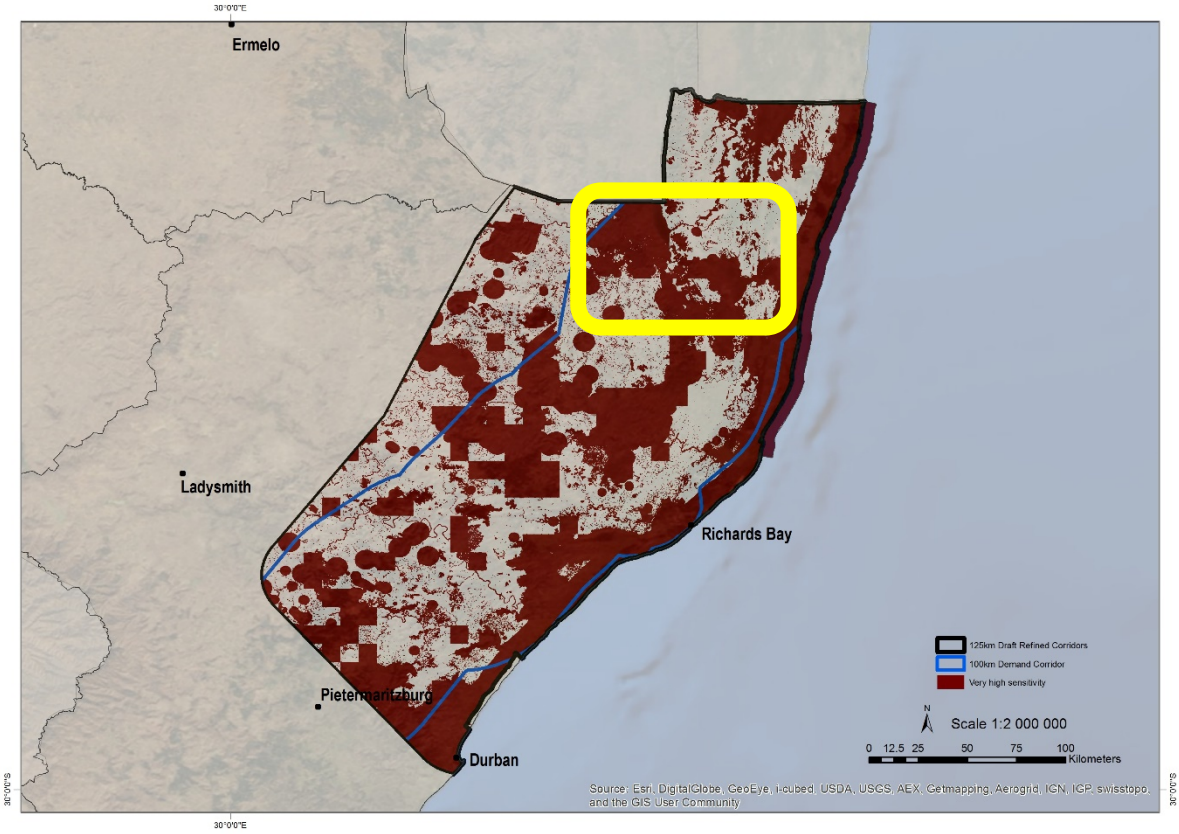
- Pinch Point 1: Expanded Eastern EGI Corridor in the northern extent of KwaZulu-Natal.

For the Expanded Western EGI Corridor, there were no complete environmental and engineering pinch points and as a result, the footprint of the 100 km wide Demand Mapping Corridor did not change. The pinch points are further described below.

5.5.1 Pinch Point 1: Expanded Eastern EGI Corridor

One pinch point was identified in the Expanded Eastern EGI Corridor (Map 12). The main constraints influencing the pinch point included the following:

- Locations of Lake Sibayi Fresh Water Reserve, iSimangaliso National Park, Hluluwe-uMfolozi Game Reserve, Tembe Elephant Park, and Silezi, Mkuzi and Ndume Nature Reserves;
- Very High sensitivity freshwater quinaries based on the Wetland and Rivers Assessment (Appendix C.1.6 of the EGI Expansion SEA Report);
- Estuaries based on the Estuaries Assessment (Appendix C.1.5 of the EGI Expansion SEA Report);
- Nesting and habitat sites for birds as identified in the Avifauna Assessment (Appendix C.1.7 of the EGI Expansion SEA Report);
- Ecoregions for bats as identified in the Bat Assessment (Appendix C.1.8 of the EGI Expansion SEA Report);
- Areas of Very High sensitivity included in the Indian Ocean Coastal Belt Biome Assessment, Avifauna Assessment, and Bat Assessment (Appendix C.1.3; Appendix C.1.7; and Appendix C.1.8 of the EGI Expansion SEA Report),
- World Heritage Sites;
- Ungraded heritage sites;
- Forests;
- Coastline;
- Towns; and
- Major dams.



Map 12: Location of the Pinch Point in Northern KwaZulu-Natal in the Expanded Eastern EGI Corridor in relation to the 100 km wide Demand Mapping Corridors (in blue) and Draft Refined 125 km wide Corridors (in black).

5.6 Step 3: Identification of Final Expanded EGI Corridors

Based on the pinch points identified in Section 5.5 of this chapter, the 100 km wide Demand Mapping Corridors were shifted at two places and re-aligned in order to identify the **Final 100 km wide Expanded Eastern EGI Corridor (Map 13).**

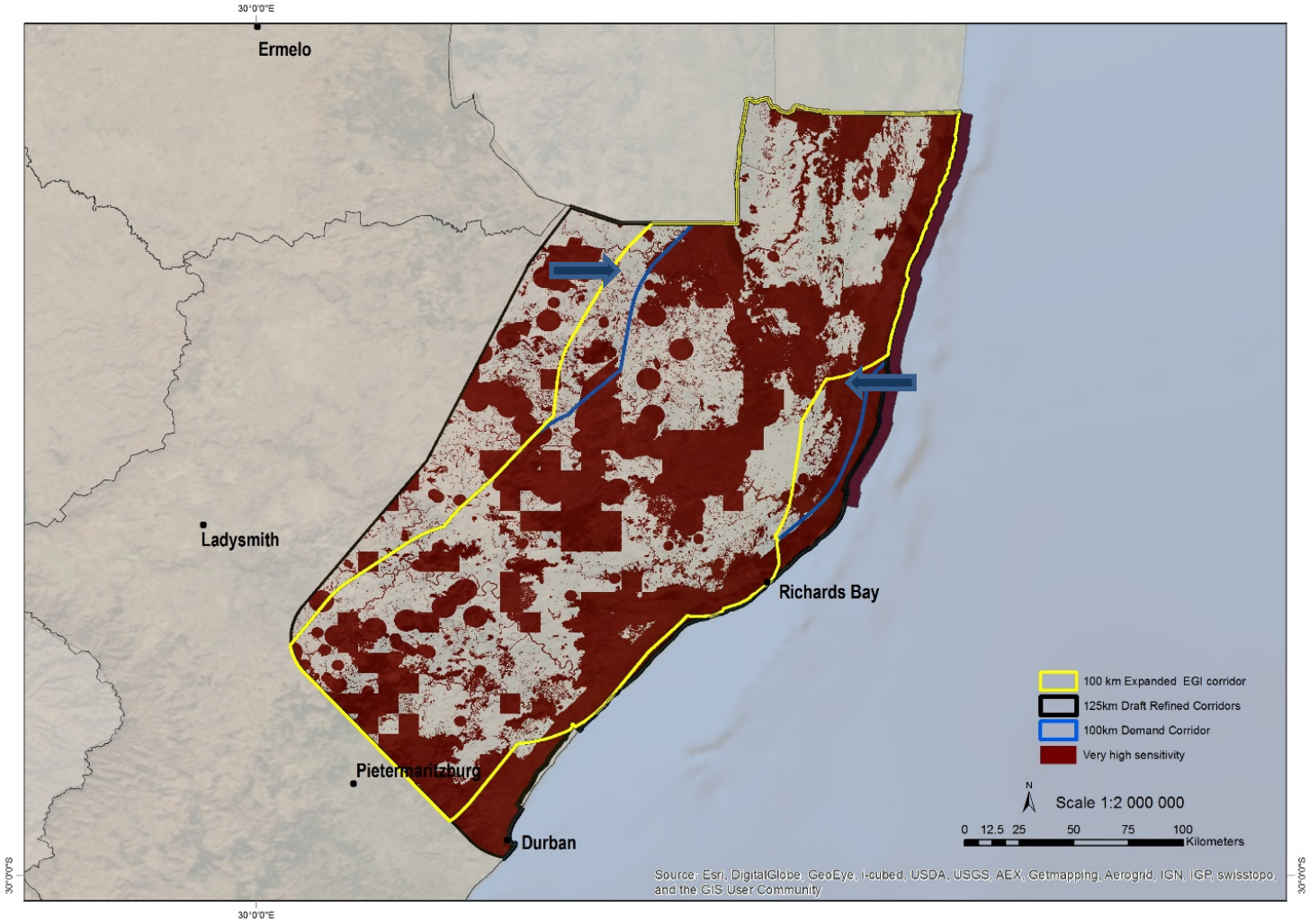
Map 14 illustrates the **Final 100 km wide Expanded Western EGI Corridor** shown in yellow, and the Draft Refined 125 km Corridors shown in black, which have been overlaid on the Very High environmental and engineering sensitivity features.

Map 15 illustrates the **Final 100 km wide Expanded EGI Corridors** that have been identified following the Final Pinch Point Analysis, which will be recommended for gazetting.

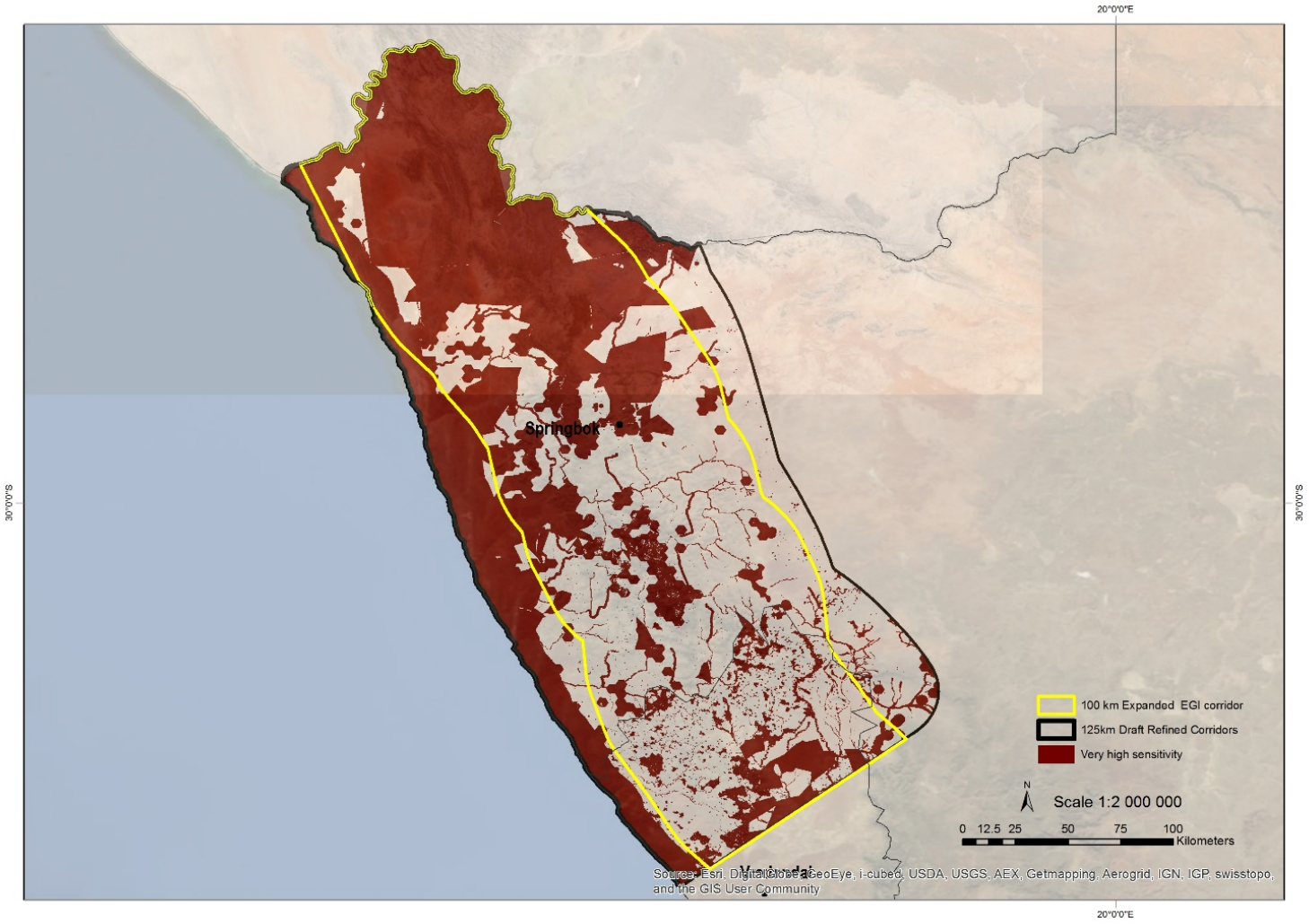
5.7 Conclusion

Map 16 illustrates the **Final 100 km wide Expanded EGI Corridors** that will be submitted for gazetting, overlaid with the five gazetted EGI corridors. Maps 17 and 18 respectively illustrate the Environmental Sensitivity and Engineering Constraints of the **Final 100 km wide Expanded EGI Corridors**.

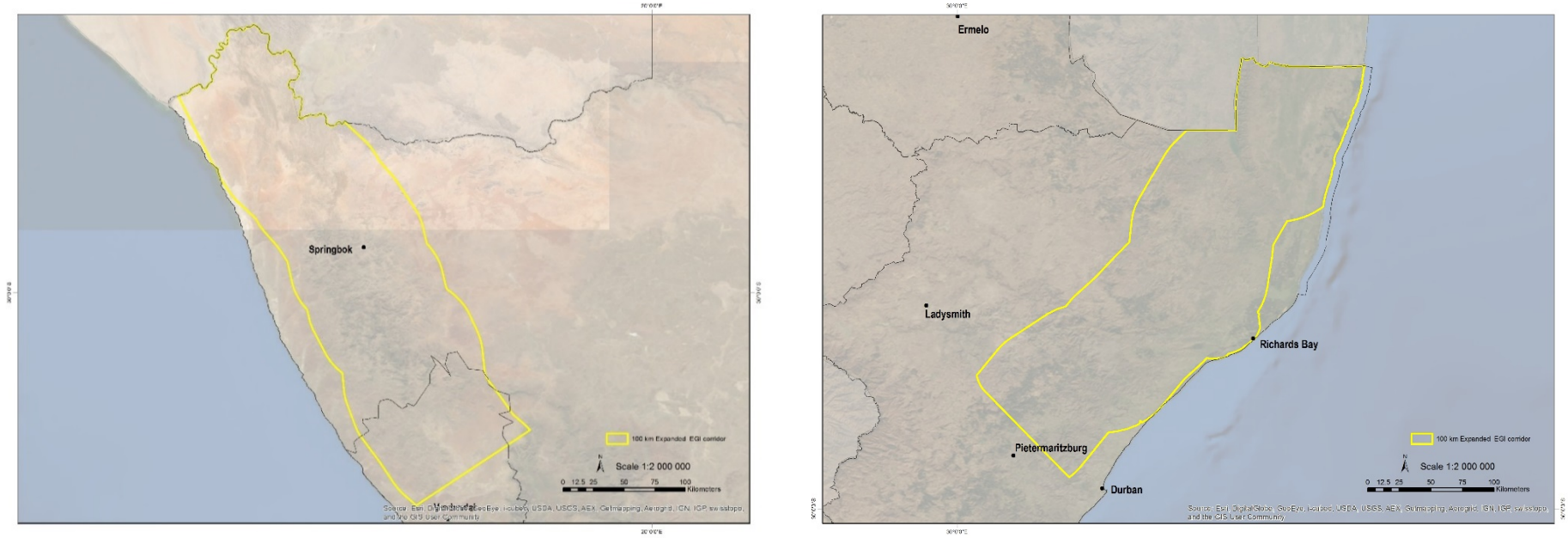
This serves as the concluding point of the SEA Process. The next step in Phase 5 of the SEA is to gazette the outputs of the SEA, which will be undertaken by the DEA. The outputs of the SEA, such as the Standard and Protocol, will be gazetted for comment prior to being gazetted for implementation. Stakeholders are encouraged to review these documents when they are made available for comment.



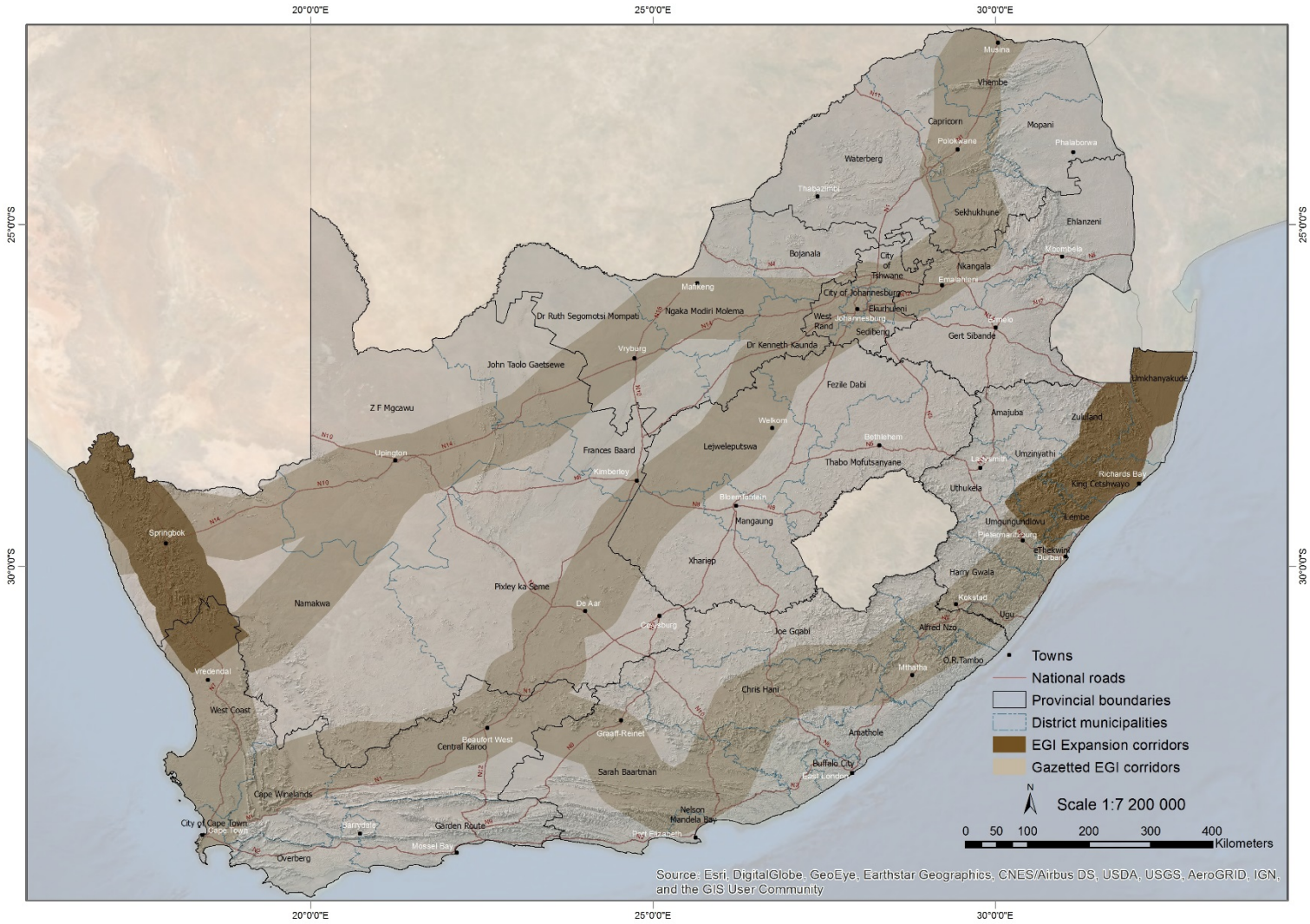
Map 13: Final 100 km wide Expanded Eastern EGI Corridor (in yellow) and the location of the Pinch Point in Northern KwaZulu-Natal in relation to the 100 km wide Demand Mapping Corridors (in blue) and Draft Refined 125 km wide Corridors (in black).



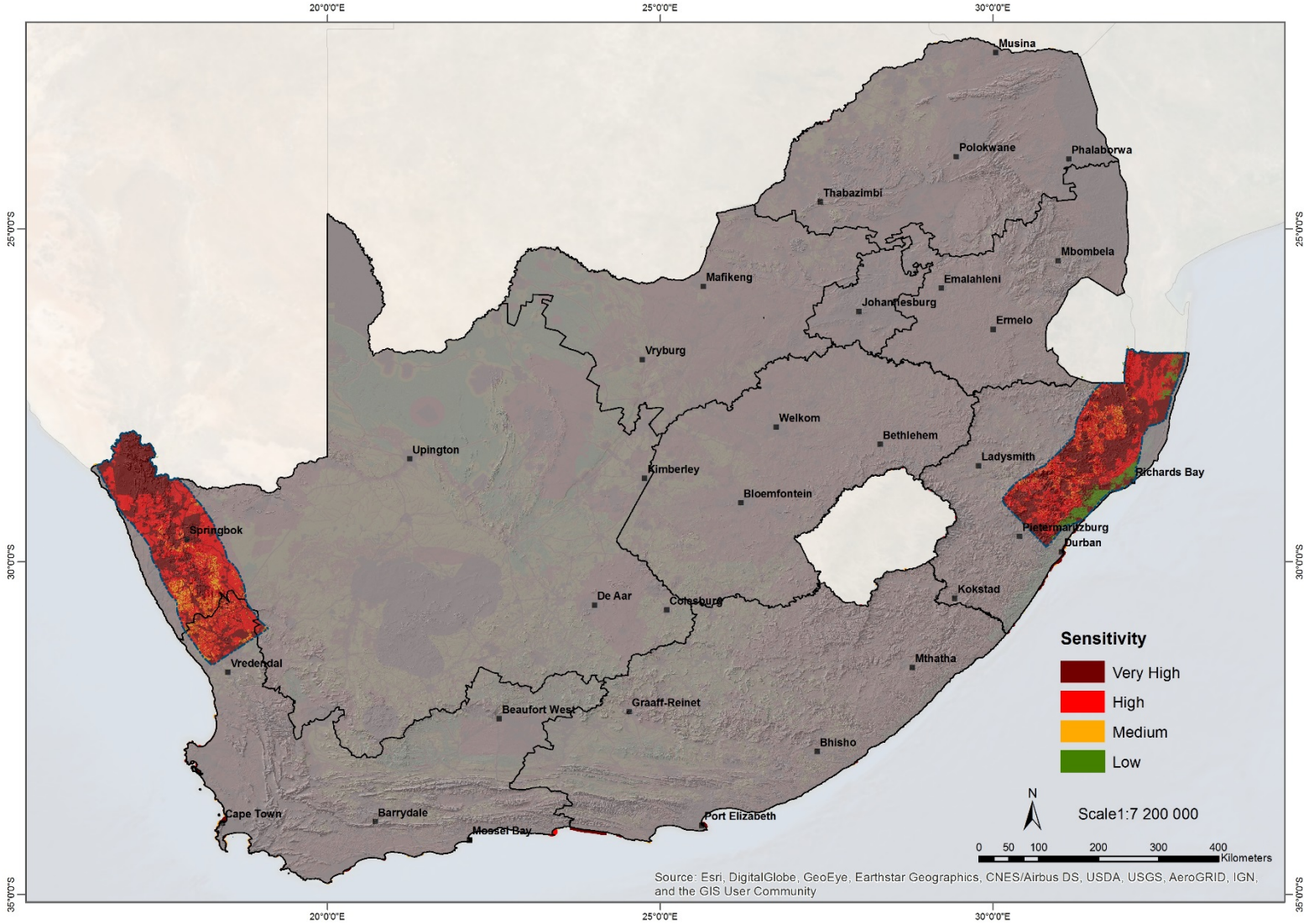
Map 14: Final 100 km wide Expanded Western EGI Corridor (in yellow) in relation to the Draft Refined 125 km wide Corridor (in black) and the Very High Sensitivity Environmental and Engineering Constraints.



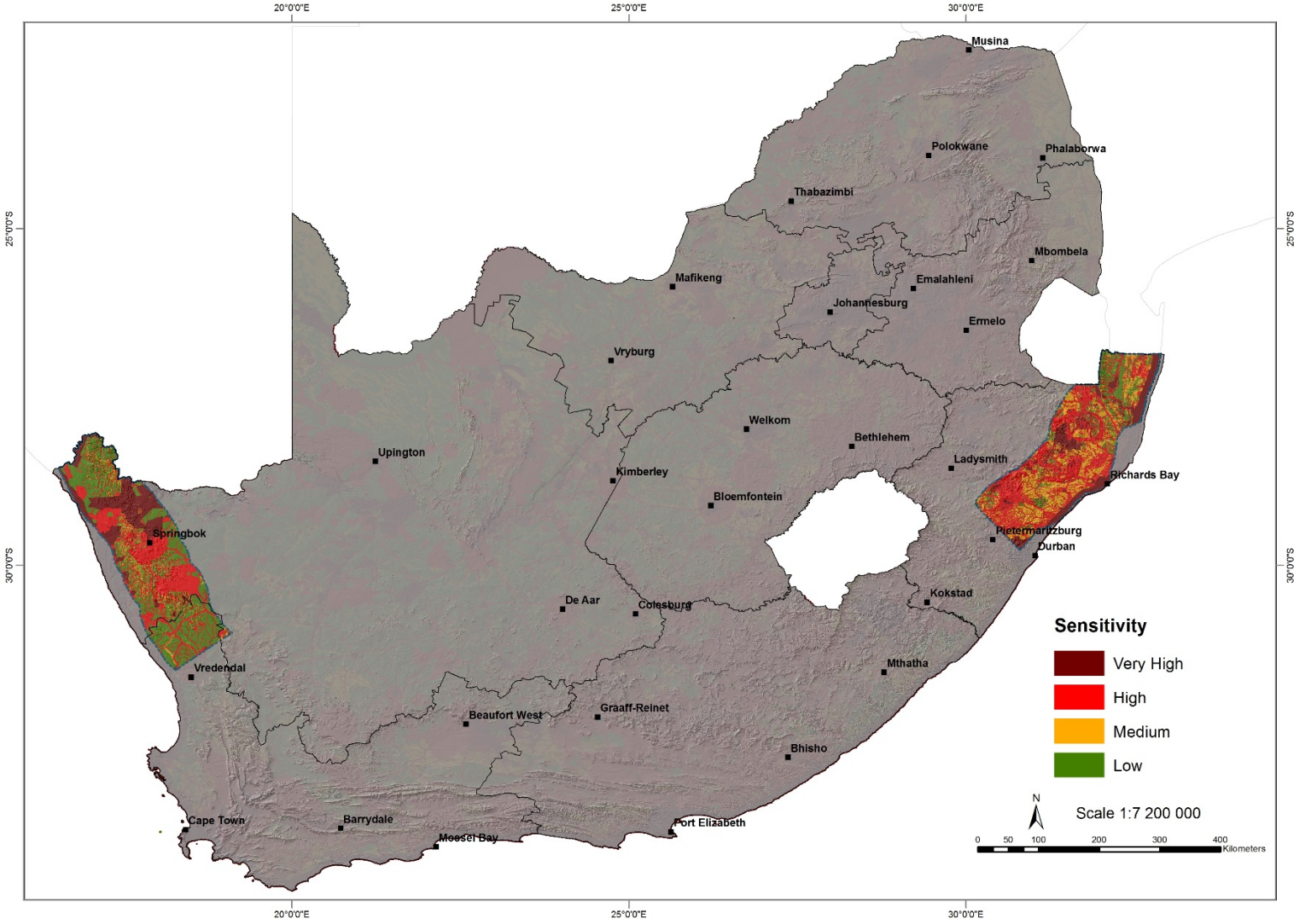
Map 15: Final 100 km wide Expanded Western and Eastern EGI Corridors for Gazetting.



Map 16: Final 100 km wide Expanded Western and Eastern EGI Corridors for Gazetting, shown in relation to the five gazetted EGI Corridors.



Map 17: Environmental Sensitivity of the Final 100 km wide Expanded Western and Eastern EGI Corridors for Gazetting.



Map 18: Engineering Constraints of the Final 100 km wide Expanded Western and Eastern EGI Corridors for Gazetting.

Appendix 5.1 – List of Features Used in the Demand Mapping Exercise

EGI Demand Mapping Category	Feature Mapped	Source and Date	Scale	Additional notes
Agriculture	Agricultural areas	uMlalazi Local Municipality Spatial Development Framework (SDF), June 2018	uMlalazi Local Municipality	
Agriculture	Agricultural areas	KwaZulu-Natal Provincial SDF (PSDF), KZN Co-operative Governance and Traditional Affairs (COGTA), February 2019	KwaZulu-Natal	
Agriculture	KZN Agricultural areas		KZN	Includes commercial farming, semi and intensive farming, and agricultural investment areas
Agriculture	Northern Cape Agricultural areas		Northern Cape	Includes the Namakwa District Municipality Agri-Park, Agri-Hubs, Agricultural Potential, Wildlife Nodes, and Agricultural Areas
Agriculture	Western Cape Agricultural areas		Western Cape	Includes intensive farming, and agricultural significance areas
Industry	Industrial areas	uMlalazi Local Municipality SDF, June 2018	uMlalazi Local Municipality	
Industry	Draft Aquaculture Development Zones	Aquaculture Strategic Environmental Assessment (SEA), January 2019	National	
Industry	Special Economic Zone	Northern Cape PSDF, January 2019	Northern Cape	
Industry	Western Cape industrial development points	Western Cape PSDF	Western Cape	
Industry	Industrial Development Zone	Richards Bay, February 2019	Richards Bay	
Industry	Industrial areas	PSDF COGTA, February 2019	KwaZulu-Natal	
Industry	Industrial areas	Saldanha LM feedback	Saldanha Bay Local Municipality	
Industry	Future activities	Sarah Baartman District Municipality, June 2018	Sarah Baartman District Municipality	
Industry	Sunbird energy approved project area	Sunbird Energy, May-19	Western Cape, Local scale	

EGI Demand Mapping Category	Feature Mapped	Source and Date	Scale	Additional notes
Industry	Renewable Energy Zones	Northern Cape Province CPA project business proposal, December 2018	Northern Cape	
Industry	Proposed Projects	Pixley Ka Seme District Municipality, September 2018	Pixley Ka Seme District Municipality	
Industry	Renewable Energy Development applications	EGIM, Department of Environmental Affairs, Q2, 2019	National	
Industry	Industrial Development Zone	Richards Bay, February 2019	Richards Bay	Includes phases 1A-F and 2A
Mining	Mining areas	PSDF COGTA, February 2019	KwaZulu-Natal Province	
Mining	Mining areas	Northern Cape PSDF, 2017	Northern Cape	
Future demand data	ESKOM Maximum Demand at MTS for 2017	ESKOM, March 2019	National	
Future demand data	Mapped 5-30 year energy demand from the 2016 EGI SEA	June 2015	National	Includes future energy generation from industry and demand from bulk energy users
Transport	Planned transport routes	NC and KZN PSDF	Provincial	
Transport	Roads (under construction, planned and scheduled)	Western Cape Transport Department, May, 2019	Western Cape Province	
Transport	Road Network in KZN	KwaZulu-Natal Department of Transport, February 2019	KwaZulu-Natal Province	Includes proposed road network in the vicinity of King Shaka International Airport
Transport	Department of Transport structure and services	KwaZulu-Natal Department of Transport, January 2019	KwaZulu-Natal Province	