ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL EIA REPORT

PROPOSED AGGENEIS – ORANJEMOND 400kV TRANSMISSION LINE AND SUBSTATIONS UPGRADE, NORTHERN CAPE PROVINCE

(DEA Ref No: 12/12/20/2041)

FINAL EIA REPORT
NOVEMBER 2011

Prepared for:

Eskom Transmission: Lands and Rights

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PROJECT DETAILS

DEA Reference No.	:	12/12/20/2041
Title	:	Environmental Impact Assessment Process Draft Environmental Impact Assessment Report: Proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substations Upgrade
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Client	:	Eskom Transmission
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Review Period	:	22 September 2011 – 22 October 2011

When used as a reference this report should be cited as: Savannah Environmental (2011) Draft Environmental Impact Assessment Report: Proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substations Upgrade Project.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

If Eskom Transmission is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis, in support of the generation processes. It is vital that transmission capacity keeps up with both electricity generation capacity and electricity demand. In terms of the network reliability criteria, as approved by the NERSA in March 2008, compliance to the N-1 criterion is required.

Therefore, Eskom Transmission is proposing the establishment of a new 400kV power line between the Aggeneis and Oranjemond Substations over an approximate distance of 240km in the Northern Cape Province. This project includes the construction of the following components:

» Construct a 400kV transmission line over a distance of 240km from Aggeneis to Oranjemond.
» Extend the HV yards at both the Aggeneis and Oranjemond substations
  * Establish 4x400kV feeder bays at the Aggeneis substation
  * Establish 2x220kV feeder bays at the Aggeneis substation
  * Establish 1x220kV feeder bay at the Oranjemond substation

Eskom has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Draft Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

» **Chapter 1** provides background to the proposed Aggeneis Oranjemond 400kV line and substation upgrade project and the environmental impact assessment process
» **Chapter 2** provides an overview of the proposed project
» **Chapter 3** outlines the process which was followed during the EIA Phase of the EIA process
» **Chapter 4** provides a description of the biophysical and socio-economic environment which may be potentially affected by the proposed project
» **Chapter 5** provides an assessment of the potential impacts associated with the proposed Aggeneis-Oranjemond 400kV power line and substations upgrade project, including a comparative assessment of the identified alternative transmission line corridors

» **Chapter 6** presents the conclusions and recommendations of the EIA and an Impact Statement on the proposed project.
» **Chapter 7** provides a list of references and information sources used in undertaking the studies for this EIA Report

The EIA Phase addressed the identified potential environmental impacts and benefits (direct, indirect, and cumulative impacts) associated with all phases of the project including design, construction, and operation. The EIA Phase recommends appropriate mitigation measures for potentially significant environmental impacts.

The EIA report aims to provide sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority (i.e. the National Department of Environmental Affairs (DEA)) to make an informed decision regarding the proposed project.

The release of a draft Environmental Impact Assessment Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final Environmental Impact Assessment Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

PUBLIC REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The Draft Environmental Impact Assessment Report was made available for public review from **22 September 2011 – 22 October 2011** at the following public places in the project area:

» www.savannahsa.com
» Aggeneys Public Library
» Springbok Public Library
» Steinkopf Public Library
» Port Nolloth Public Library
» Alexander Bay Public Library

In accordance with the EIA Regulations, a primary purpose of the Draft Environmental Impact Assessment Report was to provide stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study, and to raise any additional key issues for consideration. This Final Environmental Impact Assessment Report

incorporates all issues and responses received prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

PUBLIC MEETINGS

In order to facilitate comments on the draft Environmental Impact Assessment Report and provide feedback of the findings of the studies undertaken, various public meetings were held at the following proposed locations from the 3-7th October 2011:

» Aggeneys
» Springbok
» Port Nolloth
» Alexander Bay

The dates and venues were advertised and registered interested and affected parties were invited to attend these public meetings in writing.

EXECUTIVE SUMMARY

Background and project overview

Eskom Holdings Ltd is responsible for the provision of reliable and affordable power to its consumers in South Africa. Electricity cannot be stored and therefore must be used as it is generated. It is, therefore, required that electricity must be efficiently transmitted from the point of generation to the end user.

If Eskom Transmission is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis, in support of the generation processes. Eskom is currently responding to the growing electricity demand and predicted future demand within South Africa through the establishment of new generation and transmission capacity in South Africa.

A large part of Namaqualand is supplied via the Nama Substation, Gromis Substation and Oranjemond Substation. The 220kV line from Aggeneis to Nama, Nama to Gromis and Gromis to Oranjemond is supplying most of the area around the Namaqualand area. It is the only main feeds to Nama Substation, Gromis Substation and Oranjemond Substation. The network around the listed three substations cannot be back-fed as they are not connected to any network. Outages can therefore not be avoided when the Aggeneis-Nama 220kV line is lost.

In response to the growing electricity demand within the Northern Cape and to address current supply problems in the area, Eskom Holdings Limited is proposing the establishment of a new 400kV transmission line which will connect the Aggeneis and Oranjemond substations over an approximate distance of 240km.

The proposed project includes the expansion of the existing Aggeneis and Oranjemond substations in order to accommodate the new transmission line. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. The entire study site is located within the Eskom Western Grid and forms part of the Northern Cape Strengthening project.

The purpose of the proposed project is to:

- Improve the reliability of the existing Western grid Transmission network.
- Ensure that transmission capacity keeps up with both electricity generation capacity and electricity demand.
- Create additional Transmission network capacity to be able to

supply the increasing electricity demand.

Four alternative Transmission line development corridors have been considered within this EIA process in order to link the existing Aggeneis and Oranjemond substations.

Environmental Impact Assessment

The proposed Aggeneis-Oranjemond 400kV Transmission Power line Project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in June 2010 in terms of Section 24(5) of the National Environmental Management Act (NEMA, 1998, Act No 107). This section provides a brief overview of EIA Regulations and their application to this project. In terms of sections 24 and 24D of NEMA, as read with Government Notices R543 and R545, a Scoping and EIA process is required to be undertaken for this proposed project.

The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been acknowledged by DEA (under Application Reference number **12/12/20/2041.** Through the decision-making process, DEA will be supported by the Northern Cape Department of Environment and Nature Conservation (DENC) as the commenting authority.
This report documents the potential environmental impacts of the proposed construction, operation and decommissioning of the proposed new 400kV transmission power line and substations upgrade. This was achieved through an evaluation of the proposed project involving specialists (with expertise relevant to the nature of the project and the study area), the project proponent, as well as a consultation process with key stakeholders (including relevant government authorities) and interested and affected parties (I&APs).

This EIA study forms part of the EIA process and was conducted in accordance with the requirements of the EIA regulations in terms of section 24(5) of NEMA (Act No 107 of 1998).

The chapters which follow together with the specialist studies contained within Appendices F - J provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project.

Evaluation of the Proposed Project

As part of its capacity expansion and grid strengthening programme, Eskom Transmission is proposing the Northern Cape Strengthening Project, which includes the new proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substations Upgrade. This project is proposed to include the establishment of a new 400kV Transmission line between the

Aggeneis and Oranjemond Substations in the Northern Cape Province, as well as the expansion of both substations to accommodate the new power line. The new power line would be approximately 240 km in extent, depending on the final alignment of the power line.

The transmission power line alternatives proposed for the Aggeneis-Oranjemond 400kV Transmission power line cross various habitat sensitivity classes and potentially impacts on numerous land uses and communities. From the conclusions of all specialist studies undertaken a number of impacts of high significance have been identified which renders certain corridors to be less desirable than others.

» From an Ecological perspective, all four corridors are acceptable, with Corridor 3 being the most preferred. Corridor 1 is the least preferred although it is still viewed as being acceptable.
» From an avifauna perspective, Corridor 1 is the most preferred option. Corridor 2, 3 and 4 re considered acceptable and could also be considered for the proposed Transmission power line. Even though Corridor 3 is the least preferred option, it could still be considered due to no fatal flaws having been identified, provided that the necessary mitigation measures are implemented in terms of the findings of the Avifaunal Impact Assessment. .
» In terms of the Visual Impact Assessment, Corridor 4 is viewed as the most preferred option and Corridor 1 as the least preferred option. Corridor 3 is the second preferred option, while Corridor 2 is the third preferred option.
» The most preferred corridor identified by the Heritage specialist is Corridor 3, with Corridor 4 being the least preferred. All corridors could, however, be considered with the implementation of appropriate mitigation measures.
» It was recommended in the Social Impact Assessment that any of the four corridors could be implemented. However Corridor 3 was still elected as being the most preferred option.

From the above, it can be concluded that, although all corridors investigated could be considered environmentally acceptable with the implementation of appropriate mitigation measures, **Corridor 3 is the most preferred option** from an environmental perspective, followed by Corridor 2. From a technical and economic perspective, however, Corridor 4 is considered to be the preferred option as this alternative largely avoids the mountainous areas which would pose technical constraints from a design, construction and operations perspective. However, should Corridor 4 be selected as the overall preferred option, then this will

require extensive mitigation on the escarpment area to the west of Steinkopf, to ensure that there are no direct impacts on the Anenous Pass, "Meulpad", old railway line or any other pre-colonial or colonial heritage resources which are concentrated in this area. This will require a walk down of the proposed location of the transmission lines and micro-siting of the towers to ensure that impacts are minimised.

It is considered vital that construction of the power line within the authorised corridor take the recommended conditions identified by the specialist studies into account. In addition, should the project be authorised by DEA, the final routing of the power lines within this corridor should be undertaken in consultation with the affected landowners and the following specialists:

» Biodiversity specialist
» Avifauna specialist
» Heritage specialist

In addition, once the final transmission power line alignment has been negotiated and the tower positions surveyed and pegged, a walk-though survey must be undertaken by these specialists in order to minimise potential environmental impacts associated with the proposed project.

Overall Conclusion (Impact Statement)

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» Although some impacts of potential high significance are associated with the proposed Aggeneis-Oranjemond 400 kV Transmission Line and Substation Upgrade Project, there are no environmental fatal flaws that should prevent the proposed line from being constructed provided that the recommended mitigation measures are implemented.
» From an environmental perspective, it is recommended that the **Oranjemond Substation** be expanded towards the east or west within the existing substation site, but not to the north, where a small koppie shields the site from the Orange River.
» Although all corridors are considered acceptable from an environmental perspective (provided appropriate mitigation is implemented), **Corridor 3** is nominated as the preferred option for the construction of the proposed Transmission line, followed by Corridor 2.
» The significance levels of the majority of identified negative impacts can be minimised by

implementing the recommended mitigation measures.

Overall Recommendation

Based on the nature and extent of the proposed project, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Aggeneis-Oranjemond 400 kV Line and Substation Upgrade Project be authorised by DEA to include the following:

» Construction of the new Aggeneis-Oranjemond 400 kV Transmission line within **Corridor 3**. Eskom must negotiate the most appropriate route within this corridor with the affected landowners.
» Expansion of the **Oranjemond Substation** to take place towards the east or west within the existing substation site, but not to the north, where a small koppie shields the site from the Orange River.

The following conditions of this recommendation must be included within the authorisation issued:

» All mitigation measures detailed within this report and the specialist report contained within Appendices F to J must be implemented.
» The draft Environmental Management Programme (EMP) as contained within Appendix K of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed Aggeneis-Oranjemond 400 kV Line and Substation Upgrade Project, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Applications for all other relevant and required permits required to be obtained by Eskom must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site and disturbance of protected vegetation.
» An ornithologist must identify the exact power line spans requiring marking in order to minimise the risk of collision of birds with the earth wire. Install suitable anti-collision marking devices on earth wires as per Eskom Transmission guidelines, on high risk sections of line as identified during the avifaunal walk through. Recommendations must be made regarding the installation of Bird Guards on all self-supporting towers according to the existing Eskom guidelines. This will prevent birds from

perching in high risk areas on the towers directly above live conductors.

» An ecological specialist must conduct a final walkthrough before construction in order to identify and relocate any possible plant species of conservation importance as well as the location and number of protected tree species. If any populations of species of concern are encountered, then the individual tower structure must be shifted to avoid striking the specific habitat of concern.

» A heritage specialist must conduct a final walkthrough before construction in order to identify any important heritage resources. Transmission lines can be rerouted or realigned in order to avoid heritage sites and heritage resources can be conserved unaffected underneath power lines. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.

» Eskom must consult with the Northern Cape Heritage Authority regarding the crossing of the Richtersveld World Heritage Site.

» As far as possible, modify the alignment of the power line to keep it outside the boundaries of any affected reserves / parks.

» Before construction, demarcate the approved servitude and ensure that construction impacts are contained within this area.

» Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld.

» Where possible, position infrastructure so that individuals of protected trees are not affected.

» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.

» Mitigation of the visual impact though conventional visual impact mitigation measures (i.e. vegetation screening, landscaping or design) is highly unlikely to succeed due to the inherent functional design of the substation structures and transmission line infrastructure. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.

» The process of communication and consultation with the community representatives must be maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project

CONTENT OF THIS FEIR

The National Environmental Management Act (No. 107 of 1998 – NEMA) sets out the requirements for the environmental authorisation process. EIA Regulations R543, R544, and R545 published under NEMA stipulate the various activities that require a basic assessment or full scoping and an EIA process. The table below indicates the requirements for an environmental impact assessment report, as well as the requirements for the public participation process.

NEMA REGULATION 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS ENVIRONMENTAL IMPACT ASSESSMENT REPORT
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Refer to Section 1.6
(b) a detailed description of the proposed activity	Refer to Chapter 1 and Chapter 2
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity;	Refer to Chapter 1 and Chapter 2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Refer to Chapter 4
(e) details of the public participation process conducted in terms of subregulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	Refer to Chapter 3 and Appendix E
(f) a description of the need and desirability of the proposed activity;	Refer to Chapter 1
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Refer to Chapter 2

NEMA REGULATION 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS ENVIRONMENTAL IMPACT ASSESSMENT REPORT
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Refer to Section 3.3.5
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Refer to Chapter 5
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Refer to Chapter 5 and Appendix F – J.
(k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Refer to Chapter 5
(l) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated;	Refer to Chapter 5
(m) a description of any assumptions, uncertainties and gaps in knowledge	Refer to Chapter 5
(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Refer to Chapter 6
(o) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Refer to Chapter 6
(p) a draft environmental management programme containing the aspects contemplated in regulation 33	Refer to Appendix K
(q) copies of any specialist reports and reports on specialised processes complying with regulation 32	Refer to Appendix F - J
(r). any specific information that may be required by the competent authority.	N/A

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APPENDICES

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CARA	Conservation of Agricultural Resources Act
DEA	National Department of Environmental Affairs
DENC	Department of Environment and Narture Conservation
DSM	Demand Side Management
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EWT	Endangered Wildlife Trust
GDP	Gross Domestic Product
GG	Government Gazette
GN	Government Notice
GPS	Geographic Positioning System
GIS	Geographical Information Systems
HIV	Human Immuno-deficiency virus
I&AP	Interested and Affected Party
ISEP	Integrated Strategic Electricity Planning
kV	Kilovolt
NEMA	National Environmental Management Act (No 107 of 1998)
NEMBA	National Environmental Management and Biodiversity Act (No 10, 2004)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No 25 of 1999)
SEA	Strategic Environmental Assessment
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Do nothing alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Environment: the surroundings within which humans exist and that are made up of:

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

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered,

vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

INTRODUCTION CHAPTER 1

In response to the growing electricity demand within the Northern Cape and to address current supply problems in the area, Eskom Holdings Limited is proposing the establishment of a new 400kV transmission line which will connect the Aggeneis and Oranjemond substations over an approximate distance of 240km. The proposed project includes the expansion of the existing Aggeneis and Oranjemond substations in order to accommodate the new transmission line. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. The proposed project forms part of the **Northern Cape Strengthening Project**.

This proposed project has been investigated in detail through an Environmental Impact Assessment (EIA) process. The nature and extent of this proposed development, as well as potential environmental impacts associated with the construction and operation of this proposed project is explored in more detail in this Draft Environmental Impact Assessment (EIA) Report.

The EIA Report consists of the following chapters:

» **Chapter 1** provides background to the proposed Aggeneis Oranjemond 400kV line and substation upgrade project and the environmental impact assessment process
» **Chapter 2** provides an overview of the proposed project
» **Chapter 3** outlines the process which was followed during the EIA Phase of the EIA process
» **Chapter 4** provides a description of the biophysical and socio-economic environment which may be potentially affected by the proposed project
» **Chapter 5** provides an assessment of the potential impacts associated with the proposed Aggeneis-Oranjemond 400kV power line and substations upgrade project, including a comparative assessment of the identified alternative transmission line corridors
» **Chapter 6** presents the conclusions and recommendations of the EIA and an Impact Statement on the proposed project.
» **Chapter 7** provides a list of references and information sources used in undertaking the studies for this EIA Report

1.1. Background and Overview of the Proposed Project

Eskom Holdings Ltd is responsible for the provision of reliable and affordable power to its consumers in South Africa. Electricity cannot be effectively stored and therefore must be used as it is generated. It is, therefore, required that

electricity must be efficiently transmitted from the point of generation to the end user.

If Eskom Transmission is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis, in support of the generation processes. Eskom is currently responding to the growing electricity demand and predicted future demand within South Africa through the establishment of new generation and transmission capacity in South Africa.

In response to the growing electricity demand within the Northern Cape and to address current supply problems in the area, Eskom Holdings Limited is proposing the establishment of a new 400kV transmission line which will connect the Aggeneis and Oranjemond substations over an approximate distance of 240km. The proposed project includes the expansion of the existing Aggeneis and Oranjemond substations in order to accommodate the new transmission line. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. The proposed project forms part of the **Northern Cape Strengthening Project**.

Four technically feasible alternative transmission power line corridors have been identified for investigation within the EIA process. These are reflected in Figure 1.1. Should the project be authorised by the National Department of Environmental Affairs (DEA), Eskom will then enter into a servitude negotiation process with each affected landowner. The process of negotiating a servitude is independent of the EIA process, and will be undertaken directly by Eskom Transmission.

This project is referred to as the **Aggeneis Oranjemond 400kV Line and Substations Upgrade**. Figure 1.1 provides an indication of the four alternative corridors considered within the EIA process for this proposed project.

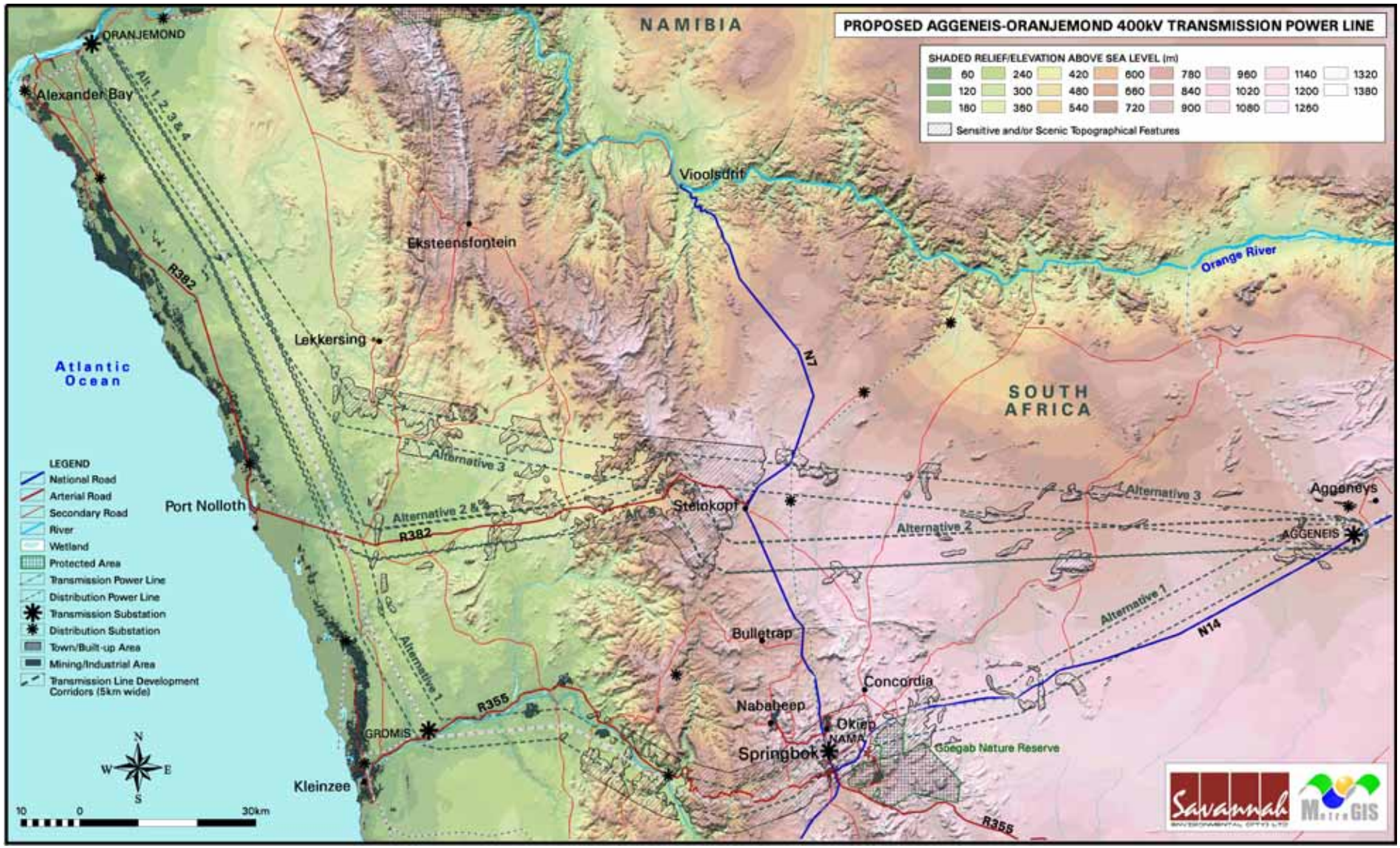

Figure 1.1: Locality map indicating the study area and the four alternative transmission line corridors identified for consideration within the EIA phase

1.2. The Purpose and Need for the Proposed Project

The ever-increasing electricity demand in South Africa is placing pressure on Eskom's existing power transmission capacity. A large part of Namaqualand is currently supplied via the Nama-, Gromis-, and Oranjemond Substations. The 220kV line from Aggeneis to Nama, Nama to Gromis and Gromis to Oranjemond is supplying electricity to most of the area around the Namaqualand area. This line is the only main feed to Nama-, Gromis-, and Oranjemond Substations. The network around the listed three Substations cannot be back-fed as they are not connected to any network. Outages can therefore not be avoided when the Aggeneis-Nama 220kV line is not operational for any reason.

The purpose of the proposed project is to:

» Improve the reliability of the existing Western grid Transmission network.
» Ensure that transmission capacity keeps up with both electricity generation capacity and electricity demand.
» Create additional Transmission network capacity to be able to supply the increasing electricity demand.

Studies have indicated that a steady 1 000 MW per annum average load growth for the period 2006 to 2025 is expected in the National Transmission System. This is due to industrialisation, urban growth and electrification. It is also a sign of good economic growth in the whole country. Through strategic studies undertaken, Eskom predicts that this load growth will continue, which will result in the need for additional generation capacity by the year 2012. In order to meet this demand, Eskom requires additional generation capacity that needs to be transmitted to load centres throughout the Eskom Transmission System. An unreliable Transmission system could hamper growth in the country.

Eskom Transmission has taken measures to get the most out of the existing Transmission system so that the construction of the new lines will occur only when needed. These measures include:

» Comprehensive checks on the existing lines to ensure that they are within the legal clearance for overhead lines. Lines sag when placed under heavy load conditions, due to heating of the conductors.
» Installation of line monitoring devices that measures the atmospheric conditions prevailing. This allows Eskom Transmission to decide whether the lines can cope with more loading (e.g. on a cold day the line can be loaded to more than usual levels since the lines cool down and they do not sag as much).
» Installation of new infrastructure.

» Demand side management.
» The best reinforcement options are selected to ensure that an optimised mix of cost, technical benefit and environmental impact was achieved.

As all options for optimisation of the existing infrastructure have already been studied and implemented within the study area, a new Transmission power line will be required to be constructed to meet the increasing power demand. The new Transmission line is proposed to be brought into operation at the time when the load growth and demand exceeds the supply. It is therefore necessary to secure the necessary servitude timeously, to ensure this will be possible.

A definite two-fold need for a new Transmission power line has therefore been identified:

» to optimise the existing system; and
» to increase line capacity in the Transmission system.

By increasing the supply into the Transmission system, the foreseen load growth can be addressed in a suitable and economical way. Optimisation of the current system is currently underway, and would alleviate some problems in the system. The medium to long term load requirements can be addressed by the increased supply due to the new Transmission power line.

1.3. Requirement for an Environmental Impact Assessment Process

The proposed Aggeneis-Oranjemond 400kV Line and Substations Upgrade Project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in June 2010 in terms of Section 24(5) of the National Environmental Management Act (NEMA, 1998, Act No 107). This section provides a brief overview of EIA Regulations and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as “listed activities”. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been acknowledged by DEA (under Application Reference number **12/12/20/2041.** Through the decision-making process, DEA will be supported by the Northern Cape Department of Environment and Nature Conservation (DENC) as the commenting authority.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project during the project planning process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project.

In terms of sections 24 and 24D of NEMA, as read with Government Notices R543 and R545, a Scoping and EIA process is required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R544 and R545 (GG No 33306 of 18 June 2010):

Number & date of relevant notice	Activity No (s) (in terms of relevant Regulation or notice)	Description of listed activity	Relevance of Regulation to Project
Government Notice R544, 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	The storage of diesel and fuel for construction machinery and vehicles on site.
Government Notice R544, 18 June 2010	22.(ii)	The construction of a road, outside urban areas, (ii) where no road reserve exists where the road is wider than 8 metres	Access roads will be constructed, dimensions to be confirmed in the EIA phase, based on the design of the facility
Government Notice R544, 18 June 2010	38	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	The upgrade of both the Aggeneis and Oranjemond substations HV yards to accommodate the new 400kV line
Government Notice R545, 18 June 2010	3	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	The storage of diesel and fuel for construction machinery and vehicles on site

Number & date of relevant notice	Activity No (s) (in terms of relevant Regulation or notice)	Description of listed activity	Relevance of Regulation to Project
Government Notice R545, 18 June 2010	8	The construction of facilities or infrastructure for the transmission or distribution of electricity with a capacity of 275kV or more, outside an urban area or industrial complex.	The establishment of the new 400kV power line
Government Notice R546, 18 June 2010	4(a)(ii)(gg)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres- Outside urban areas, in: Areas within 10 kilometres from national parks or world heritage Sites.	Access roads will be constructed
Government Notice R546, 18 June 2010	14(a)i	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (3) the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.	Transformation of land due to the establishment of the new 400kV power line and associated access roads.
Government Notice R546, 18 June 2010	19 (ii)(gg)	The widening of a road by more than 4 metres or the lengthening of a road by more than 1 kilometre- Outside urban areas, in: Areas within 10 kilometres from national parks or world heritage Sites.	Access roads will be constructed, dimensions to be confirmed in the EIA phase, based on the design of the facility

This report assesses the potential environmental impacts of the proposed construction, operation and decommissioning of the proposed new 400kV transmission power line and substations upgrade. This EIA report forms part of the EIA process, which was conducted in accordance with the requirements of the EIA regulations in terms of section 24(5) of NEMA (Act No 107 of 1998).

1.4. Eskom's Planning Process and the Role of the Environmental Impact Assessment Process

Eskom Transmission's planning process is required to be based on anticipated load requirements, rather than immediate load requirements in order to timeously supply the anticipated increased demand in the country. This is due to the time-consuming process of acquiring the necessary permissions to construct such infrastructure from DEA and the National Energy Regulator of South Africa (NERSA), servitude negotiations with landowners, as well as transmission power line design and construction.

Four technically feasible alternative transmission power line corridors have been identified for investigation within the EIA process. Through the EIA process, a preferred alternative transmission power line corridor will be nominated. Should the project be authorised by the National Department of Environmental Affairs (DEA), Eskom will then enter into a servitude negotiation process with each affected landowner. The process of negotiating a servitude is independent of the EIA process, and will be undertaken directly by Eskom Transmission.

While there should be reasonable confidence in the environmental acceptability of the preferred corridor nominated (up to 5 km in width), certain criteria identified during the land negotiation process and the final placement of towers may require minor alterations to the power line alignment within the corridor which receives environmental authorisation. These may include:

» Identification of a technical problem during the detailed design phase which will require excessive cost to resolve (e.g. unstable subsurface conditions identified by detailed geotechnical investigations).
» Request by a landowner during the course of the negotiation process that the alignment be shifted to avoid disruption of a particular activity on his property, but provide a feasible and reasonable new alignment.

Provided such potential deviations to the power line alignment are within the corridor authorised and are not unreasonable, it is fair for Eskom Transmission to investigate and negotiate local adjustments. This may be required at a number of points along the alignment.

1.5. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the potentially feasible alternatives and extent of the studies required within the EIA Phase. This was achieved through a desk-top evaluation of the proposed project using existing information, involving the

project proponent, specialists with experience in undertaking EIAs for similar projects, and a public consultation process with key stakeholders (including government authorities) and interested and affected parties (I&APs).

The EIA assesses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The EIA Report includes a draft Environmental Management Programme (EMP), which details environmental specifications required to be implemented to reduce environmental impacts associated with the proposed project. Should the project be authorised, this EMP will be finalised and will form part of the Contract documentation for construction and operation of the power line.

The release of a draft EIA Report (including the draft EMP) provided stakeholders with an opportunity to verify that the issues that they had raised through the EIA process had been captured and adequately considered. This final EIA Report incorporates all issues and responses raised during the public review of the draft EIA report prior to submission to DEA.

1.6. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA

Savannah Environmental was contracted by Eskom Holdings as an independent environmental assessment practitioner to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of its specialist sub-consultants on this project are subsidiaries of or affiliated to Eskom Holdings Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools.

The Savannah Environmental team have considerable experience in environmental assessment and environmental management, and have been

actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa. Strong competencies have been developed in project management of environmental EIA processes, as well as strategic environmental assessment and compliance advice, and the identification of environmental management solutions and mitigation/risk minimising measures.

Savannah Environmental have gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through their involvement in related EIA processes. They have successfully managed and undertaken EIA processes for other power transmission projects for Eskom Holdings Limited throughout South Africa. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

The EAP's from Savannah Environmental who are responsible for this project are:

» Jo-Anne Thomas - a registered Professional Natural Scientist and holds a Master of Science degree. She has 13 year's experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several projects across the country.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Details of these specialist studies are included in Chapter 3. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

Eskom, as the primary supplier of electricity in South Africa, is currently responding to the growing electricity demand and predicted future demand within South Africa by proposing new generation and Transmission capacity building projects throughout the country over the next few years. Through the Integrated Strategic Electricity Planning (ISEP) process, Eskom continually assesses the projected demand for electricity within South Africa. As part of this process, Eskom continues to investigate a variety of electricity generation options, strengthening and efficiency building options to improve Transmission efficacy.

As part of its capacity expansion and grid strengthening programme, Eskom Transmission is proposing the Northern Cape Strengthening Project, which includes the proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substations Upgrade. This project is proposed to include the establishment of a new 400kV Transmission line between the Aggeneis and Oranjemond Substations in the Northern Cape Province, as well as the expansion of both substations to accommodate the new power line. The new power line would be approximately 240 km in extent, depending on the final alignment of the power line.

This project is proposed to include:

» The construction of a new **400 kV transmission power line** which will connect the Aggeneis and Oranjemond substations. The transmission power line is expected to be approximately 240 km in length, depending on the final alignment. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. A new servitude of 55m will be required to be secured for this power line.
» The **expansion** of both the Aggeneis and Oranjemond Substations to accommodate the new power line. This expansion is proposed to be within the footprint of the existing substations.
» **Associated works** to integrate the proposed new transmission power line into Eskom's electricity Transmission grid (including the construction of service/access roads where required, etc.).

2.1. Description of Project Alternatives

The following alternatives for satisfying the need for additional electrical supply to the Transmission system and optimising the existing infrastructure were investigated by Eskom Transmission:

2.1.1. The Do Nothing Option

The 'do-nothing' alternative is the option of not undertaking the construction of the proposed Aggeneis-Oranjemond 400kV Transmission power line and associated Substation upgrades.

The electricity demand in South Africa is placing increasing pressure on Eskom's existing power Transmission capacity. A large part of Namaqualand is supplied via the Nama-, Gromis-, and Oranjemond Substations. The 220kV line from Aggeneis to Nama, Nama to Gromis and Gromis to Oranjemond Substations are supplying most of the area around the Namaqualand area. It is the only main feeds to Nama, Gromis, and Oranjemond Substations. The network around the listed three Substations cannot be back-fed as they are not connected to any network. Outages can therefore not be avoided when the Aggeneis-Nama 220kV line is lost.

The 'do-nothing' alternative will result in no environmental impacts as a result of the construction of the proposed new power line. However, this option will result in future Transmission capacity shortages and power supply 'shedding' in the Namaqualand region which will result in unreliable electricity supply to this area. This will have an impact on the potential for development within the area, as well as on the economy of the region. The 'do-nothing' alternative is therefore not considered to be a feasible alternative and will not be considered further within this draft EIA report.

2.1.2. Construction of the Proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substations Upgrade

The extent of the study area and the selection of the alternative alignment corridors gave consideration to aspects such as ecological impacts, social impacts, visual impacts, technical feasibility and cost.

The following criteria were considered by Eskom Transmission in the identification of technically feasible corridors for the establishment of the proposed Aggeneis-Oranjemond 400kV Transmission power line and substation upgrades:

» Four technically viable and cost effective corridors of approximately 5 km in width were identified.
» As far as possible, the number and magnitude of angles along the line should be minimised in order to allow the use of less expensive and visually less-intrusive tower types.
» Crossing over of existing major power lines should be avoided as far as possible as this increases the potential for technical incidents during operation.

- The alignment should cater for known topographical/terrain constraints of the tower types to be used, and soil conditions for the foundations in terms of geotechnical suitability and costs.
- The proposed alignment should provide for the need of appropriate access roads to the servitude and tower positions for both the construction and maintenance/operation phases.
- Care should be taken to avoid the following as far as tower positioning and access road construction are concerned:
  - extensive rock outcrops;
  - rugged terrain, hills and mountains;
  - active clay soil, vleis and floodplains;
  - potential unstable side-slope terrain; and
  - eroded and unstable areas.
- Other issues which technically affect the location of a Transmission power line include:
  - agricultural lands, in particular those under irrigation;
  - large water bodies;
  - open-cast mining; and
  - crossing points with roads, rail and telecommunication lines at off-set angles less than 60°.
- The following obvious and observable environmental issues were taken into account:
  - human settlements and communities;
  - land use (where possible);
  - passing between water bodies (bird flight paths usually extend between water bodies);
  - ecologically sensitive areas;
  - scenic areas with high visual/aesthetic quality; and
  - untransformed indigenous vegetation.

Four technically feasible alternative Transmission power line development corridors have been identified for investigation during the EIA process (refer to Figure 1.1). The four identified power line development corridors as proposed and the areas affected are described in more detail below.

Corridor 1 is proposed to exit from the existing Aggeneis Substation which is situated approximately 7km south-west of the town Aggeneys, parallel to an existing 220 kV power line, and to the north of the N14 Highway towards the town of Springbok. The proposed corridor then passes to the north of the Goegap Nature Reserve and will traverse between the towns of Springbok and Okiep, near the Nama Substation and crosses the N7 Highway. The corridor is situated on both sides of the R355 Provincial Road up to the Spektakel distribution Substation, after which it bends to the south of the R355 in the direction of Kleinzee. Before the Gromis Substation and just to the north of the Buffels River,

the corridor turns in a north westerly direction and passes the town of Port Nolloth to the east. Mining activities are located in close proximity to where the proposed corridor passes from Port Nolloth towards the Oranjemond Substation. The corridor then crosses the R382 and follows the R382 northwards towards Alexander Bay. The last section of the corridor follows the existing 220kV line in a northerly direction to the Oranjemond Substation along with Corridors 2, 3 and 4.

Although this corridor tends to avoid mountainous areas, it will be the longest to construct of the four alternative alignment options, reaching approximately 301 km in extent. From a technical perspective, however, Corridor 1 has the potential to be the most effective in terms of future network connections as the course that it will follow passes in close proximity to existing Substations. This can allow for effective future loop-ins and loop-outs.

Corridor 2 is anticipated to run from the existing Aggeneis Substation in a westerly direction towards Steinkopf. It then traverses the N7 national road to the south of Steinkopf, and then turns in a north easterly direction where it crosses the R382 and links with Corridor 3 for a small section. It again then turns in a south westerly direction and runs in a westerly direction parallel to the R382 in the direction of the town of Port Nolloth. Approximately 10 km east of Port Nolloth, Corridor 2 links up with Corridor 1 and 4 and later also with Corridor 3 and runs parallel to the existing Gromis-Oranjemond power line in a northerly direction towards the Oranjemond Substation. The total length of Corridor 2 is approximately 245 km.

Corridor 3 is foreseen to exit the existing Aggeneis Substation in a westerly direction towards Steinkopf. It traverses the N7 Highway to the north of Steinkopf and then continues in a westerly direction towards the town of Port Nolloth. The corridor then turns northwards approximately 20 km north east of Port Nolloth where it links up with Corridor 1, 2 and 4, and continues northwards, parallel to the existing Gromis-Oranjemond power line until it reaches the Oranjemund Substation. The total length of Corridor 3 is approximately 275 km.

Corridor 4 is proposed to follow the same alignment as Corridor 2 from the Aggeneis Substation towards the west, with only one deviation evident at the mountains located east of Steinkopf. After the alignment crosses the N7 to the south of Steinkopf, it deviates in a north westerly direction. From hereon the alignment turns in a south westerly direction towards the town of Port Nolloth. It then links up with Corridor 1 and later with Corridor 3 to run parallel to the existing power line to the north towards the Oranjemond Substation.

These alternative transmission line development corridors are assessed within this EIA Report (refer to Chapter 5).

Both the Aggeneis and Oranjemond Substations will be upgraded/extended as part of the proposed project. This will include the following:

» Establish 4x400kV feeder bays at the Aggeneis substation
» Establish 2x220kV feeder bays at the Aggeneis substation
» Establish 1x220kV feeder bay at the Oranjemond substation.

This proposed expansion will be undertaken within the existing substation footprint and, therefore, no alternatives are proposed for assessment.

2.1.3. Construction Phase

Transmission lines are constructed in the following simplified sequence:

Step 1: Determination of technically feasible alternatives
Step 2: EIA input into corridor selection
Step 3: Negotiation of final corridor with affected landowners
Step 4: Survey of the corridor (by air)
Step 5: Determination of the conductor type
Step 6: Selection of best-suited conductor, towers, insulators, foundations
Step 7: Final design of line and placement of towers (including final walk-though survey by environmental specialists and compilation of site-specific Environmental Management Programme (EMP)).
Step 8: Issuing of tenders and award of contract to construction companies
Step 9: Vegetation clearance and construction of access roads (where required)
Step 10: Tower pegging
Step 11: Construction of foundations
Step 12: Assembly and erection of towers
Step 13: Stringing of conductors
Step 14: Rehabilitation of disturbed areas and protection of erosion sensitive areas
Step 15: Testing and commissioning

Construction of the proposed Aggeneis-Oranjemond 400kV line will take approximately 24 months to complete. Construction crews for the Transmission power line and substations expansion will constitute mainly skilled and semi-skilled workers. Due to the remoteness of the area, it is most likely that construction workers will be accommodated within construction camps which will move along the transmission line as construction progresses. Construction camps can be located within the construction area but only in consultation and agreement with the landowner. It is generally preferred that the construction camps be in close proximity to the construction site.

2.1.4. Servitude Negotiation and the EIA Process

Transmission power lines are constructed and operated within a servitude (55 m wide for 400kV lines) that is established along the entire length of the power line. Within this servitude, Eskom Transmission has certain rights and controls that support the safe and effective operation of the power line. The process of achieving the servitude agreement is referred to as the Servitude Negotiation Process, or simply just the negotiation process. The following important points relating to the negotiation process should be noted:

» Servitude negotiation is a private matter between Eskom Transmission and the appropriate landowner.
» The negotiation process involves a number of stages (see below), and culminates in the 'signing' of a servitude. Here Eskom Transmission enters into a legal agreement with the landowner.
» The servitude is registered as a 'right of way', and Eskom do not purchase the servitude from the landowner. Compensation measures are agreed in each case.
» The agreements will detail such aspects as the exact location and extent of the servitude, and access arrangements and maintenance responsibilities, as well as any specific landowner requirements.
» The negotiation process may take place at any time in the planning of a new power line.
» This process must be completed (i.e. the agreement must be signed) with the relevant landowner before construction starts on that property.
» The negotiation process is undertaken directly by Eskom Transmission and is independent of the EIA process. It is important that the aims of the two processes are seen as separate.

The EIA process has become important in the initial planning and corridor selection of new Transmission lines. For this reason, it is usually preferable that the negotiation process begins after the EIA has been completed. At this stage there is greater confidence in the corridor to be adopted, and it would be supported by environmental authorisation. However, it may be required that the negotiation process begins earlier, and may begin before, or run in parallel with the EIA process. This may be due to urgent timeframes for the commissioning of the new power line, knowledge of local conditions and constraints, etc. Eskom Transmission has a right to engage with any landowner at any time, though they do so at risk if environmental authorisation has not been awarded.

2.1.5. The Negotiation Process

Eskom Transmission is responsible for the negotiation process for all new Transmission power lines. It is critical that the process is correctly programmed

and incorporated into the planning of a new line. The negotiation process involves the following steps:

i. Initial meeting with the landowner.
ii. The signing of an 'option' to secure a servitude (this indicates that the owner will accept that the power line will traverse his property, subject to conditions to be finalised in the negotiation of the servitude agreement). An option is valid for one year.
iii. Once the corridor is confirmed (i.e. options are signed with the upstream and downstream landowners), the servitude agreement will be finalised with the individual landowners. This agreement will set out the conditions for the establishment, rehabilitation and maintenance of the servitude, and will be site-specific (as different landowners may have different requirements). Compensation payments would be made when the servitude is registered at the Deeds Office[1].
iv. Once construction is complete and the land rehabilitated to the landowners satisfaction (and as agreed prior to construction), the landowner signs a 'Final Release' certificate. Until the 'Final Release' certificate has been signed, Eskom Transmission remains liable for the condition of the land.
v. Once the clearance certificate is signed, the responsibility for the power line and servitude is handed over to the regional Eskom Transmission office.

2.1.6. Technical Details of Tower and Transmission Line Designs

All components of a Transmission line are interdependent, but are distinct in the roles which they fulfil. The primary components include towers, foundations, insulators and hardware, and conductors.

» *Towers*

Transmission line conductors are strung on in-line (suspension) towers and bend (strain) towers. Various tower designs are available for use by Eskom on the proposed project (refer to Figure 2.1 to 2.3). The type of towers which can be used will be dependent on the final alignment of the power lines and individual agreements with affected landowners and stakeholders. Suspension towers are typically less cumbersome structures, which are less steel-intensive than strain/bend towers. This makes them less visually intrusive, and cheaper to construct than strain towers.

[1] Compensation will be based on present day property valuations for all properties obtained from registered evaluators. Eskom only pays compensation for the strip of land that is affected at 100% of present day property value. In cases where properties are significantly affected, Eskom may consider purchasing the whole property at present day market value. All improvements will be valued. Sentimental value is not considered in any valuations as it is not measurable. Valuations are done according to the Expropriation Act.

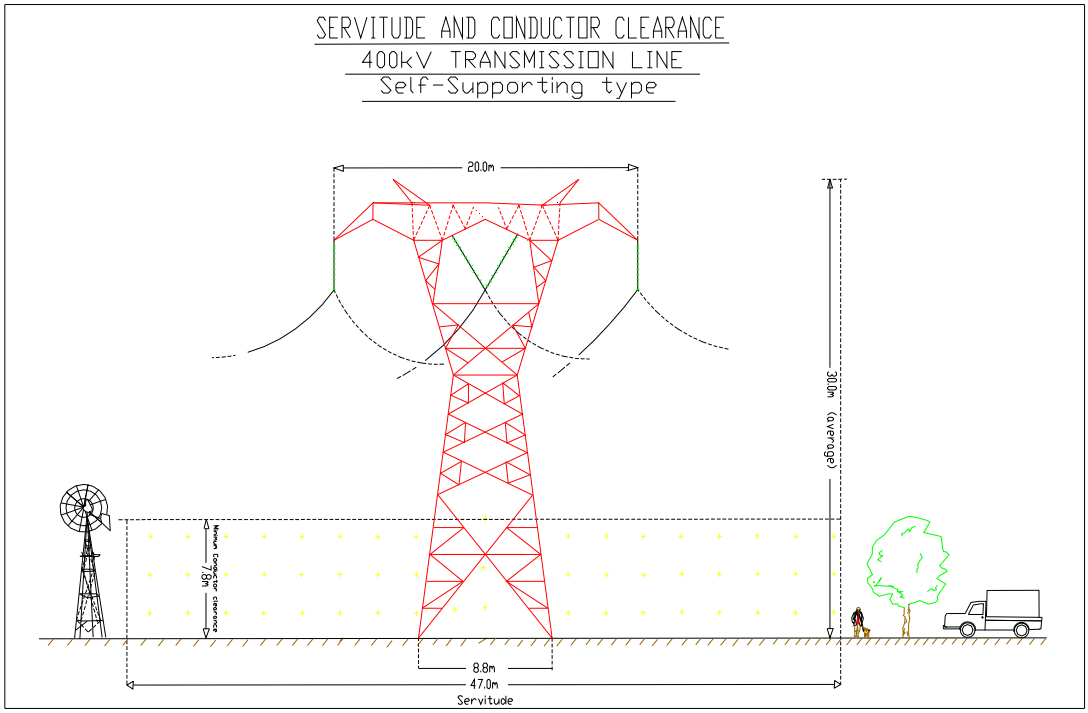

Figure 2.1: Diagrammatic representation of the self-supporting strain/bend tower

Figure 2.2: Compact Cross-rope suspension tower

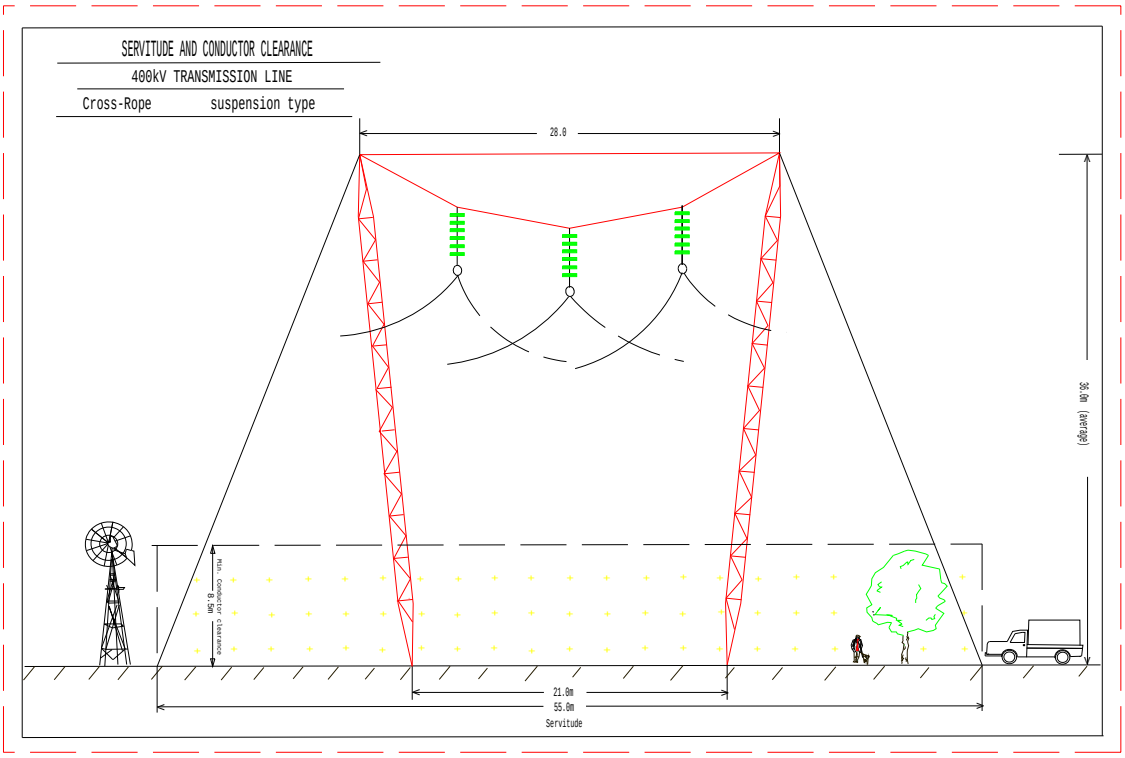

Figure 2.3: Cross Rope Suspension Tower

Therefore Transmission line corridors are planned with as few bends as possible. The compact cross-rope suspension tower is typically used along the straight sections of the servitude, while the self-supporting angle towers are used where bends occur in the power line alignment.

» *Servitude Requirements*

The servitude width for a 400kV Transmission line is 55 m. The servitude is required to ensure the safe construction, maintenance and operation of the line, and thereby entitles Eskom Transmission Division certain rights (e.g. unrestricted access). Where 400kV Transmission lines are constructed in parallel, a minimum separation distance of 55 m is required in order to ensure the reliable operation of both lines. The minimum vertical clearance to buildings, poles and structures not forming part of the power line must be 3.8 m, while the minimum vertical clearance between the conductors and the ground is 8.1 m (Refer to Figure 2.4).

The minimum distance of a 400kV Transmission power line running parallel to proclaimed public roads must be 100 m from the centre of the Transmission power line servitude to the centre of the road servitude. Any main road located close to a Transmission line tower must have Armco barriers as protection. The minimum distance between any part of a tree or shrub and any bare phase conductor of a 400kV Transmission line must be 3,8 m, allowing for the possible sideways movement and swing of power towers and conductors.

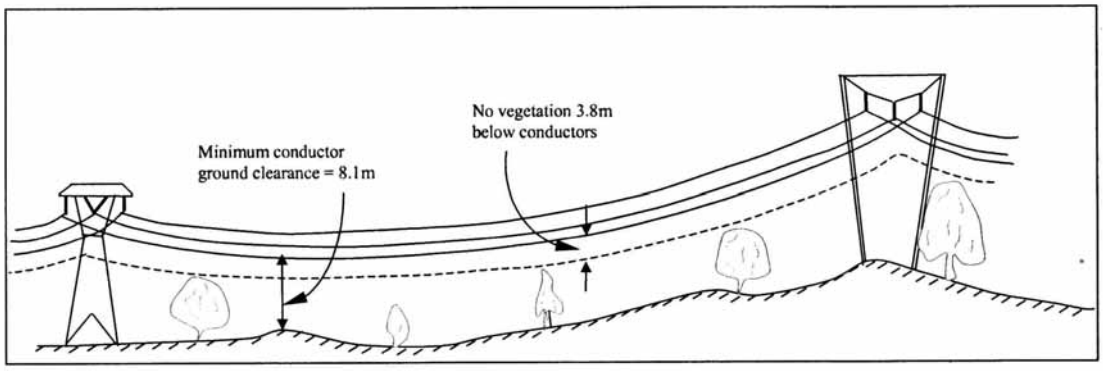

Figure 2.4: Servitude requirements in terms of vegetation clearing under conductors and minimum ground clearance

A maximum 8 m wide strip is to be cleared of all trees and shrubs down the centre line of the Transmission line servitude for stringing purposes only. Any tree or shrub in other areas which will interfere with the operation and/or reliability of the Transmission line must be trimmed or completely cleared. The clearing of vegetation will take place, with the aid of a surveyor, along approved profiles and in accordance with the approved EMP, and in accordance with the minimum standards to be used for vegetation clearing for the construction of the proposed new Transmission line as listed in Table 2.1.

Table 2.1: Minimum standards to be used for vegetation clearing for the construction of a new Transmission power line

Item	Standard	Follow up
Centre line of the proposed Transmission line	Clear to a maximum (depending on tower type and voltage) of a 4-8m wide strip of all vegetation along the centre line. Vegetation to be cut flush with the ground. Treat stumps with herbicide.	Re-growth shall be cut within 100 mm of the ground and treated with herbicide, as necessary.
Inaccessible valleys (trace line)	Clear a 1 m strip for access by foot only, for the pulling of a pilot wire by hand.	Vegetation not to be disturbed after initial clearing – vegetation to be allowed to re-grow.
Access/service roads	Clear a maximum (depending on tower type) 6 m wide strip for vehicle access within the maximum 8 m width, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil.	Re-growth to be cut at ground level and treated with herbicide as necessary.
Proposed tower position and proposed	Clear all vegetation within proposed tower position in an area of 20 x 20 m (self-supporting towers) and 40 x	Re-growth to be cut at ground level and treated with herbicide as

Item	Standard	Follow up
support/stay wire position	40 m (compact cross-rope suspension towers) around the position, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil. Allow controlled agricultural practices, where feasible.	necessary.
Indigenous vegetation within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, selective trimming or cutting down of those identified plants posing a threat to the integrity of the proposed Transmission line.	Selective trimming
Alien species within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, remove all vegetation within servitude area and treat with appropriate herbicide.	Cut and treat with appropriate herbicide.

Once the centre line has been cleared, the contractor's surveyor will peg every tower position and marks the crossing point with existing fences for new gate installation. Where required, once the tower positions have been marked, the vegetation clearing team will return to every tower position and clear vegetation (in accordance with the specification outlined in the Environmental Management Programme (EMP)) for assembling and erection purposes.

» *Foundations*

The choice of foundation is influenced by the type of terrain encountered, as well as the underlying geotechnical conditions. Geotechnical requirements for all tower types are catered for by using various foundation types, which are designed to withstand conditions varying from hard rock to waterlogged marshes. The main types of foundations include piles, pad-and-chimney, and rock anchors. The actual size and type of foundation to be installed will depend on the type of tower to be erected, and the actual sub-soil conditions. Strain towers require more extensive foundations for support than in-line suspension towers, which contribute to the construction expenses.

The construction of foundations is the slowest part of the line construction, and is typically started some time ahead of tower erection. Prior to filling of the foundations and tower erection, excavated foundations are covered or fenced in, in order to safe-guard unsuspecting animals and people from injury. The foundations also represent the biggest unknown in the cost and

construction time, since access to the tower sites is required for earth-moving machinery and concrete.

All foundation excavations are back-filled, stabilised through compaction, and rehabilitated at ground level.

» *Insulators and Hardware*
The insulators and hardware are used to connect the conductors to the towers. The main types are glass, porcelain, and composite insulators. Glass and porcelain have been used for many years, and are the most common. They are, however, heavy and susceptible to breakage by vandals, as well as contamination by pollution.

Composite insulators have a glass-fibre core with silicon sheds for insulation. The composite insulators are light-weight and resistant to both vandalism and pollution. They are, however, more expensive than the more common glass insulators.

» *Conductors*
The conductors are made of aluminium with a steel core for strength. Power transfer is determined by the area of aluminium in the conductors. Conductors are used singularly, in pairs, or in bundles of three, four or six. The choice is determined by factors such as audible noise, corona, and electro-magnetic field mitigation.

Many sizes of conductor are available, the choice being based on the initial and life-cycle costs of different combinations of size and bundles, as well as the required load to be transmitted.

2.1.7. Substations Upgrade

As mentioned, both the Aggeneis and Oranjemond Substations will be upgraded/extended as part of the proposed project. This will include the following:

» Establish 4x400kV feeder bays at the Aggeneis substation
» Establish 2x220kV feeder bays at the Aggeneis substation
» Establish 1x220kV feeder bay at the Oranjemond substation.

This proposed expansion will be undertaken within the existing substation footprint and, therefore, no alternatives are proposed for assessment.

As the proposed substation upgrades are located within the existing HV yards of the Aggeneis and Oranjemond substations, no additional environmental impacts

are expected to occur as a result of the planned construction and operational activities. Therefore, no further investigation of these sites is required.

The proposed substations would be upgraded in the following simplified sequence:

Step 1: Assembly, erection and installation of equipment (including transformers)

Step 2: Connection of conductors to substation infrastructure

2.2. Project Operation Phase

The expected lifespan of the proposed Transmission power line is between 35 and 40 years, depending on the maintenance undertaken on the power line structures.

During the life-span of the Transmission power line and Substation, on-going maintenance is performed. Power line inspections are undertaken on an average of 1 – 2 times per year, depending on the area. During this maintenance period, the power line is accessed via the access routes, as agreed with affected landowners during the negotiation phase. During maintenance activities on the Substations, components may require replacement in order to significantly extend the lifespan. The oil which is contained in the Substation transformers is classified as a hazardous substance. When this transformer oil need to be replaced it will have to be stored in containers on-site, and therefore a waste licence application may be deemed necessary, depending on the quantities stored at any one time. Maintenance of the power line and substations are required to be undertaken in accordance with the specifications of the Environmental Management Programme (EMP) which forms part of this draft EIA Report (Appendix K).

The creation of additional employment opportunities during the operational phase of the power line and substations will be limited, and will be restricted to skilled maintenance personnel employed by Eskom.

2.2.1. Servitude and Substation Maintenance Responsibilities

The management of a Transmission power line servitude is dependent on the details and conditions of the agreement between the landowner and Eskom Transmission, and are therefore site-specific. These may, therefore, vary from one location to another. However, it is a common occurrence that there is a dual responsibility for the maintenance of the servitude:

» Eskom Transmission will be responsible for the tower structures, maintenance of access roads, watercourse crossings, and gates and fences relating to servitude access.
» The landowner will retain responsibility for the maintenance of the land and land use within the servitude (e.g. cropping activities, veld management, etc.).

Exceptions to the above may arise where, for example dual use is made of the access roads and gates or specific land use limitations are set by Eskom Transmission within the servitude which directly affects the landowner (e.g. Forestry). Maintenance responsibilities are, ultimately, clearly set out in the servitude agreement.

During the life-span of the substations, on-going maintenance is performed by Eskom. Substation inspections are undertaken on an average of 1–2 times per year, depending on the area. During this maintenance period, components may require replacement in order to significantly extend the lifespan of the substations.

APPROACH TO UNDERTAKING THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE CHAPTER 3

An Environmental Impact Assessment (EIA) process refers to that process (as per the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: a **Scoping Phase** and an **EIA Phase**. The EIA phase culminates in the submission of an Environmental Impact Report (EIR) (including a draft Environmental Management Programme (EMP)) to the competent authority for review and decision-making. The EIA process is illustrated below:

The EIA process for the proposed Aggeneis-Oranjemond 400kV Transmission Power Line and Substation upgrade has been undertaken in accordance with the EIA Regulations GNR543, published in Government Notice 33306 of 18 June 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with these Regulations. These phases are described below.

3.1. Phase 1: Scoping Study

The Scoping Study, which commenced in October 2010, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Aggeneis-Oranjemond 400 kV Transmission Line Project, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders, relevant government authorities and interested

and affected parties (I&APs). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the "do nothing" option) were identified for consideration within the EIA process.

The draft Scoping Report compiled was made available at public places for I&AP review and comment. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report. The Final Scoping Report and Plan of Study for EIA were submitted to the National Department of Environmental Affairs (DEA) in March 2011. The Final Scoping Report was accepted by DEA, as the competent authority on 13 May 2011 (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project.

3.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, feasible alternative Transmission power line corridors were identified for further investigation in the EIA Phase of the process. A number of issues requiring further study for all components of the project (i.e. the substations and power line corridors) were highlighted. A comparative assessment of identified issues associated with the identified feasible alternative Transmission power line corridors has been undertaken within the EIA phase of the process.

The EIA Phase aimed to achieve the following:

» Provide an overall description and assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
» Comparatively assess identified feasible alternative Transmission power line corridors.
» Nominate a preferred Transmission power line alternative corridor for consideration by DEA.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and aims to provide the

environmental authorities with sufficient information to make an informed decision regarding the proposed project.

3.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations GNR543, published in Government Notice 33306 of 18 June 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public involvement process throughout the EIA process in accordance with Regulation 54 of Government Notice No R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of Government Notice No R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of Government Notice No R543 of 2010.
» Preparation of this Draft EIA Report in accordance with the requirements of the Regulation 31 Government Notice No R543 of 2010.

These tasks are discussed in detail below.

3.3.1. Authority Consultation

As Eskom is a state-owned enterprise (SoE), the National DEA is the competent authority for this application. Consultation with the regulating authorities (i.e. DEA and DENC) and Organs of State which have jurisdiction in respect of the activity to which the application relates has continued throughout the EIA process. On-going consultation included the submission of a Final Scoping Report (submitted to National DEA in March 2011) following a 30-day public review period (and consideration of stakeholder comments received).

The following will also be undertaken as part of this EIA process:

» Submission of a Final Environmental Impact Assessment (EIA) Report to the National DEA and Northern Cape DENC following the 30-day public review period.
» Consultation with Organs of State that may have jurisdiction over the project:

* National, provincial, and local government departments (including DEA, DENC, South African Heritage Resources Association, Heritage Northern Cape, Provincial Department of Agriculture Land Reform and Rural Development, Department of Water Affairs, Northern Cape Department of Roads and Public Works etc.)
* Nama Khoi Local Municipality
* Richtersveld Local Municipality
* Khai-Ma Local Municipality
* Namakwa District Municipality
* Parastatals, including South African National Roads Agency Limited (SANRAL)
* Conservation authorities (i.e. WESSA and SANParks)
* Department of Energy
* Civil Aviation Authority

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. A record of the consultation in the EIA process is included within Appendix B.

3.3.2. Comparative Assessment of Alternatives

The following project alternatives were investigated in the EIA (refer to Figure 1.1):

» Alternative Transmission power line corridors 1, 2, 3, and 4

These alternatives are described in detail in Chapter 2 of this report.

3.3.3. Public Involvement and Consultation: EIA Phase

The public involvement process was initiated at the start of the EIA process and has continued throughout the Scoping and EIA Phases. The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All

relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C for a listing of recorded parties and landowner consultation maps). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been ongoing for the duration of the EIA process and the project database has been updated on an on-going basis.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

» Focus group as well as public meetings (pre-arranged and stakeholders invited to attend). Due to the low attendance at the public meetings held in the Scoping Phase of the process, public meetings in the EIA phase were limited to major centres. Focus Group Meetings were determined as being the more effective means of communication for this study area and was therefore used as the main mechanism for communication.
» One-on-one consultation meetings (where requested) and telephonic consultation sessions (consultation with various parties, for example with directly affected landowners, by the project participation consultant as well as specialist consultants).
» Written, faxed or e-mail correspondence.

The table below provides an overview of the meetings held during the EIA phase of the process:

Date	Meeting
3 October 2011	Public Meeting: Aggeneys
4 October 2011	FGM: Boesmanland Agricultural Union and Landowners between Aggeneys, Kleinsee and Springbok
	FGM: Khai-Ma Local Municipality
	Public Meeting: Springbok
5 October 2011	FGM: Namakwa District Municipality
	FGM: Nama Khoi Local Municipality
6 October 2011	FGM: Richtersveld Local Municipality
	Public Meeting: Port Nolloth
7 October 2011	Public Meeting: Alexander Bay
10 November 2011	FGM: Affected LOs: Route 2&4 (Springbok – Port Nolloth – Alexander Bay)
11 November 2011	FGM: Richtersveld Communal Property Association (RCPA)
	FGM: Affected LOs: Route 2&4 (Springbok – Port Nolloth – Alexander Bay)
14 November 2011	FGM: Affected LOs: Route 2&4

Records of all consultation undertaken to date are included within Appendix D.

It is important to note that the following meetings, although scheduled with the relevant Authorities, could not take place: Feedback could not be secured from the Khai-Ma Local Municipality for the non-attendance and verbal information was received from the Namakwa District Municipality that Officials were required to attend an emergency strategic session. No written comments to date were submitted by these Authorities.

In addition, no parties attended the public meetings held.

3.3.4. Identification and Recording of Issues and Comments

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to Appendix E for the Comments and Response Reports compiled from both the Scoping and EIA Phases).

The Comments and Response Reports include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

3.3.5. Assessment of Issues Identified through the Scoping Process

Based on the findings of the Scoping Study, the following issues were identified as being of low significance, and therefore not requiring further investigation within the EIA:

1. ***Agricultural Potential and Land Capability***
   Due to the prevailing unfavourable climatic conditions for arable agriculture as well as prevalence of soils with limited depth, the agricultural potential within the study area was determined to be low. Therefore, no further detailed Agricultural Potential and Land Capability investigation was required during the EIA Phase.

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 3.1.

Table 3.1: Specialist studies undertaken within the EIA phase

Specialist Study	Specialist	Appendix
Ecology, flora and fauna	David Hoare of David Hoare Consulting cc	Appendix F
Avifauna	Jon Smallie and Luke Strugnell of Endangered Wildlife Trust (EWT)	Appendix G

Specialist Study	Specialist	Appendix
Visual	Lourens du Plessis of MetroGIS	Appendix H
Heritage / Archaeology	Lita Webley and David Halkett of ACO Associates	Appendix I
Social Impact Assessment	Ingrid Snyman of Batho Earth	Appendix J

A review of the EIA process was undertaken by CEN Integrated Environmental Management Unit.

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Aggeneis Oranjemond 400 kV Line and Substation Upgrade Project. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);

- Assigned a score of 4 is highly probable (most likely); and
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» The **status**, which is described as either positive, negative or neutral.
» The degree to which the impact can be reversed.
» The degree to which the impact may cause irreplaceable loss of resources.
» The degree to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

S=(E+D+M)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As Eskom has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft Environmental Management Programme is included as Appendix K.

3.3.6. Public Review of Draft EIA Report and Feedback Meeting

This Draft EIA Report will be made available for public review. During this review period, stakeholder meetings will be held in order to facilitate comments on the Draft EIA Report.

This report has been made available for public review for a 30 day period from **22 September 2011 to 21 October 2011** at the following locations:

» Aggeneys Public Library
» Springbok Public Library
» Steinkopf Public Library
» Port Nolloth Public Library
» Alexander Bay Public Library

The availability of the Draft EIA Report and duration of the public review period was advertised in the Gemsbok, Die Plattelander and the Ons Kontrei newspapers. In addition, all registered I&APs was notified of the availability of the report as well as the date of the public meetings either by e-mail or letter (refer to Appendix D).

3.3.7. Final EIA Report

The final stage in the EIA Phase will entail the capturing of responses from I&APs on the Draft EIA Report in order to refine it. It is this final report upon which the decision-making environmental authorities make a decision regarding the proposed project.

3.3.8. Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

» All information provided by Eskom and I&APs to the Environmental Team was correct and valid at the time it was provided.
» Should the project be authorised by DEA, the Transmission line corridors identified by Eskom, and investigated through the EIA process are technically and economically viable. The final power line route will be determined by Eskom through the negotiation process after the EIA process within the nominated preferred power line corridor.
» Strategic, forward planning deliberations are reflected in the IEP, NIRP and ISEP planning processes and do not form part of this EIA.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power transmission or power generation alternatives.

3.4. Regulatory and Legal Context

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy transmission project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

3.4.1. Regulatory Hierarchy

At National Level, the main regulatory agencies are:

» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.
» *South African National Roads Agency (SANRAL):* This department is responsible for all National road routes.
» *SANParks* is responsible for all National Parks in South Africa.
» The National Department of Agriculture is responsible for all matters which affects agricultural land in South Africa.

At Provincial Level, the main regulatory agencies are:

» *The Northern Cape Department of Environment and Nature Conservation (DENC)* is the commenting authority for this project as it falls within the Northern Cape Province.
» *The Department of Transport and Public Works* in the Northern Cape Province is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Heritage Northern Cape:* This body is responsible for all heritage related issues in the Northern Cape Province.
» *The Provincial Department of Agriculture* is responsible for all matters which affects agricultural land within the Northern Cape Province.

At Local Level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape Province, both Local Municipalities and District Municipalities play a role. The relevant municipalities include Nama Khoi Local Municipality, Khai-Ma

and Richtersveld Local Municipalities, as well as the Namakwa District Municipality.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.

There are also numerous non-statutory bodies and environmental lobby groups that play a role in various aspects of planning and the environment that will influence renewable energy development.

3.4.2. Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Draft EIA Report:

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Final Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)

Several other Acts, standards or guidelines which have informed the project process and the scope of issues assessed within this EIA are summarised in Table 3.2.

Table 3.2: List of applicable legislation and compliance requirements required for the proposed project

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No 107 of 1998)	» EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. » In terms of GNR 543 - 546 of June 2010, a scoping and EIA process is required to be undertaken for the proposed project	» National Department of Environmental Affairs – competent authority. » DENC – provincial commenting authority.	This EIA report is to be submitted to the competent and commenting authorities in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	» In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. » In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	» National Department of Environmental Affairs (as regulator of NEMA).	» While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
National Water Act (Act No. 36 of 1998)	» Under S21 of the act, water uses must be licensed unless such water use falls into	» National Department of Water Affairs	» The abstraction of water, the storage of water, and the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	one of the categories listed in S22 of the Act or falls under the general authorisation. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» Northern Cape Department of Water Affairs	alteration of the characteristics of a watercourse are regarded as a water use (as defined in terms of S21 of the NWA). Should any water courses or drainage lines have to be crossed, then a Water Use License (WUL) must be applied for. » Requirements set by S19 will apply throughout the life cycle of the project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are set out in Section 39 of the Act.	» Department of Minerals and Energy	» As no borrow pits are expected to be required for the project, no mining permit or right is required to be obtained.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as “priority areas.” » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.	» National Department of Environmental Affairs	» Measures in respect of dust control (S32) – no regulations promulgated as yet
National Heritage Resources Act (Act No 25 of 1999)	» Section 4 of the NHRA provides that within 14 days of receipt of notification the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe a	» South African Heritage Resources Agency (SAHRA) as well as Heritage Northern Cape – National heritage sites (grade 1 sites) as well	» A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	heritage resource may be affected. » Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. » The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. » This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided » Stand alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not	as all historic graves and human remains.	

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	addressed by the EIA should be covered by the heritage component.		
Nature Conservation Ordinance (Act 19 of 1974)	» Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, and gathering, uprooting, damaging, or destroying). Schedule 3 lists endangered flora and Schedule 4 lists protected flora. » Articles 26 to 47 regulate the use of wild animals.	» National Department of Environmental Affairs	» Compliance requirements
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» In terms of Section 57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. » In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase. » The developer has a responsibility for: » The conservation of endangered	» National Department of Environmental Affairs	» As the applicant will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. » A permit may be required should any protected plant species be disturbed or destroyed because of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems.		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all	» Department of Agriculture	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. » The permission of agricultural authorities will be required if the Project requires the draining of

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. » These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E. » Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048)		vleis, marshes or water sponges on land outside urban areas.
National Veld and Forest Fire Act (Act 101 of 1998)	» In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land. » In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of section 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	» Department of Water Affairs	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project with regards to fire prevention and control.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Forests Act (Act No 84 of 1998)	» Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. » Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.	» Department of Water Affairs	» A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest.
Hazardous Substances Act (Act No 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death because of their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it	» Department of Health	» It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. » The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	» The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed	» Provincial Department of Transport (provincial roads) » South African National Roads Agency Limited (national roads)	» An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22 m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (i.e. height and width).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		
Subdivision of Agricultural Land Act (Act No 70 of 1970)	» Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land, or for the registration of a servitude or lease for longer than 10 years.	Consent of Minister of Agriculture to subdivide, or register long lease or servitude, in respect of agricultural land.	Registration of a servitude is required to be undertaken following the issuing of an environmental authorisation for the proposed project and negotiation with the affected landowner.
National Environmental Management: Waste Act (Act No 59) of 2008	» The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » The Minister may amend the list by— *(a)* adding other waste management activities to the list; *(b)* removing waste management activities from the list; or *(c)* making other changes to the particulars on the list. » In terms of the Regulations published in terms of this Act (GN 718), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise	National Department of Water and Environmental Affairs (hazardous waste and effluent) Provincial Department of Environmental Affairs (general waste)	Waste licence could be required in the event that more than $100m^3$ of general waste or more than $35m^2$ of hazardous waste is to be stored on site at any one time. The volumes of waste generated during construction and operation of the power line and substations are not expected to be large enough to require a waste license. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMP.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	provided by this Act, to ensure that *(a)* the containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; *(b)* adequate measures are taken to prevent accidental spillage or leaking; *(c)* the waste cannot be blown away; *(d)* nuisances such as odour, visual impacts and breeding of vectors do not arise; and *(e)* pollution of the environment and harm to health are prevented		
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	» National Department of Environmental Affairs.	» No permitting or licensing requirements. This act may find application during the project EIA.
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested & affected parties have right to be heard	» National Department of Environmental Affairs.	» No permitting or licensing requirements. This act will find application during the project EIA.
Provincial Legislation			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	The Act provides for: » the sustainable utilisation of wild animals, aquatic biota and plants; » the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; » offences and penalties for contravention of the Act;	» Department of Environmental and Nature Conservation – Northern Cape	» No permitting or licensing requirements. This act may find application during the project EIA.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» the appointment of nature conservators to implement the provisions of the Act; » the issuing of permits and other authorisations. » lists of protected species for the Province.		
Nature Conservation Ordinance (Act No. 19 of 1974)	» Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, and gathering, uprooting, damaging, or destroying). » Schedule 3 lists endangered flora and Schedule 4 lists protected flora. » Articles 26 to 47 regulate the use of wild animals.	» Provincial Department of Environmental Affairs	» No permitting or licensing requirements arise from this legislation for the proposed activities to be undertaken for the proposed project.
Guideline Documents			
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	» Outlines the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits.	» Provincial Department of Transport	» N/A
Policies			
Namakwa District Municipality's Integrated Development Plan	» Assisting in the identification of "identified geographical areas" in terms of NEMA. » Assisting in the identification of specified activities within identified geographical areas. » The provision of a decision support system in respect to environmental attributes, issues, and priorities.	Namakwa District Municipality	N/A

This section of the EIA Report provides a description of the environment that may be affected by the proposed Aggeneis-Oranjemond 400 kV Transmission Power Line and Substation upgrade project. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Features of the biophysical, social and economic environment that could be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area and proposed development site as well as collected field data, and aims to provide the context within which the environmental assessment has been conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within Appendices F – K.

4.1. Regional Setting of the Study Area

The study area is situated within the western section of the Northern Cape Province. This province lies to the western part of South Africa and borders Namibia and Botswana. The Free State Province borders the province to the east, the North West Province borders to the north east, and the Western Cape Province lies to the south. Some of the major towns that are located in the study area which could possibly be affected by the proposed project include Aggeneys, Springbok, Okiep, Carolusberg, Steinkopf and Alexander Bay (Refer to Figure 4.1).

The study area falls within the jurisdiction of the Namakwa District Municipality, which is made up of six Local Municipalities (LM). Three of the six Local Municipalities as well as a small section of the Namaqualand District Management Area (DMA) have jurisdiction over the area in which the study site is located (Figure 4.2). These Local Municipalities include:

» Khai-Ma LM
» Nama Khoi LM
» Richtersveld LM
» Namaqualand District Management Area

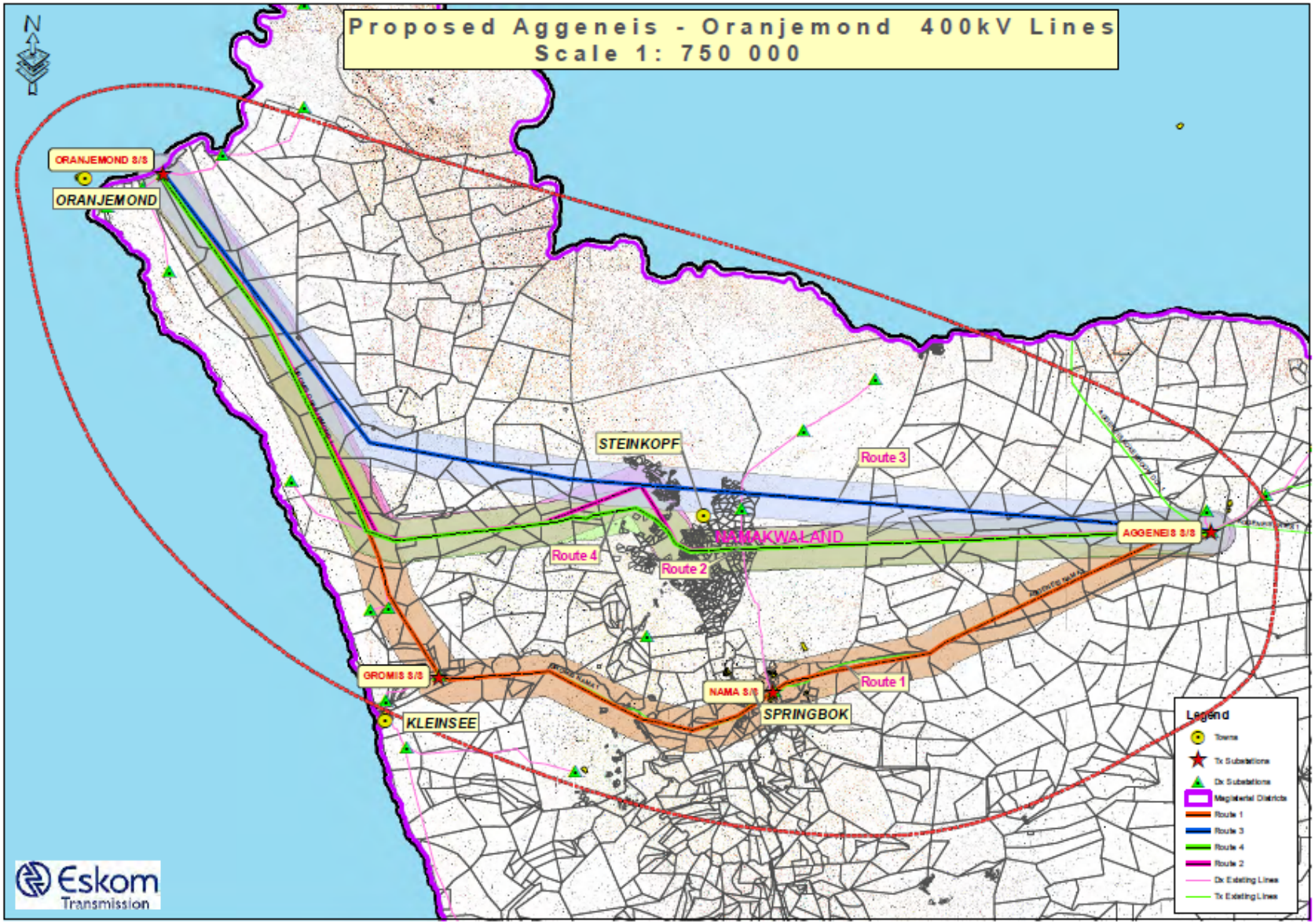

Figure 4.1: Locality Map indicating the four Alternative Transmission power line corridors

The proposed alternative power line corridors cross landform types ranging from plains to a number of areas consisting of hills and mountains. A number of properties within the study area are potentially affected by the proposed alternative transmission power line corridors. These are owned by either private landowners or Traditional Authorities. On a regional scale, the N14, N7, R382 as well as the R355 roads provide access to the study area.

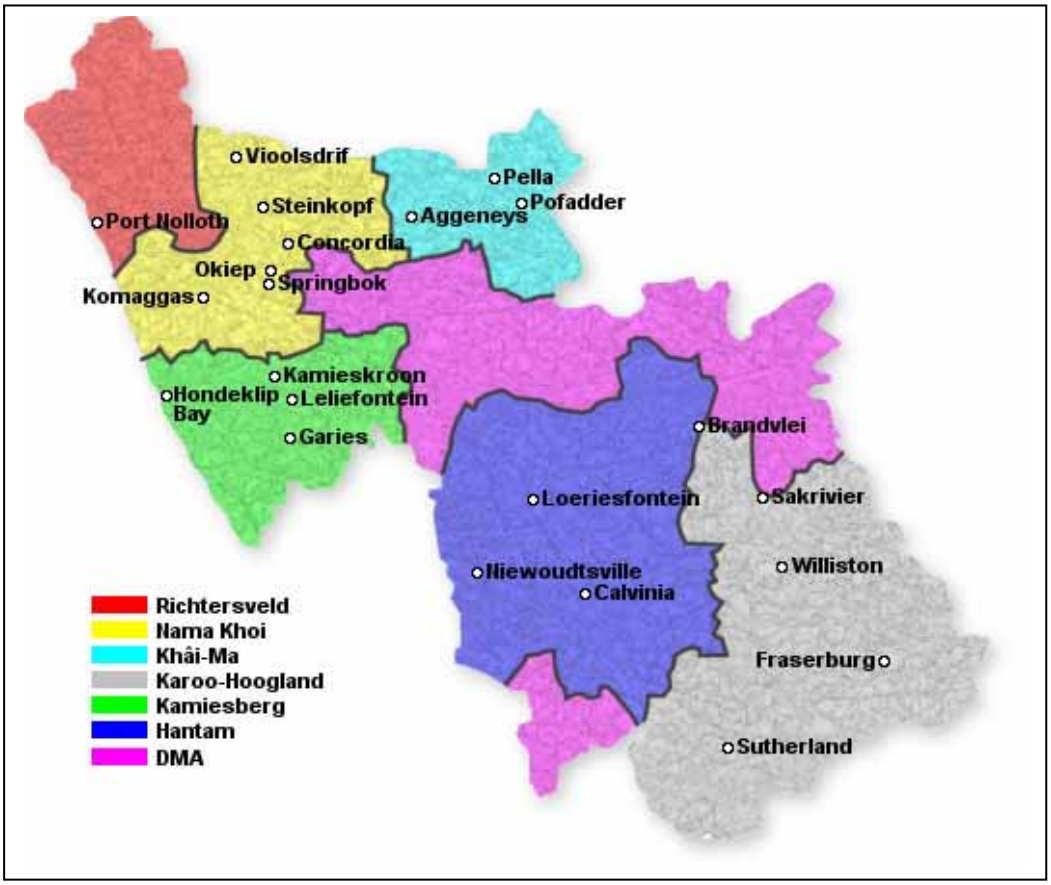

Figure 4.2: Delineation of the Namakwa District Municipality with associated Local Municipalities

4.2. Social Characteristics of the Study Area

As mentioned, the study area is located within the boundaries of the Northern Cape Province. The Local Municipalities (LM) which were identified for the proposed project include the Nama Khoi, Khai-Ma and Richtersveld Local Municipalities. These Local Municipalities all form part of the Namakwa District Municipality.

4.1.1. Demographic Profile

The total population in the potentially affected municipalities is estimated at approximately 67 032 individuals of which the majority (44 752) resides within the Nama Khoi LM. A total of 11 348 individuals reside within the Khai-Ma LM

whilst the Richtersveld LM and the Namaqualand DMA respectively contain 10 119 and 813 individuals (Stats census SA 2001). From the above it is evident that the study area is very sparsely populated. However, the affected municipalities' population in the rural towns is increasing. This is as a result of the downscaling of some mines in the area and the fact that there are some other established industries in these towns that could provide limited work opportunities attracting individuals to these towns.

In the Northern Cape, Afrikaans is widely spoken by almost all racial groups (about 68% of the population), followed by Setswana speakers at 20% and isiXhosa at 6.3%. English follows a distant fourth at 2.4%. About 70% of the population in the Northern Cape is urbanised while the rest remain in the rural areas (www.northerncape.gov.za).

The age distribution of the study area imitates a population dominated by the young and a large middle age grouping. Within the Northern Cape, females outnumber males by 4%, being 51% and 47% respectively (Census 2001 Statistics). The same applies for the Namakwa District Municipality with 51 339 of the population being female and 50 376 of the population being male. However, the situation is not the same for the Richtersveld Local Municipality as males (1 969 individuals - 69%) represent two-thirds of the total population and females only one third (898 individuals - 31%). Unemployment levels are higher among females as most of the established industries employ mostly males.

4.1.2. Socio-economic Profile

The two dominant economic sectors within the District and Local Municipalities include mining, fishing, mari-culture, livestock farming (including sheep, goats and cattle), as well as fruit production (www.northerncape.gov.za & Khai-Ma LM IDP, 2010).

Within the harsh and dry landscape, mining is the dominant economic sector within the area. Diamonds, quartzite and lime are the three most economically viable mineral deposits found in the Richtersveld. The Black Mountain zinc mine, now owned by Vedanta and Exxaro Resources Limited, is located 10 km west of Aggeneys and falls within the Khai-Ma LM. Since 2007, the De Beers owned Kleinzee mine has also experienced drastically reduced diamond mining operations. The staff component has been reduced from approximately 3 000 to 250. This has had serious negative economic implications for schools, houses and recreational centres in the town. Although De Beers is aiming to give a boost to the area through tourism, fish farming and other industries, it is a slow process (www.terradaily.com).

The other established economy in the area is based around the fishing industry that operates from Port Nolloth, with its shallow water harbour. The oldest economy in the region is livestock farming. Although it is not a lucrative or large industry due to the dry and ecologically fragile ecosystem, it does still support a large number of people living in the area and is an important livelihood option to the people of the Northern Cape.

The growing industry in the District municipal area is nature-based tourism. As a large part of the Northern Cape's coastline has been mined, an even larger section has been kept pristine due to the area being under strict security for approximately 80 years. These undeveloped sections of coastline with its large variety of plants could thus have a significant tourism potential along with some potential for job creation. Currently most of the tourism market is dominated by 4x4 vehicle enthusiasts to the Richtersveld National Park (RNP). Although large numbers of vehicles pass through the study area, very few direct benefits reach the residents of the area. If these tourism activities could be altered to directly benefit the locals, it has a large development potential, as more people visit the RNP than the number of people living in the Richtersveld communal area. Irrigation agriculture along sections of the Orange River has been an important economic sector for a number of years. The established grape export industry, as well as the potential for expansion of this industry and the production of other fruit such as dates remains a key source of employment creation and thus economic sector.

The capital generated in the Namakwa District Municipality has the second lowest economic growth rate in South Africa. A major concern for the area is that the district is losing its young, economically active population to other more viable regions (NDM IDP, 2006). The main reason for this is the limited economic opportunities and resultant high levels of unemployment, which has increased significantly from 1996 to 2001. This is especially the case for the affected Local Municipalities in the study area with a 35.5% level of unemployment in the district. This figure could now be even higher as unemployment has also increased from 2001 due to the closure of mines and the retrenchment of workers (NDM IDP, 2006).

The Integrated Development Plan (IDP) for the Namakwa District Municipality (NDM, 2006) indicates that a development shift in the district is the best possible way to increase the living standards of the people. Therefore, the need has arisen for alternative forms of livelihoods, which has come mainly in the form of developing eco-tourism.

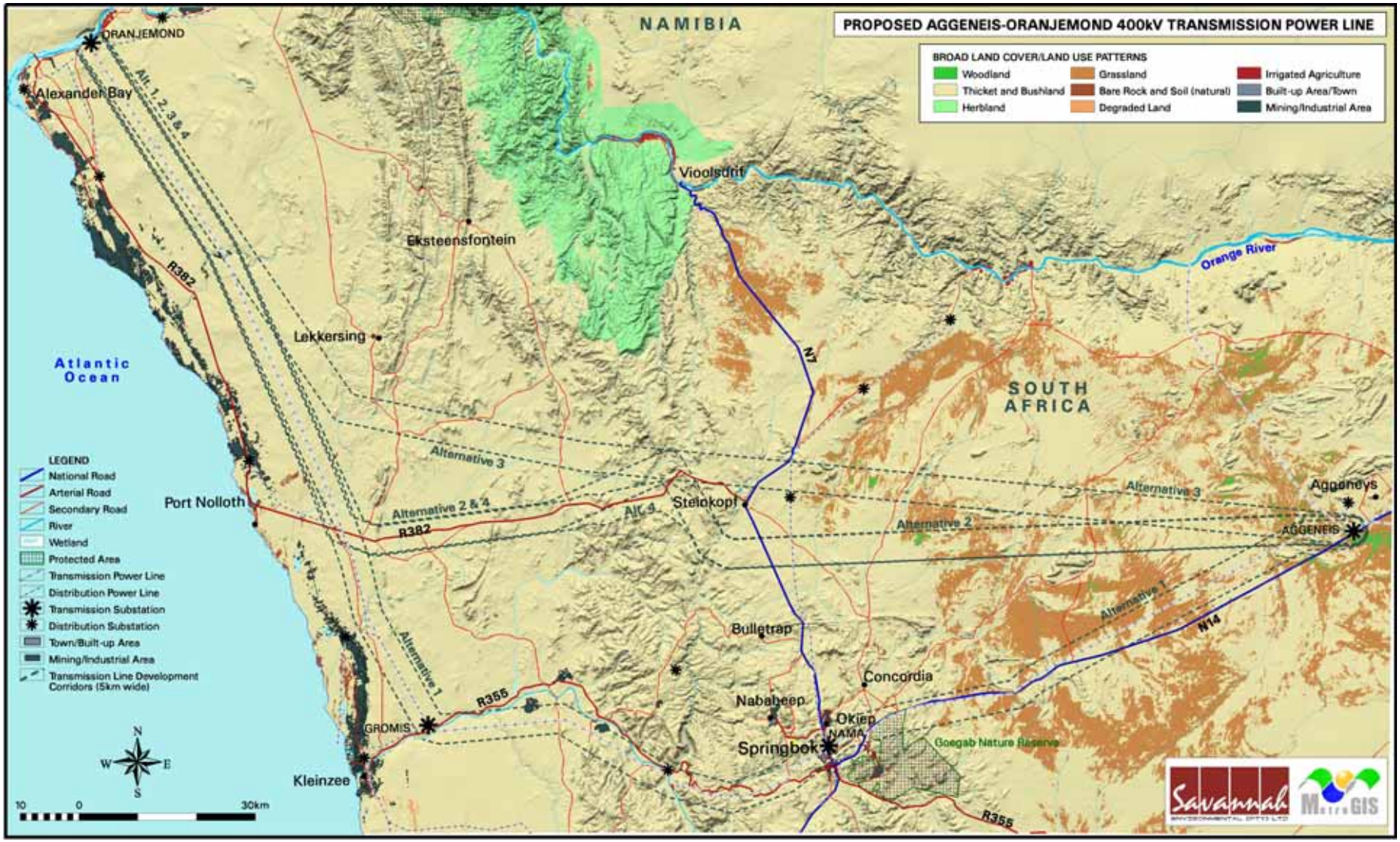

Figure 4.3: Land use patterns of the areas affected by the Alternative Transmission line corridors

4.1.3. Services and Infrastructure

The majority of households in the NDM receive the minimum basic services but the provisions of bulk water supply to certain communities are still a problem that should be addressed. The table below gives an indication of the services rendered to a total of 27 779 households in the district (NDM IDP, 2006).

Table 4.1: Services rendered in the Namakwa District Municipality

Municipalities	**Number of households**			
	Electricity (Energy used for fuel)	**Water**	**Sanitation**	**Refuse removal**
DMA (Namaqualand)	57	57	0	0
Nama Khoi LM	7 599	10 884	8 641	9 792
Richtersveld LM	2 809	3 058	3 058	3 058
Hantam LM	4 336	4 397	4 381	4 365
Kamiesberg LM	4 081	4 564	4 398	4 564
Khai Ma LM	1 716	1 788	1 788	1 726
Karoo Hoogland LM	2 674	2 717	2 717	2 674
TOTAL	**23 272**	**27 465**	**25 040**	**26 179**

It is clear from the table above that electricity and sanitation need to be addressed by the relevant municipalities.

Housing backlogs exist in the study area, especially in the towns of Port Nolloth, Sanddrift, Lekkersing, Eksteenfontein and Kuboes. Although some progress has been made in this regard, the backlog is worsened by the difficulties experienced in providing plots with water and other services (RLM IDP, 2009).

High incidences of alcohol and drug abuse in all of the affected municipalities prevail, and HIV/AIDS is becoming a growing problem. In the Richtersveld LM area there is only one hospital in Port Nolloth (RLM IDP, 2009), which is poorly equipped, as well as a clinic. In the Khai-Ma LM there is a sufficient functioning clinic in Aggeneys, but the clinic is only available to the mining workers and not to their extended families (Khai-Ma LM IDP, 2010). Alexander Bay has a very well equipped 26-bed hospital and a clinic. It functions as a private hospital for those who can afford its services. A fully-equipped emergency unit functions well and has a back-up ambulance available.

According to general criteria and standards there are sufficient facilities, especially if one includes those available in the mining towns. However these are not state-owned facilities and are not available to all residents. Without the

mining facilities, the general standard of health facilities in the region is classified as very poor.

4.1.4 Socio-Cultural Profile

The four alternative Transmission line corridors cross a number of different geographic regions, origination on the grassy plains of the Bushmanland east of Aggeneys, then crossing the mountainous area around Steinkopf and Springbok, and extending down the escarpment onto the coastal plains and then heading northward through the Sandveld close to the Atlantic coast passing the towns of Kleinzee and Port Nolloth, to the Orange River. The following remarks can be made regarding the heritage features of the study area:

» *Pre-Colonial Archaeology*
Beaumont et al. (1995) have shown a low density scatter of Pleistocene age stone artefacts across Bushmanland, east of the escarpment, mainly manufactured on quartzite cobbles. Substantial Middle Stone Age sites with good context are uncommon in Bushmanland, and those that have been documented have contained only small samples (Beaumont et al. 1995).

The restricted distribution of ESA sites suggests a greater reliance on proximity to water sources in the inhospitable inland areas. No substantial sites have been found on the plains to the west of Aggeneys with only very sparse localised scatters reported in the hills or at the bases of hills.

Substantial Middle Stone Age sites with good context are uncommon in Bushmanland, and those that have been documented have contained only small samples (Beaumont et al. 1995). Late Holocene Later Stone Age (LSA) sites are the predominant pre-colonial archaeological heritage noted in surveys both above and below the escarpment. These also tend to focus on water sources and wherever some possibilities of shelter existed. Pans, springs rock shelters and koppies are likely locations.

» *Colonial History*
The Orange River became the official border of the Cape Colony in 1847 with the discovery of large deposits of copper in the area. Mining began in earnest in 1854 in the Blue Mine, around which the town of Springbok eventually developed. Soon rich deposits of copper were being mined at Okiep, Concordia, Spektakel and later at Nababeep and would continue to be mined until the later part of the 20th century. The study area is therefore littered with evidence of abandoned mining activity, including old mine shafts, spoil heaps, and old mining machinery. The significance of these remains has been recognised with the nomination of the Namaqualand Copper Mining

Landscape on South Africa's tentative list of World Heritage sites (Refer to Figure 4.4). The towns in close proximity to the proposed line include: Aggeneys, Concordia, Okiep, Steinkopf, Springbok and Port Nolloth and they have a history extending back to the mid-19th century.

The towns and mining could only develop because of the development of the roads and railways and these form an important part of the heritage of the area. Copper ore and later copper concentrate were transported from Okiep to Hondeklipbaai by ox-wagon along the Messelpad (Ross 2002). However, Ross (2002) points out that although Hondeklipbaai was the major shipping port, there was always a certain amount going out via Port Nolloth, and this material had to be transported with wagons. Between 1869 and 1876, RT Hall pushed for the construction of a railway line to Port Nolloth. The line initially ran from Port Nolloth to the foot of the escarpment terminating at Muishondfontein (probably Anenous) (Smallberger 1975). However by 1876 the line reached Okiep, a distance of about 140km. This was a narrow gauge railway and initially rail carriages transporting goods and passengers were pulled by mules until steam engines could be obtained. The rail continued to be used until 1942 when it was replaced with road transport. After the railway line was decommissioned, the rail tracks were removed.

By the end of the 1920s, De Beers Consolidated Mines had purchased a great deal of land south of Port Nolloth. Diamond mining led to the establishment of mining towns such as Kleinzee and Koingnaas.

» *Living Heritage*

There is a direct historical link between the small stock farmers in the Steinkopf, Concordia and Richtersveld Communal Lands and the Namaqua Khoekhoen who were encountered by early travellers in the 17th century. Many of the residents of the Concordia, Steinkopf and Richtersveld Communal Reserves are descended from these Nama-speaking pastoralists who at one time practised a transhumant lifestyle across most of Namaqualand. The Trekboer encroachment into the region during the late 17th and early 18th century resulted in the Namaqua losing access to their traditional grazing lands and they eventually settled towards the mission stations that were established at Steinkopf, Concordia and the in Richtersveld during the 19th century. Residents were granted a "Ticket of Occupation" in the mid-19th century and the Mission Stations and Communal Reserves Act of 1909 placed the communal land under government control.

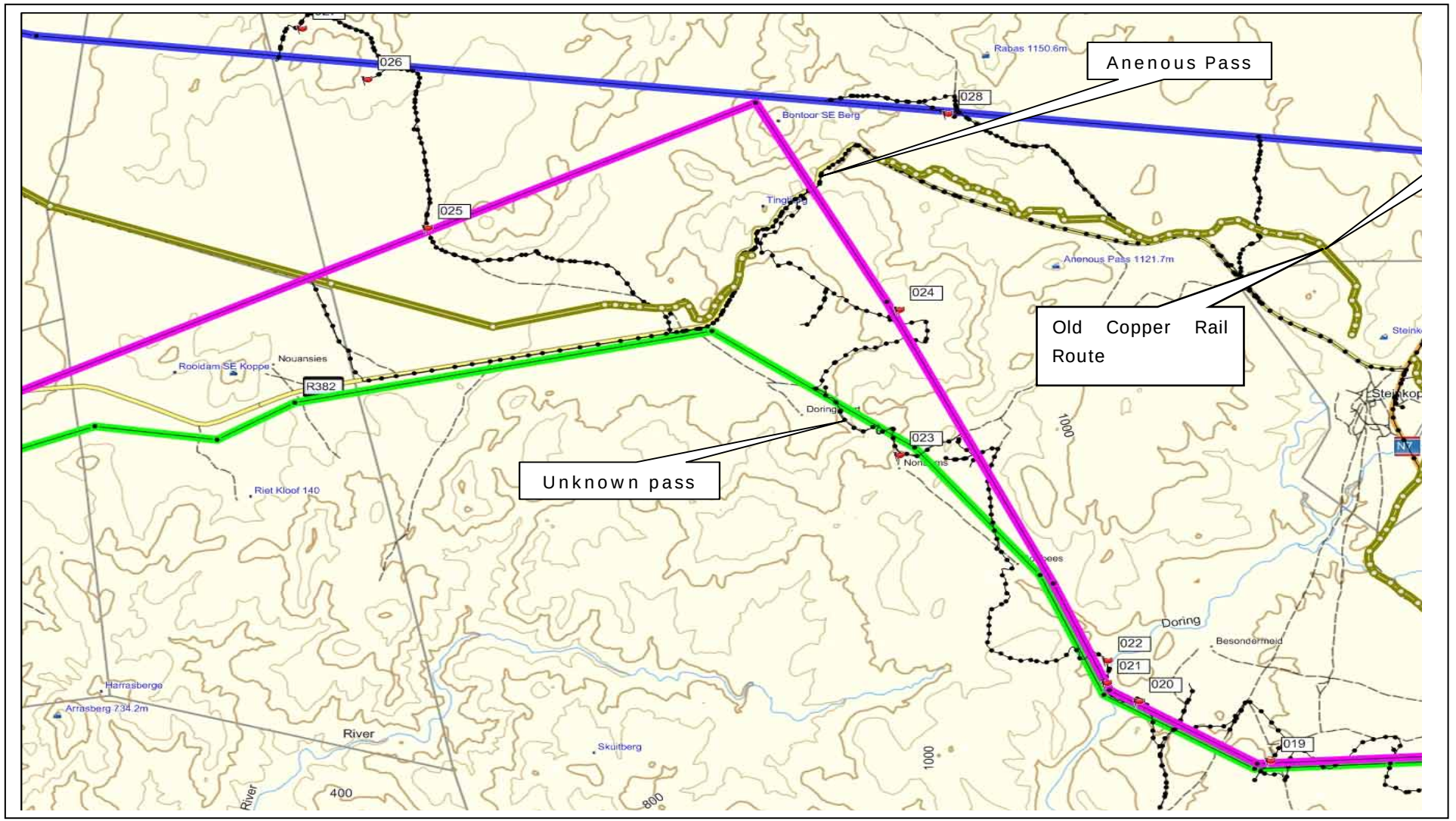

Figure 4.4: The most sensitive areas identified in the survey, including the Old Copper Rail Route

Figure 4.5: The borders of the Richtersveld World Heritage Site indicated in red.

The mission stations provided a form of social support for the Namaqua, but the establishment of schools and churches in the reserves meant that the inhabitants started practicing a more limited transhumant cycle using the villages as one permanent point in their seasonal cycle. Steinkopf residents were still practicing a limited form of transhumance in 1986 (Webley 1987) but many of the old stockposts have now become semi-permanent settlements.

Stockpost locations are typically situated next to a rocky hill or koppie (Plate 19), where the rock provides some shelter from the elements (Webley 1982). Stockposts often have one or more kraals nowadays often enclosed by wire fences, whereas in the past they were constructed of stone (Plate 20). There is a great deal of similarity between stockposts in Steinkopf, Concordia and the Richtersveld and Webley (1987) has suggested that they may have a long history. They are a tangible example of a rapidly disappearing pastoralist way of life in the communal lands of Namaqualand and a very good example of living heritage as defined in the National Heritage Resources Act (NHRA).

The significance of this ancient form of land management was given official recognition with the proclamation of the Richtersveld as a World Heritage Site (Figure 4.5 above). However, similar systems of land management are also practised in Concordia, Steinkopf and other communal reserves in Namaqualand.

4.2. Biophysical Characteristics of the Study Area

4.2.1. Geographical Profile

The study area comprises elevation ranging from 0 to 1 380 meters above sea level (masl). The mountains surrounding the Orange River range from less than 350 to 1 380 masl. The terrain west of Aggeneys is described as plains with even slopes, while the rest of the study area consists of low mountains of the escarpment and slightly undulating plains along the coast. The Orange River is the most prominent hydrological feature in the area, but other rivers, such as the Buffels, the Holgat and the Kamma Rivers are also prominent.

Land use within the study area is largely unspecified, consisting of wide open land, mostly left in its natural state. However, some low density agricultural practices (livestock farming) occur, and extensive mining takes place along the coastline between Alexander Bay and Kleinzee. The land cover comprises mostly of Thicket and Bushland, with patches of Grassland occurring in the east. The land cover is undisturbed for large sections in the study area, but degraded in the

area between Aggeneys and the N7 route due to agricultural activities and settlement patterns.

The natural vegetation types include Strandveld along the coastline, giving rise to a combination of Succulent Karoo and Namaqualand Broken Veld in the vicinity of Springbok. Towards the east, the vegetation consists of Mountain renoster-bush Veld. The study area includes two conservation areas, these being the Goegap Nature Reserve situated to the east of Springbok and the Ai-Ais/Richtersveld Transfrontier Park, situated to the far north, near Alexander Bay.

4.2.2. Avifauna

The vegetation found in the study area is very uniform when examined at the biome level. Two vegetation types, the Nama Karoo and Succulent Karoo biomes, dominate the broader area. There is little difference if any, in the avifauna expected to associated with either of these vegetation types.

In addition to vegetation type, bird micro habitats are also informative in determining where certain bird species occur as well as their abundance. The three main types of microhabitat available to avifauna within the study area are the open plains which are very arid, the mountainous terrain which is also very arid and the major river systems which are lush, have large scale agriculture and attract lots of birds. Two Important Bird Areas (IBAs) exist in the study area and are located along or near the four route alternatives (Figure 4.6). These are described below:

» *SA030 Orange River Mouth Wetland*
This IBA is important as it is considered the sixth most important coastal wetland in South Africa in terms of the overall numbers of wetland birds that it supports. Bird numbers can be as high as 26 000 individuals comprising 56 species. These numbers diminish substantially during winter suggesting that the vast majority of species are migratory. Important species in this IBA include: African Marsh Harrier, Caspian Tern, Lesser and Greater Flamingo, Black Harrier, African Black Oystercatcher, Damara Tern, White Pelican, Peregrine Falcon, and Chestnut banded Plover. This IBA is some distance from the proposed power line corridors, and many of the species occurring in the IBA would not be expected within the corridors.

» *SA035 Haramoep and Black Mountain Mine Nature Reserve*
This IBA is located at the start of the four alternative power lines at Aggeneis substation. This site is important to avifauna as it is one of the few sites protecting the globally threatened Red Lark and the Near Threatened Sclaters Lark.

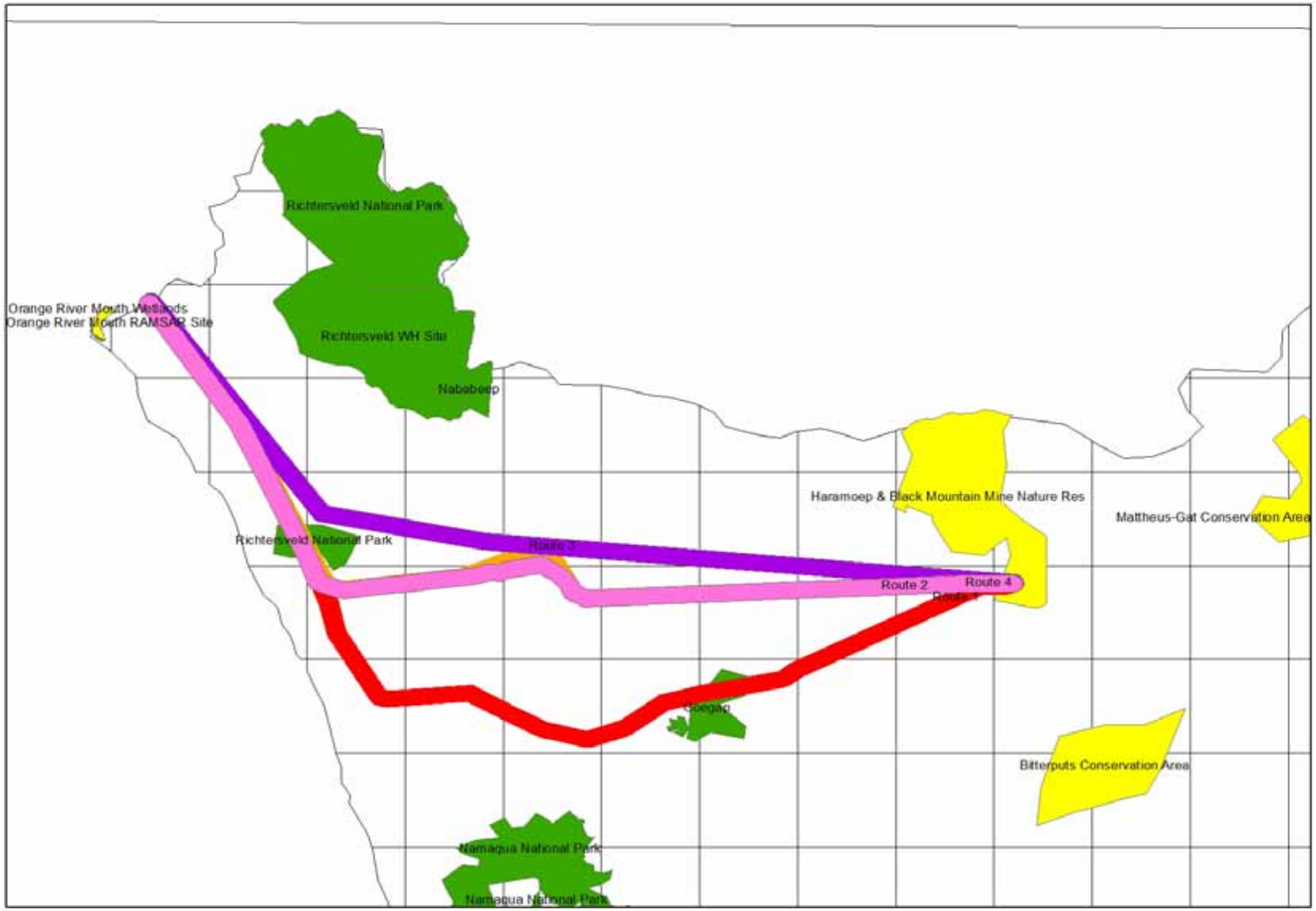

Figure 4.6: Study area showing important avifaunal factors such as Important Bird Areas (yellow) and protected areas (green)

4.2.3. Ecological Profile

The study area traverses the Nama Karoo, Succulent Karoo and Desert Biomes (Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al*. 2006). This map shows 26 different vegetation types across which the proposed alternative corridors traverse. The vegetation types are indicated in Figure 4.7.

On the basis of rates of transformation, all but one of the 26 vegetation types are classified as Least Threatened. The vegetation type, i.e. Lower Gariep Alluvial Vegetation, associated with the floodplain of the Orange River, is classified as Endangered.

» *Succulent Karoo Region and Gariep Centre of Endemism*
Most of the study area falls within the Succulent Karoo Region, a floristic region containing a number of areas with concentrations of endemic species (van Wyk & Smith 2001). It is recognised as an important centre of plant diversity and endemism in Africa (Davis et al.1994). There are a number of areas within the Succulent Karoo Region that are foci of high local endemism, including the Gariep Centre of Endemism, the Knersvlakte Centre, the Little Karoo Centre, the Worcester-Robertson Karoo Centre and the Hantam-Roggeveld Centre. The study area falls partly within the Gariep Centre of Plant Endemism (GC) (van Wyk & Smith 2001).

This area occupies the lower reaches of the Orange River valley and surrounding areas, extending from Augrabies to Alexander Bay and including the Richtersveld (van Wyk & Smith 2001). The GC is exceptionally rich in succulents and is considered to have the richest variety of succulents on earth (van Wyk & Smith 2001). The GC is thought to have approximately 2700 species / infraspecific taxa of which 21% are endemics. Approximately 80% of the endemics are succulents (van Wyk & Smith 2001). The area is a centre of diversity and endemism for a number of plant groups.

» *Important Biodiversity Areas*
A bioregional planning project named the Succulent Karoo Ecosystem Plan (SKEP) was undertaken in 2002 to provide an overarching framework to guide conservation efforts in the Succulent Karoo (Driver et al. 2003). The goal of the Biodiversity Component of SKEP was to identify broad-scale geographic priorities for terrestrial biodiversity conservation in the Succulent Karoo biome, using a systematic conservation planning approach. The current study area (from approximately 18^{o} longitude wetwards) falls within a geographical priority area called the Greater Richtersveld Region. A map of the critical biodiversity areas located in the study area is shown in Figure 4.8.

According to the Final Namakwa District Biodiversity Sector Plan, the following features occur in areas that may be affected by the proposed alignments:

- corridors;
- terrestrial areas important for biodiversity of different groups, including plants, fish, invertebrates, birds, mammals, reptiles and amphibians;
- kloofs;
- SA vegetation types of high conservation value;
- SA vegetation on quartzitic substrates;
- steep slopes.

» *Red Data Plant Species*

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1 of the ecology specialist study per quarter degree grid. Each grid has a different number of threatened, near threatened and rare species (Refer to Table 4.3 for an explanation of categories). Important to note is that species that are listed on the SANBI website as "*Thr" (i.e. suspected to be threatened but not assessed) are listed here as Data Deficient.

An indication of the number of threatened plant species (CR, EN, VU & DD) per quarter degree grid is provided in Figure 4.9. This provides an assessment of which parts of the study area are most likely to contain threatened plant species. The escarpment area, especially around Steinkopf, appears to have the highest concentrations of threatened plant species. This is followed by concentrations in the hilly areas to the north-east to south-east of Port Nolloth. Note that Figure 4.9 excludes all other plant species of conservation concern, i.e. those listed as near threatened or rare.

» *Red Data Vertebrate Species*

All Red List vertebrates (mammals, reptiles, amphibians) that could occur in the study area are listed in Appendix 2 of the ecology specialist study.

There are three mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Critically Endangered (CR), De Winton's Golden Mole, one species classified as Endangered, Hartmann's Mountain Zebra and one classified as Vulnerable in the South African part of its range, although globally, it is listed as Least Concern, the Angolan Wing-gland Bat.

There is one frog species of conservation concern previously recorded in the grids in which the study area is located and which could occur on site. This is

the Namaqua Stream Frog, listed as Vulnerable (VU). Within the study area, it is restricted to mountainous areas along the Great Escarpment, where it is found in seeps and springs.

There are three reptile species of conservation concern that occur in the study area, one, the Armadillo Girdled Lizard, listed as Vulnerable, and two, the Namaqua Plated Lizard and the Speckled Padloper, listed as Near Threatened.

» *Protected trees*

Tree species protected under the National Forest Act are listed in Appendix 3 of the ecology specialist study (Appendix F). Those that have a geographical distribution that includes the study area are *Acacia erioloba* (Camel Thorn, Kameeldoring), *Acacia haematoxylon* (Grey Camel Thorn, Vaalkameeldoring), *Boscia albitrunca* (Shepard's Tree / Witgatboom / !Xhi) and *Euclea pseudebenus* (Ebony Tree, Ebbeboom).

Acacia erioloba occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands (mostly Bushmanland Arid Grassland). *Acacia haematoxylon* occurs on deep Kalahari sand between dunes or along dry watercourses (Bushmanland Arid Grassland). *Boscia albitrunca* occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils (mostly Bushmanland Arid Grassland). *Euclea pseudobenus* occurs in semi-desert and desert areas, usually along watercourses and in depressions. It could occur in the hills or on the flats. *Acacia erioloba* is relatively common in the study area, whereas *Acacia haematoxylon*, *Euclea pseudobenus* and *Boscia albitrunca* occur more sparsely.

Any of these species could occur in any part of the study area, depending on local conditions. It is, however, most likely that they would occur in drainage areas or at the base of mobile dunes.

Table 4.3: Explanation of IUCN categories (IUCN, 2001)

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Declining	Declining taxa	Orange List

IUCN / Orange List category	Definition	Class
Rare	Rare	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

» *Reserves and Parks*

There are various parks and reserves in the country, which serve to conserve critical areas of biodiversity. These are categorised according to the level of protection they are afforded. Statutory reserves, including National Parks, have the highest level of protection. Private Reserves also provide for conservation of natural areas, but do not have the same level of legal protection. In all conservation planning products, existing protected areas are considered to be "no go" areas in terms of future development.

There are three protected areas along the path of proposed alternative alignments:

* The first is the Goegap Nature Reserve to the east of Springbok. Corridor 1 crosses the northern boundary of this reserve.
* The second is a small outlier of the Richtersveld National Park, situated just inland of Port Nolloth. Corriodors 1, 2 and 4 pass through the middle of this protected area.
* A third protected area is indicated in the draft Namakwa District Biodiversity Sector Plan as occurring around Aggeneys. It is called the Black Mountain Mine Reserve. No information is available on this reserve, but it is probably a private reserve owned by the mining company at Aggeneys. The town of Aggeneys is entirely within the reserve. All four corridors pass through this reserve, because the substation at Aggeneys is located within the reserve.

» *Sensitivity assessment*

The sensitivity assessment identified those parts of the study area that could possibly have high conservation value or that may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 4.10.

There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

- vegetation of conservation importance: this is based primarily on the Draft Ecosystem List;
- presence of reserves and National Parks;
- “irreplaceable” and “important” biodiversity areas;
- perennial and non-perennial rivers and streams: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
- potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a high chance of occurring within natural habitats in the study area.

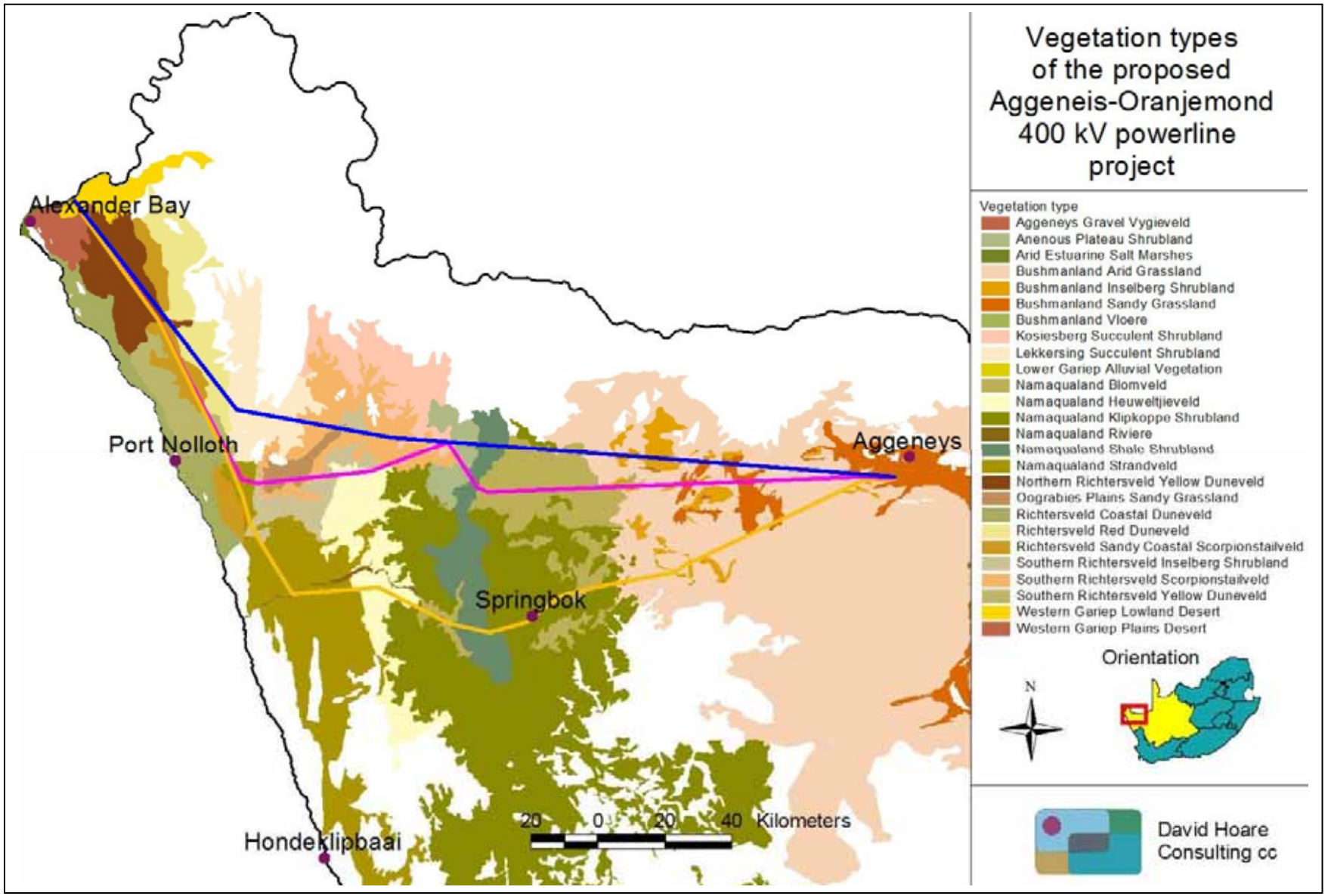

Figure 4.7: Vegetation types of the study area

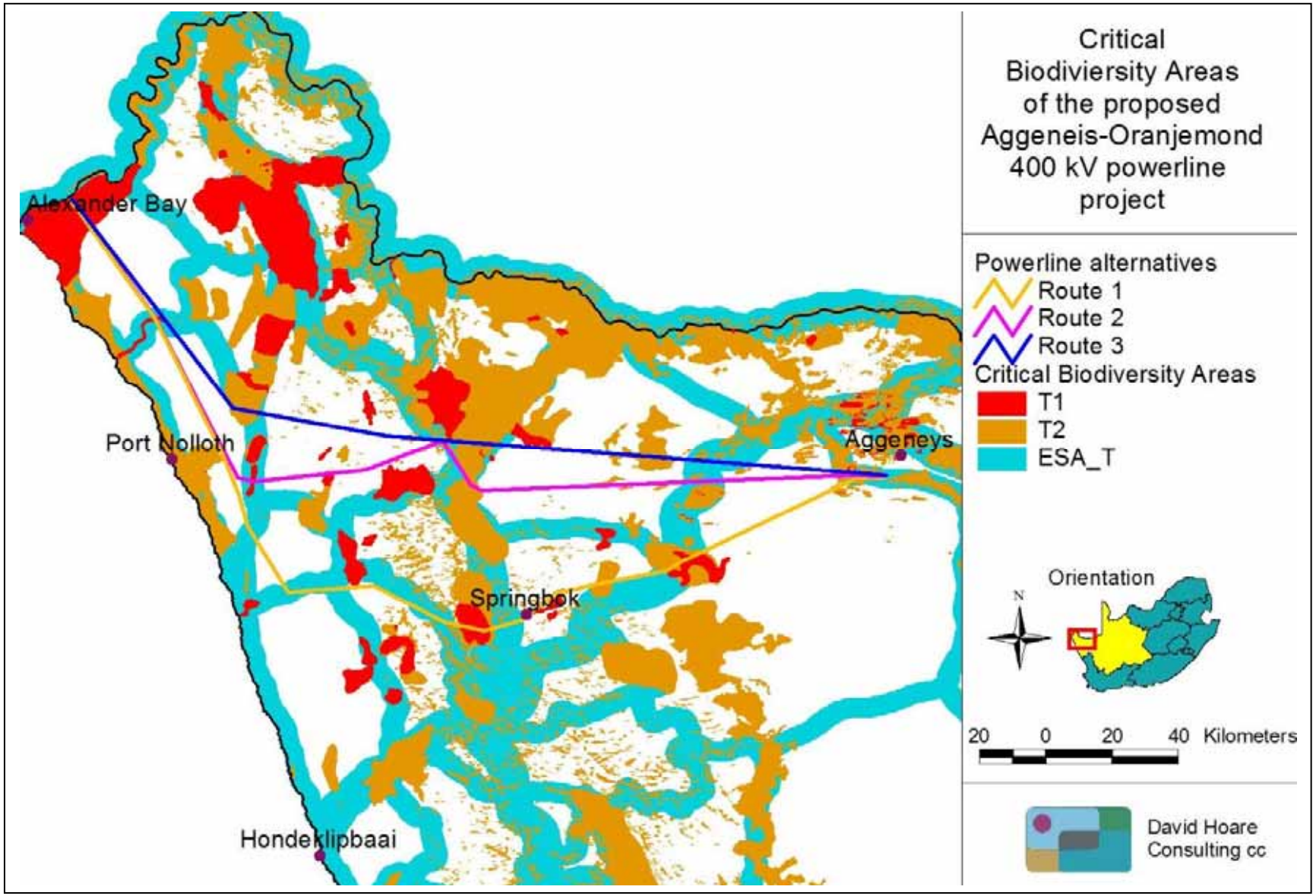

Figure 4.8: Critical Biodiversity areas within the study area

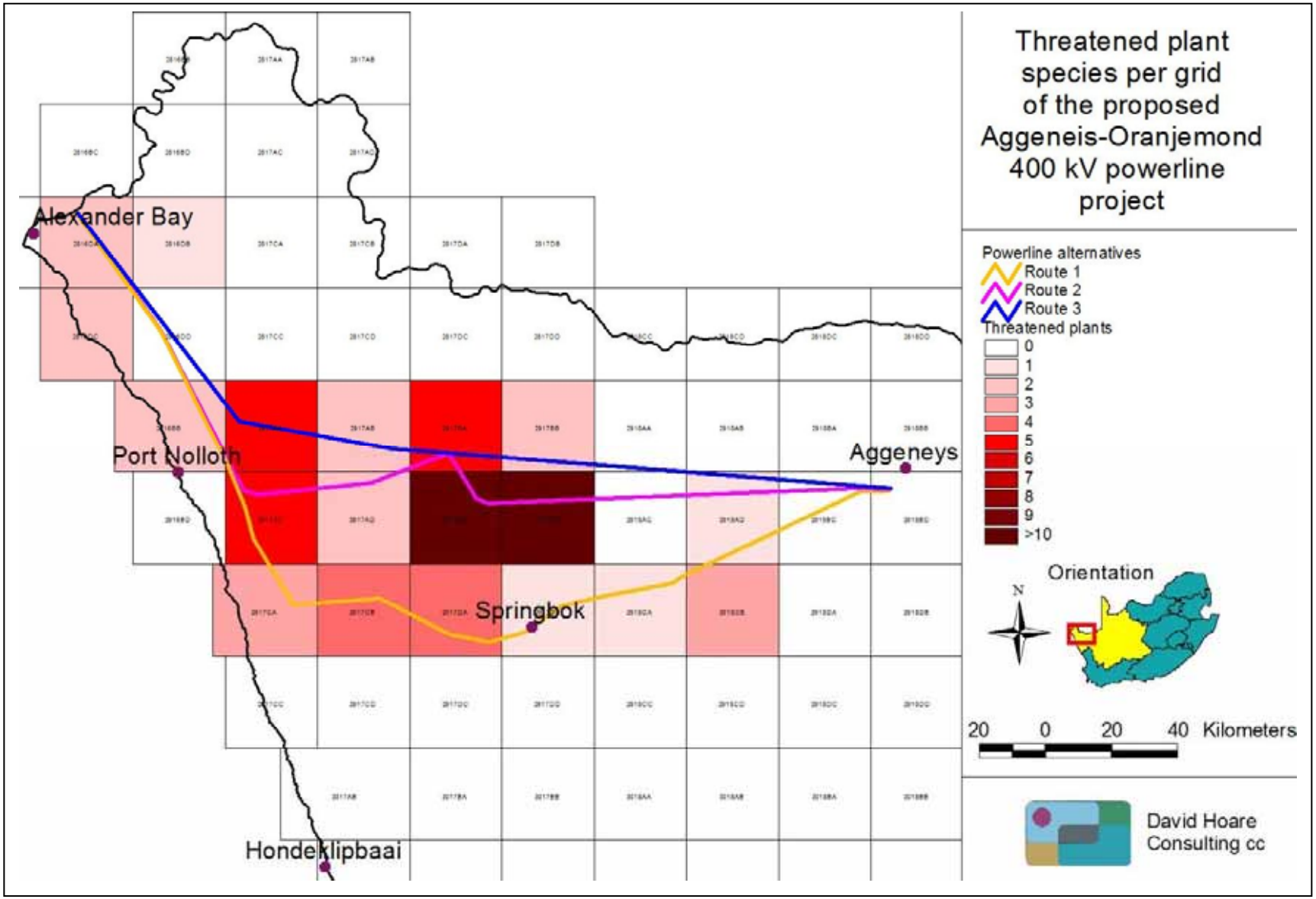

Figure 4.9: Number of threatened plant species recorded per quarter degree grid

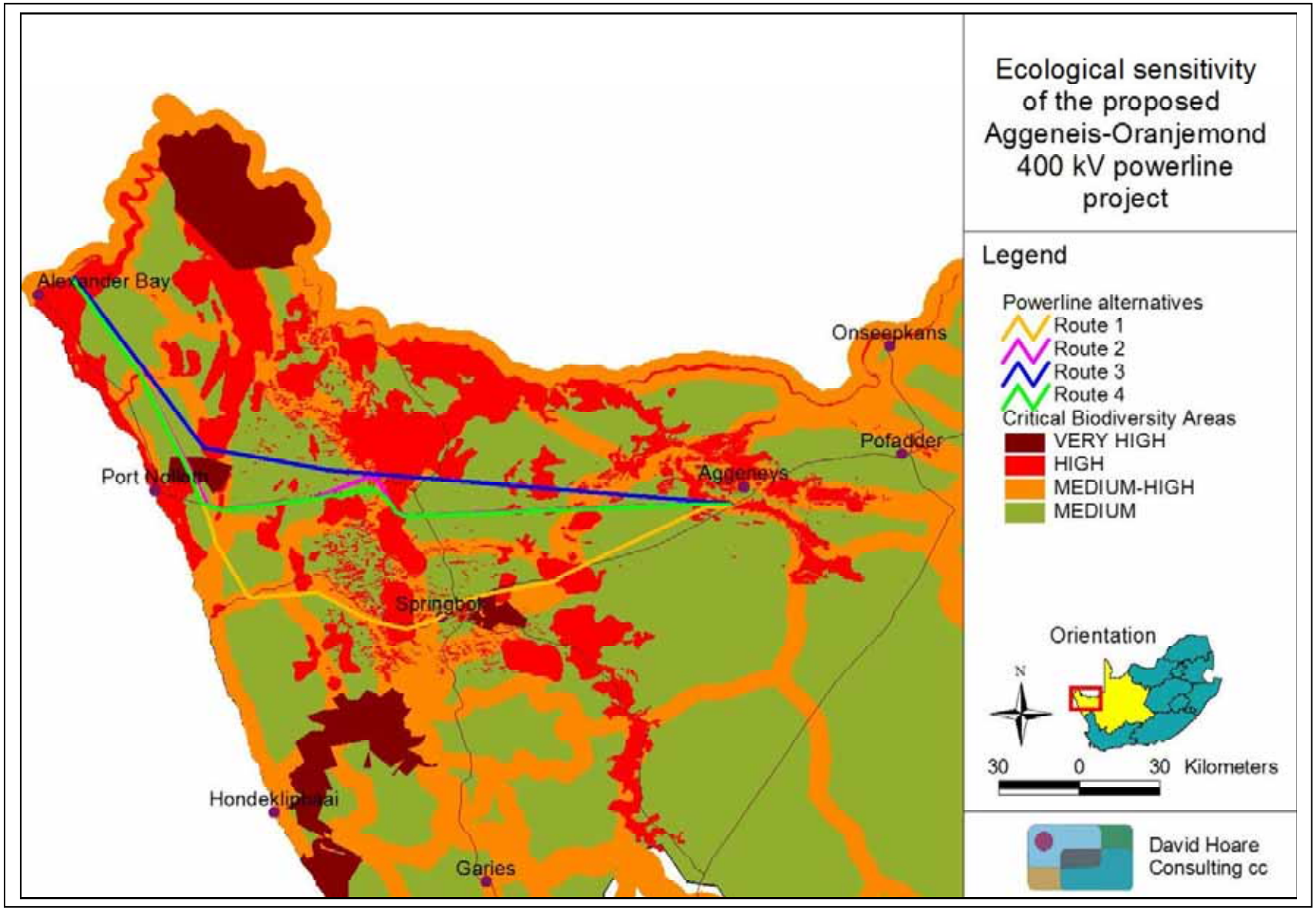

Figure 4.10: Potentially sensitive parts of the study area

ASSESSMENT OF IMPACTS: TRANSMISSION POWER LINE CORRIDORS CHAPTER 5

In response to the growing electricity demand within the Northern Cape and to address current supply problems in the area, Eskom Holdings Limited is proposing the establishment of a new 400kV transmission line which will connect the Aggeneis and Oranjemond substations over an approximate distance of 240km. The proposed project includes the expansion of the existing Aggeneis and Oranjemond substations in order to accommodate the new transmission line. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. The proposed project forms part of the **Northern Cape Strengthening Project**.

Four technically feasible alternative Transmission power line corridors have been identified by Eskom in order to link the existing Aggeneis and Oranjemond substations. These are reflected in Figure 5.1.

As the proposed substation upgrades are located within the existing HV yards of the Aggeneis and Oranjemond substations, no additional environmental impacts are expected to occur as a result of the planned construction and operational activities. Therefore, no further investigation of these sites is required, although management measures are required to be included within the Environmental Management Programme (EMP).

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed Transmission power line corridors, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Programme (refer to Appendix K).

5.1. Assessment of Potential Impacts on Ecology

The study area traverses the Nama Karoo, Succulent Karoo and Desert Biomes (Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al*. 2006). This map shows 26 different vegetation types across which the proposed alternative corridors traverse. On the basis of rates of transformation, all but one of the 26 vegetation types are classified as Least Threatened. The vegetation type, i.e. Lower Gariep Alluvial Vegetation, associated with the floodplain of the Orange River, is classified as Endangered.

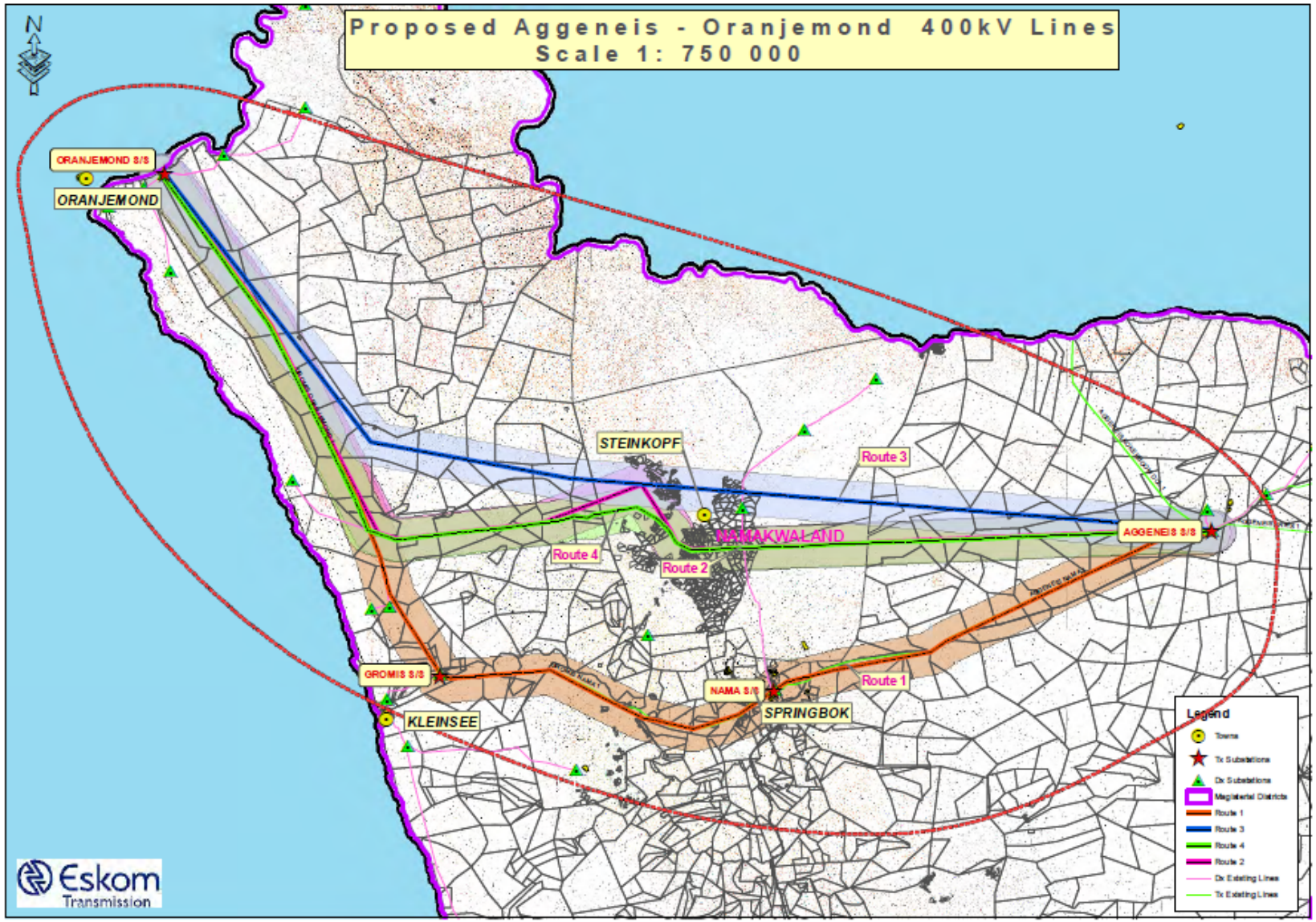

Figure 5.1: Alternative Transmission power line corridors identified for investigation in the EIA studies

According to the Final Namakwa District Biodiversity Sector Plan, the following features occur in areas that may be affected by the proposed corridors:

» corridors;
» terrestrial areas important for biodiversity of different groups, including plants, fish, invertebrates, birds, mammals, reptiles and amphibians;
» kloofs;
» SA vegetation types of high conservation value;
» SA vegetation on quartzitic substrates; and
» steep slopes.

There are four protected tree species that occur in the area and which may occur within the proposed servitude. A walk-through of the entire servitude would be required to identify the exact location of these in relation to proposed construction activities.

There are three mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Critically Endangered (CR), i.e. De Winton's Golden Mole; one species classified as Endangered, i.e. Hartmann's Mountain Zebra; and one classified as Vulnerable in the South African part of its range, although globally, it is listed as Least Concern, i.e. the Angolan Wing-gland Bat.

There is one frog species of conservation concern previously recorded in the grids in which the study area is located and which could occur on site. This is the Namaqua Stream Frog, listed as Vulnerable (VU).

There are three reptile species of conservation concern that occur in the study area, one, the Armadillo Girdled Lizard, listed as Vulnerable, and two, the Namaqua Plated Lizard and the Speckled Padloper, listed as Near Threatened.

On the basis of the location of sensitive plant species and habitats, the sensitivity assessment identified those parts of the study area that could possibly have high conservation value or that may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 5.2.

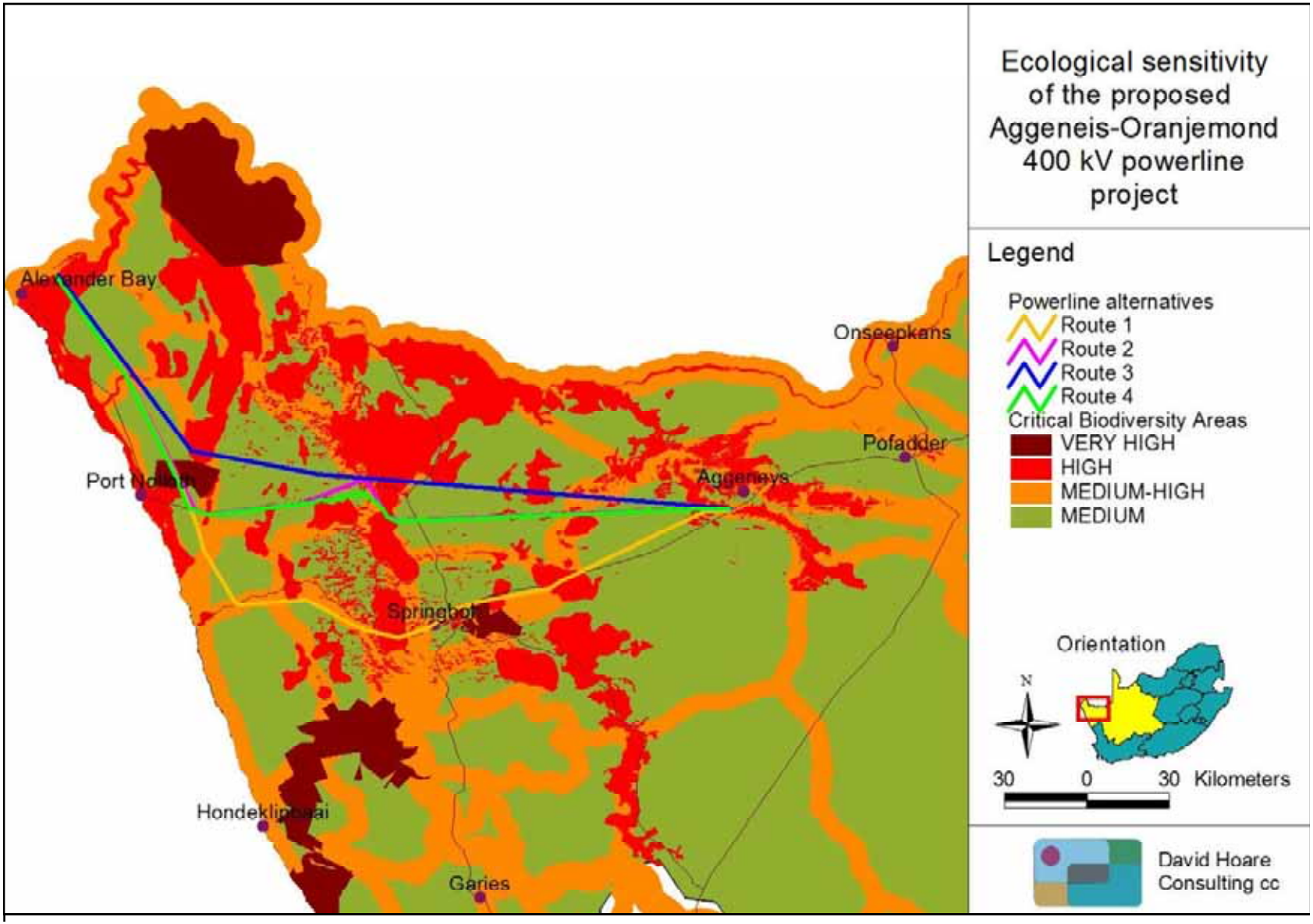

Figure 5.2: Potentially sensitive ecological areas within the study area

The following impacts/ issues were identified that could affect the ecological attributes of the study area adversely:

» Impacts on threatened animals.
» Impacts on threatened plants.
» Impacts on protected tree species.
» Impacts on indigenous natural vegetation.
» Impacts on wetlands.
» Establishment and spread of declared weeds and alien invader plants.
» Impacts on National Parks / reserves.

The following series of tables provides a summary of the potential impacts on the ecology of the area associated with the proposed alternative Transmission power line corridors. All four alternatives are comparatively assessed against each other.

Impact tables summarising the significance of impacts on ecology (with and without mitigation)

Nature: Loss of habitat for threatened animals – corridor 1, 2 and 4

There are various threatened animal species that occur in the study area, many of which are restricted to specific localities (cannot move from the path of construction). This includes De Winton's Golden Mole (CR), which could potentially be severely affected if infrastructure is placed directly over habitat in which it occurs. It also includes various species that are relatively slow-moving and/or likely to be restricted to specific localities, including the Namaqua Stream Frog (VU), the Armadillo Girdled Lizard (VU), the Namaqua Plated Lizard (NT) and the Speckled Padloper (NT). The remaining two species of concern (Hartmann's Mountain Zebra and the Angolan Wing-gland Bat) can move from the path of construction and are, therefore, less likely to be directly affected by construction.

For corridor 1, all five species of concern, as described above, could occur within the corridor, but there are three species for which there is a higher chance of encountering them than on other corridors. These are the Namaqua Stream Frog (VU), the Armadillo Girdled Lizard (VU) and the Speckled Padloper (NT).

For corridor 2 and 4, all five species of concern, as described above, could occur.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short-term (1)
Magnitude	High (8)	Small (1)
Probability	Definite (5)	Highly unlikely (1)
Significance	**High (70)**	**Low (3)**
Status (positive or negative)	Negative	Negative

Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Undertake a walkthrough survey of the selected route, once tower positions are known. If any populations of species of concern are encountered, then the individual tower structure must be shifted to avoid striking the specific habitat of concern. » Use existing access roads as far as possible.		
Cumulative impacts: Loss of habitat, damage to drainage lines, alien invasions may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: None likely		

Nature: Loss of habitat for threatened animals – corridor 3

There are various threatened animal species that occur in the study area, many of which are restricted to specific localities (cannot move from the path of construction). This includes De Winton's Golden Mole (CR), which could potentially be severely affected if infrastructure is placed directly over habitat in which it occurs. It also includes various species that are relatively slow-moving and/or likely to be restricted to specific localities, including the Namaqua Stream Frog (VU), the Armadillo Girdled Lizard (VU), the Namaqua Plated Lizard (NT) and the Speckled Padloper (NT). The remaining two species of concern (Hartmann's Mountain Zebra and the Angolan Wing-gland Bat) can move from the path of construction and are, therefore, less likely to be directly affected by construction.

For corridor 3, four of the five species of concern, as described above, could occur (De Wintons Golden Mole does not occur along this corridor). There are two species for which there is a higher chance of encountering them than on other corridors. These are the Namaqua Plated Lizard (NT) and the Speckled Padloper (NT).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short-term (1)
Magnitude	Medium (6)	Small (1)
Probability	Definite (5)	Highly unlikely (1)
Significance	**Medium (60)**	**Low (3)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
Undertake a walkthrough survey of the selected route, once tower positions are known.
Cumulative impacts:
Loss of habitat, damage to drainage lines, alien invasions may all lead to additional impacts that will exacerbate this impact.
Residual Impacts:
None likely

Nature: Destruction/permanent loss of individuals of threatened plant species

There is a large number of Red List or Orange List plant species that have a geographic distribution that includes the study area and populations of these may occur in concentrations in different parts of the study area. Corridors 2 and 4 go through the grids with the highest concentration of threatened species, although all 4 corridors could affect threatened species and all 4 corridors have an equal probability of affecting additional species of lower conservation concern.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (1)
Probability	Definite (5)	Highly unlikely (1)
Significance	**High (70)**	**Low (7)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Undertake a walk-through survey of the selected route, once tower positions are known. This must take place during the correct season for determining whether the species of concern occur there or not.
» Use existing access roads as far as possible.

Cumulative impacts:

Loss of habitat, alien invasions may lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None likely

Nature: Loss of individuals of protected trees

There are four protected tree species that have a geographic distribution that includes the study area, *Acacia erioloba, Acacia haematoxylon, Boscia albitrunca* and *Euclea pseudebenus*. Any of these species could occur in any part of the study area, depending on local conditions. It is, however, most likely that they would occur in drainage areas or

at the base of mobile dunes. Corridor 1 is the least likely to encounter protected trees, although the likelihood still exists that protected trees could occur within this corridor.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (40)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To some degree	

Mitigation:

» Undertake a walk-through survey of the selected route, once tower and access road positions are known, in order to determine the exact number of individuals of each species that will be affected. Obtain a permit for any protected trees that have to be destroyed or trimmed in order to construct or maintain the power line. If large numbers of trees will be affected then additional biodiversity offsets or planting programmes may be required.

» Use existing access roads as far as possible.

Cumulative impacts:

Impacts due to alien invasions and damage to watercourses may possibly cause damage to habitat where protected trees could grow that may exacerbate this impact.

Residual Impacts:

None likely

Nature: Loss of habitat within indigenous natural vegetation types

The individual tower structures of the power line occupy a relatively small area. Access roads potentially occupy more space, but tend to be tracks through the veld. In some areas where the natural vegetation is relatively tall, it may be necessary to trim all tall vegetation within the servitude to a height of less than 4 m. Due to the arid nature of the study area, very little vegetation is tall enough to warrant this action. Eskom usually clear the centre line of the servitude (usually about 8m) for stringing purposes during construction. This would need to be rehabilitated after construction is completed. Disturbed areas in this very arid region are not likely to recover very quickly.

Power lines do not form an impenetrable barrier across the vegetation and are therefore not likely to lead to any significant form of fragmentation. Access roads are generally less than 4 m wide and tend to eventually become grown over with vegetation, except where it is maintained as bare ground.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)

Magnitude	Small (3)	Small (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Medium (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Not easily reversible	Not easily reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: » Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the servitude of the power line. » Use existing access roads as far as possible		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.		

Nature: Damage to watercourses and drainage lines
There are a number of non-perennial watercourses within the proposed corridors that could potentially be affected by the proposed construction of the power line. These are primarily lower order watercourses. There are some wetlands very close to the coast, but these areas are not affected by this project. There are also some non-perennial wetlands in the drainage lines of the escarpment zone to the west of Steinkopf and around Springbok.

	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Highly unlikely (1)
Significance	**Medium (36)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Not Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To some degree	
Mitigation: Keep power line tower structures a minimum of 50 m outside any watercourse or drainage line, and avoid crossing drainage lines and wetlands as far as possible with access roads; OR obtain a permit from DWA.		

Cumulative impacts:
Soil erosion and alien invasions may lead to additional impacts on watercourses that will exacerbate this impact.
Residual Impacts:
None.

Nature: Establishment and spread of declared weeds and alien invader plants		
The presence of a diffuse disturbance over a wide area could lead to the spread of species that are present in the area. Watercourses are especially vulnerable to such impacts.		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Not Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area » Do not translocate soil stockpiles from areas with alien plants » Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove » Establish an on-going monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

Nature: Crossing National Parks / reserves –corridor 1, 2 and 4		
Corridors 1, 2 and 4 crosses directly through the middle of an outlier of the Richtersveld National Park just inland of Port Nolloth. Corridor 1 also crosses the northern part of the Goegap Nature Reserve to the east of Springbok. All corridors cross the Black Mountain Mine Reserve near Aggeneys.		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)

Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Small (1)
Probability	Definite (5)	Highly improbable (1)
Significance	**High (65)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Not Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To some degree	
Mitigation: » Modify the alignment to keep it outside the boundary of the affected reserve / parks. If this is not possible then the agency managing the affected area must be consulted for comment and potential mitigation.		
Cumulative impacts: None		
Residual Impacts: None, if mitigation measures are applied		

Nature: Crossing National Parks / reserves – corridor 3 Corridor 3 crosses the Black Mountain Mine Reserve near Aggeneys.		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Small (1)
Probability	Definite (5)	Highly improbable (1)
Significance	**Medium (55)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Not Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To some degree	
Mitigation: » Modify the alignment to keep it outside the boundary of the affected reserve / parks.		
Cumulative impacts: None		
Residual Impacts: None, if mitigation measures are applied		

5.1.1. Comparative Assessment

Corridors 2 and 4 pass through the grids with the highest concentration of threatened plant species, although all 4 corridors could affect threatened plant species and all 4 corridors have an equal probability of affecting additional species of lower conservation concern. Although the risks of encountering threatened plant species are greater on corridors 2 and 4, a walk-through survey in combination with modified micro-siting of tower structures could effectively avoid impacts on plant species of conservation concern.

All four of the proposed corridors could potentially affect populations or habitats of animal species of concern. However, corridor 1 is the one with the greatest risk to threatened animal species, including the greatest risks to the Critically Endangered (CR) De Winton's Golden Mole, the Vulnerable (VU) Armadillo Girdled Lizard and the Vulnerable (VU) Namaqua Stream Frog. The only corridor that does not affect the Critically Endangered (CR) De Winton's Golden Mole is corridor 3. Although the risks of encountering threatened animal species are greater on corridor 1, a walk-through survey in combination with modified micro-siting of tower structures could potentially avoid impacts on animal species of conservation concern.

Corridors 1, 2 and 4 cross directly through the middle of the outlier of the Richtersveld National Park just inland of Port Nolloth. An alternative alignment past this area is required to make these corridors acceptable. Corridor 1 crosses the northern part of the Goegap Nature Reserve to the east of Springbok. An alternative alignment past this area is required to make this corridor acceptable. All four corridors cross the Black Mountain Mine Reserve near Aggeneys. Due to the disturbed nature of the area around this reserve, it is potentially acceptable to cross this reserve, but it may be better to find an alternative route past this reserve.

All four proposed corridors are potentially acceptable, if proposed mitigation measures are put in place to manage potential impacts. However, in terms of the risk to the ecological receiving environment, Corridor 1 is considered to be the least favourable and **Corridor 3 the most favoured**.

5.1.2. Implications for Project Implementation

» Once a corridor has been selected, and tower positions and access road routes have been determined, a walk-through survey of high risk portions of the route must be undertaken to determine whether populations of threatened animal and/or plant species will be affected or not. Tower structures and access roads should then be shifted as far as possible to avoid local impacts. If not possible

to avoid impacts, a permit is required according to Chapter 7 the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

» It is recommended that local alternative routes be found to avoid crossing National Parks and reserves, or that corridor 3 is selected as the preferred option. It is especially important that the outlier of the Richtersveld National Park, situated just inland of Port Nolloth, is not crossed by the proposed power line.
» Corridor 3 is the preferred alternative from an ecological point of view.

5.2. Assessment of Potential Impacts on Avifauna

Potential impacts on avifauna associated with the establishment of the proposed Transmission infrastructure include the following:

» Collisions with the earth wire of power lines.
» Habitat destruction and transformation during the construction and maintenance of power lines.
» Disturbance during the construction and maintenance of power lines.

Electrocution of birds on overhead lines is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa. Electrocutions are not possible on the larger Transmission lines (400 kV) as the relevant clearances between live parts and live and earthed components exceed the wingspan of any bird. It is possible for birds to be electrocuted in electrical substations. There are a wide variety of specific sites within a substation that could pose an electrocution risk, depending on exact dimensions and species involved. This impact is not anticipated to be significant for birds as sensitive and threatened species are unlikely to frequent the substations.

The following series of tables provides a summary of the potential impacts on avifauna associated with the construction and operation of the proposed Transmission power line.

Impact tables summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Disturbance of birds during construction and maintenance

During the construction and maintenance of electrical infrastructure a certain amount of disturbance inevitably occurs. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding. Figure 5.2 below illustrates important avifaunal factors such as Important Bird Areas (yellow) and protected areas (green)

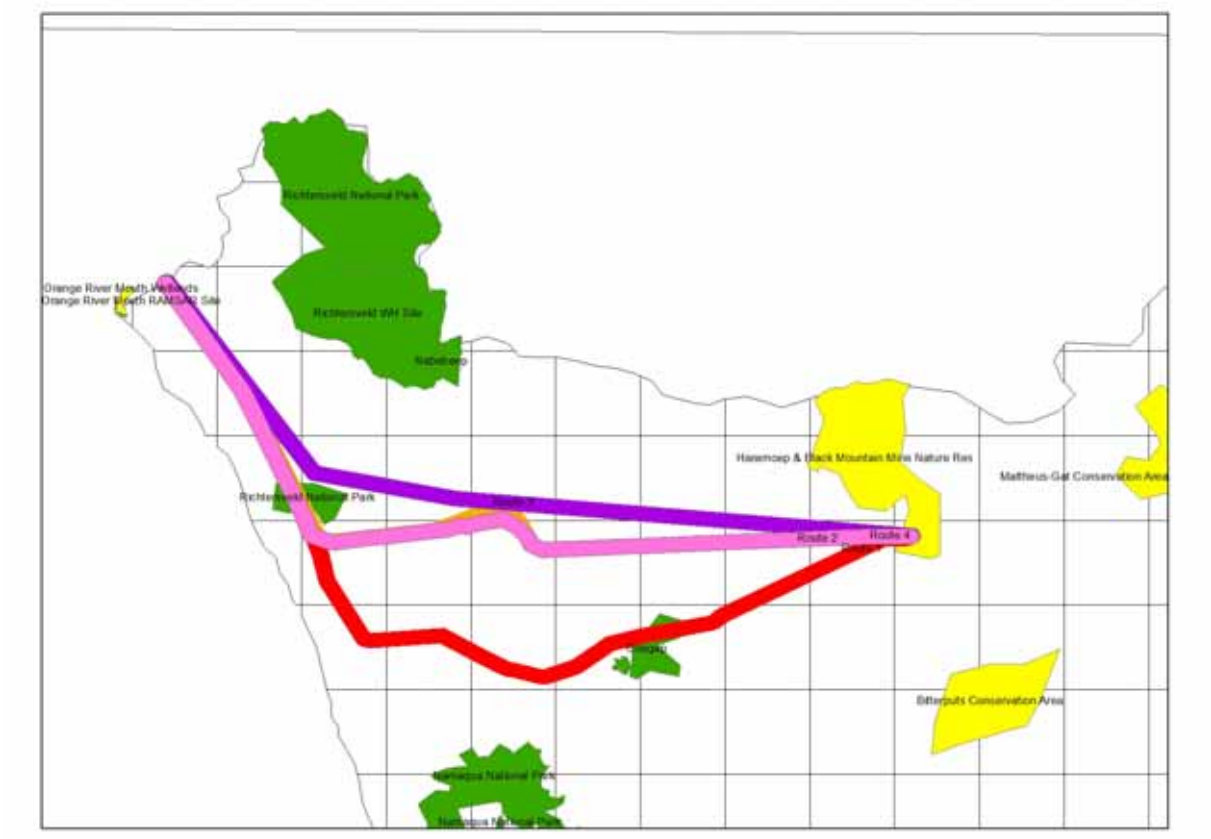

Figure 5.2: Important avifaunal factors such as Important Bird Areas (yellow) and protected areas (green)

	Corridor 1		**Corridor 2**		**Corridor 3**		**Corridor 4**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short (2)	Short (2)	Short (2)	Short (2)	Short (2)	Short (2)	Short (2)	Short (2)
Magnitude	Low (4)	Low (3)	Low (4	Low (3)	Low (4)	Low (3)	Low (4)	Low (3)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (18)**	**Low (21)**	**Low (18)**	**Low (21)**	**Low (18)**	**Low (21)**	**Low (18)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Irreplaceable loss of resources?	No	No	No	No	No	No	No	No
Can impacts be mitigated?	To a minimal extent through correct management							

Mitigation:

Follow environmental best practice during construction and maintenance activities. This includes the timing of construction in sensitive areas to avoid impacts on sensitive features during particular seasons; avoid using heavy machinery and vehicles in sensitive habitats; minimizing the use of machinery and vehicles off the servitude; restricting construction camps to already impacted areas; identifying any sensitive breeding species at onset of construction and managing them appropriately; and any other management options that may be identified by the avifaunal walk through.

Cumulative impacts:

None, as the area is vast and largely undisturbed.

Residual impacts:

Impact remains until power lines are decommissioned and removed

Nature: Destruction of habitat during construction and maintenance

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the leveling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimise the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

However, the area is very arid and as such the vegetation is very short and in some areas almost non-existent. This will mean that very little vegetation will be affected by the construction as it will not be necessary to clear servitudes. The only impact will thus be at the tower itself and any access roads that are required.

	Corridor 1		**Corridor 2**		**Corridor 3**		**Corridor 4**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)	Low (4)	Low (3)	Low (4)	Low (3)	Low (4)	Low (3)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low to Medium (30)**	**Low (27)**	**Low to Medium (30)**	**Low (27)**	**Low to Medium (30)**	**Low (27)**	**Low to Medium (30)**	**Low (27)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	To a minimal extent.							

Mitigation:

Follow environmental best practice during construction and maintenance activities. This includes the timing of construction in sensitive areas to avoid impacts on sensitive features during particular seasons; avoid using heavy machinery and vehicles in sensitive habitats; minimizing the use of machinery and vehicles off the servitude; restricting construction camps to already impacted areas; identifying any sensitive breeding species at onset of construction and managing them appropriately; and any other management options that may be identified by the avifaunal walk through.

Cumulative impacts:

Not significant, as the area is vast and largely undisturbed.

Residual impacts:

Impact remains until power lines are decommissioned and removed

Nature: Collision of birds with earth wire

Collision refers to the scenario where a bird collides with the conductors or earth wires of overhead power lines. This occurs because the birds cannot see the cables whilst in flight. Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. Unfortunately, many of the collision sensitive species are considered threatened (Red Data status) in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. These species have not evolved to cope with high adult mortality, with the result that consistently high adult mortalities over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

	Corridor 1		**Corridor 2**		**Corridor 3**		**Corridor 4**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)	Moderate(6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)

Significance	**Moderate (36)**	**Moderate (30)**	**Moderate (36)**	**Moderate (30)**	**Moderate (36)**	**Moderate (30)**	**Moderate (36)**	**Moderate (30)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes, partially, although it will not reduce the probability.							

Mitigation:

» High risk sections of line will have to be installed with line marking devices as per Eskom Transmission guidelines, in order to make the line more visible to flying birds. These sections of line will need to be identified during an avifaunal walk through, once the final route has been decided, and tower positions have been surveyed and pegged.

» Due to the relative uniformity of the study area and its stochastic (rainfall driven) nature, it is exceptionally difficult to identify flight paths at this point. This will need to be done once tower positions are finalized and the route can be driven, and a 'feel' obtained for where birds are likely to occur and move. It is likely that this will result in more than half of the length of the power line requiring marking. If this walk through cannot be conducted, the specialist will likely need to identify almost the entire line for marking as a precautionary approach.

Cumulative impacts:

Not significant for much of the study area due to the relative lack of existing power lines in the area.

Residual impacts:

This impact will persist as long as the power lines are operational

5.2.1. Comparative Assessment

» *Corridor 1:*
- This is the southernmost corridor and follows an existing 220kV Transmission line for the entire route from Aggeneis to Oranjemond. This is an advantage from an avifaunal perspective as it helps to decrease the collision risk (grouping lines makes them more visible to birds – APLIC 1994).
- This is the longest corridor, measured in kilometres.
- The corridor passes close to a protected area, the Goegab Nature Reserve.

» *Corridor 2*
- This is the central corridor and follows a more direct route from Aggeneis to Oranjemond.
- This corridor does not follow an existing transmission line, but does not pass near any protected areas.
- This corridor is shorter in kilometres than corridor 1.

» *Corridor 3*
- This is the northern most alternative and follows a direct line from Aggeneis towards the west, then turning north towards Oranjemond.
- This corridor does not follow an existing Transmission line and does not pass near any protected areas.

» *Corridor 4*
- This corridor is very similar to Corridor 2 with a slight deviation to the north in the vicinity of Steinkopf.

In order to rank these alternatives a table was compiled and the four corridors given a rating on a scale of 1 to 5, with 1 being the least preferred and 5 being the most highly preferred option. This ranking was done on the basis of what was seen during field work, and factors such as proximity to existing infrastructure.

Preference scores for the four transmission corridors are as follows:

Corridor	Preference Rating
Corridor 1	5
Corridor 2	3
Corridor 3	1
Corridor 4	3

From the above analysis, it can be concluded that:

Corridor 1 is the most preferred as it is adjacent to an existing transmission line. This will aid in mitigating for many of the impacts and in particular the impacts of collision and habitat destruction. Corridors 2, 3 or 4 are considered acceptable and could also be considered provided the recommended mitigation is implemented.

5.2.2. Implications for Project Implementation

» No fatal flaws have been discovered on this project and as such the project may proceed from an avifaunal perspective.
» Collisions are expected to be the largest impact of this project on avifauna. In order to mitigate effectively for this, the high collision risk sections of line will need to be identified by an avifaunal walk through and marked with an effective line marking device, irrespective of the corridor selected.
» Control all activities so as to impact on natural vegetation as little as possible and create as little as possible noise and disturbance on site.

5.3. Assessment of Potential Visual Impacts

The construction and operation of the proposed Aggeneis-Oranjemond 400kV Power Line and its associated infrastructure will have a visual impact on the scenic resources of this region. The power line infrastructure will be visible within an area that is generally seen as having a high quality natural and scenic landscape and a resultant tourism value and potential. The infrastructure would thus be visible within an area that incorporates various sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive.

Potential visual impacts are expected to be associated with both the construction and operational phases of the proposed project. In the event of eventual decommissioning of the infrastructure, impacts are expected to be similar to those experienced in the construction phase of the project.

The substation upgrades will take place within the existing substation HV yards, and therefore associated visual impacts are likely to be limited in extent to that of the existing substations. There will therefore be no change in the existing impact. This assessment therefore excludes the proposed substation upgrades.

5.3.1. Potential Visual Impacts associated with the Construction Phase of the Transmission Lines

The construction phase of the Aggeneis-Oranjemond 400 kV Line and Substation Upgrade Project is approximated at two years. This is obviously dependent on a number of external factors that may not always be controlled by either Eskom or

the preferred contractors. During this time heavy vehicles will frequent the roads along the transmission line corridor and to the substation sites and may cause, at the very least, a visual nuisance to other road users and resident of the area.

Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

» Reduce the construction period through careful planning and productive implementation of resources.
» Plan the placement of lay-down areas and any potential temporary construction camps along the corridor in order to minimise vegetation clearing.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter and disused construction materials are managed and removed regularly.
» Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
» Reduce and control construction dust through the use of approved dust suppression techniques.
» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
» Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.

5.3.2. Potential Visual Impacts associated with the Operational Phase of the Transmission Lines

Viewshed analyses of the proposed infrastructure, based on a 20 m contour interval digital terrain model of the study area, indicate the potential visual exposure. The visibility analyses were undertaken at an offset of 35 m for the Transmission line alternative corridors in order to simulate a worst-case scenario. The viewshed analyses include the visual absorption which is the topography's capacity to absorb the potential visual impact.

Corridor 1 runs alongside an existing power line for its entire length. The corridor crosses a number of large rivers and passes through the mountainous area between Goegap Nature Reserve and the escarpment for a distance of about 65km. Although the nature of the terrain offers some visual screening due to the hilly topography, it also represents natural features sensitive to visual intrusion (i.e. the scenic mountains). Stretches of the N14 and R355 will be exposed to potential visual impact along lengths where Corridor 1 runs alongside the road. Both of these are important tourist access routes, and the Spektakel Pass west of Springbok on the R355 is particularly scenic.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for this Alternative, although this part of the Heritage Site is already impacted upon by the presence of the existing power line.

Lastly, the Namaqualand Copper Mining Landscape may be potentially impacted upon at Springbok, and for a very short stretch where the Alignment crosses the historic railway line (i.e. in the vicinity of the R382).

Corridor 2 takes a more direct route to the west, before zigzagging through mountainous terrain between Steinkopf and the escarpment. In addition to this roughly 40km stretch through the mountains, the alignment also crosses a few minor drainage lines. Long stretches of the R382 will be exposed to potential visual impact along lengths where the proposed Alternative runs alongside the road. This is also an important tourist access route, and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

In addition, short stretches of the N14, the N7 and various secondary roads lie within the zone of potential visual exposure where Corridor 2 crosses over. The two secondary roads leading north off the R382 to Lekkersing and Eksteenfontein are popular scenic drives during the flower season.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed forCorridor 2, although this part of the Heritage Site is already impacted upon by the presence of the existing power line.

Corridor 3 is even more direct in its alignment than Corridor 2. The stretch through the mountains between Steinkopf and the escarpment is, however, somewhat longer, measuring approximately 70km. The alignment also crosses a few minor rivers. Short stretches of the R382, the N14, the N7 and various secondary roads will be exposed to potential visual impact where Corridor 3 crosses over or bypasses nearby. Two of the secondary roads leading north off the R382 to Lekkersing and Eksteenfontein are popular scenic drives during the flower season and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for Corridor 3. This is the only corridor that does not correspond with the existing power line in this part of the Heritage Site and therefore represents a new visual impact.

Corridor 4 follows mostly the same alignment as Corridor 2, but takes a shortcut through the mountains west of Steinkopf. In addition to this roughly 35km stretch through the mountains, the alignment also crosses a few minor drainage lines. Long stretches of the R382 will be exposed to potential visual impact along

lengths where the proposed Alternative runs alongside the road. This is also an important tourist access route, and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Transmission line corridors are displayed below in Figure 5.3 to Figure 5.6 (more detailed visual impact index maps are included within the specialist visual impact assessment report contained in Appendix H). Here the weighted impact and the likely areas of impact are indicated as a visual impact index. An area with short distance, high frequency of visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

» *Visual impact index – Corridor 1*
Potential areas of **very high** visual impact within the short distance include the following:
* Stretches of the N14, R355 and various secondary roads (where the corridor runs adjacent to the road);
* Very short stretches of the N7, the R355, the R382 and various secondary roads (where the corridor crosses the road);
* The far north western parts of Springbok, which has some historic status;
* A number of settlements (approximately 3 in the east of the study area);
* Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 65km section of corridor between Goegap and the escarpment, and to a lesser extent in the east between Goegap and Aggeneys and
* A short stretch of the historic railway line in the vicinity of the R382 crossing.

The visual impact index map for Corridor 1 clearly indicates a core area of potentially **high** visual impact within a 500m offset on either side of the proposed power line (i.e. short distance). This zone of potentially high visual impact includes a far northern strip of the Goegap Nature Reserve. Within the mountains (i.e. between Goegap and the escarpment), some visually protected patches occur, shielded from potential impact due to the topography of the area.

» *Visual impact index – Corridor 2*
Potential areas of **very high** visual impact within the short distance include the following:
* Stretches of the R382 (where the corridor runs adjacent to the road);
* The Anenous and Nonaams Passes west of Steinkopf on the R382;

- Very short stretches of the N7 and various secondary roads (where the corridor crosses the road);
- A number of settlements (approximately 4 in the east of the study area);
- Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 40km section between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.

Potential areas of **high** visual impact within the medium distance include the following:

- Stretches of the R382 (where the alignment runs adjacent to the road);
- Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
- A number of settlements (approximately 3 in the east of the study area);
- The mountains and steep slopes in the 40km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.

» *Visual impact index – Corridor 3*

Potential areas of **very high** visual impact within the short distance include the following:

- Very short stretches of the N7 and various secondary roads (where the corridor crosses the road);
- A number of settlements (approximately 3 in the east of the study area); and
- Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 70km section between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys.
- A very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.

Potential areas of **high** visual impact within the medium distance include the following:

- Very short stretches of the N7, the R382 and various secondary roads (where the alignment crosses the road);
- Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
- A number of settlements (approximately 2 in the east of the study area);

- The mountains and steep slopes in the 70km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
- A very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.

» *Visual impact index – Corridor 4*

Potential areas of **very high** visual impact within the short distance include the following:

- Stretches of the R382 (where the corridor runs adjacent to the road);
- Very short stretches of the N7 and various secondary roads (where the corridor crosses the road);
- A number of settlements (approximately 4 in the east of the study area); and
- Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 35km section between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys.

Potential areas of **high** visual impact within the medium to longer distance include the following:

- Stretches of the R382 (where the alignment runs adjacent to the road);
- Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
- Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
- A number of settlements (approximately 3 in the east of the study area);
- The mountains and steep slopes in the 35km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys and
- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.

The tables which follow provide a summary of the assessment of potential visual impacts associated with the four alternative Transmission power line corridors. It must be noted that the primary visual impact, namely the presence of the proposed power line is not possible to mitigate.

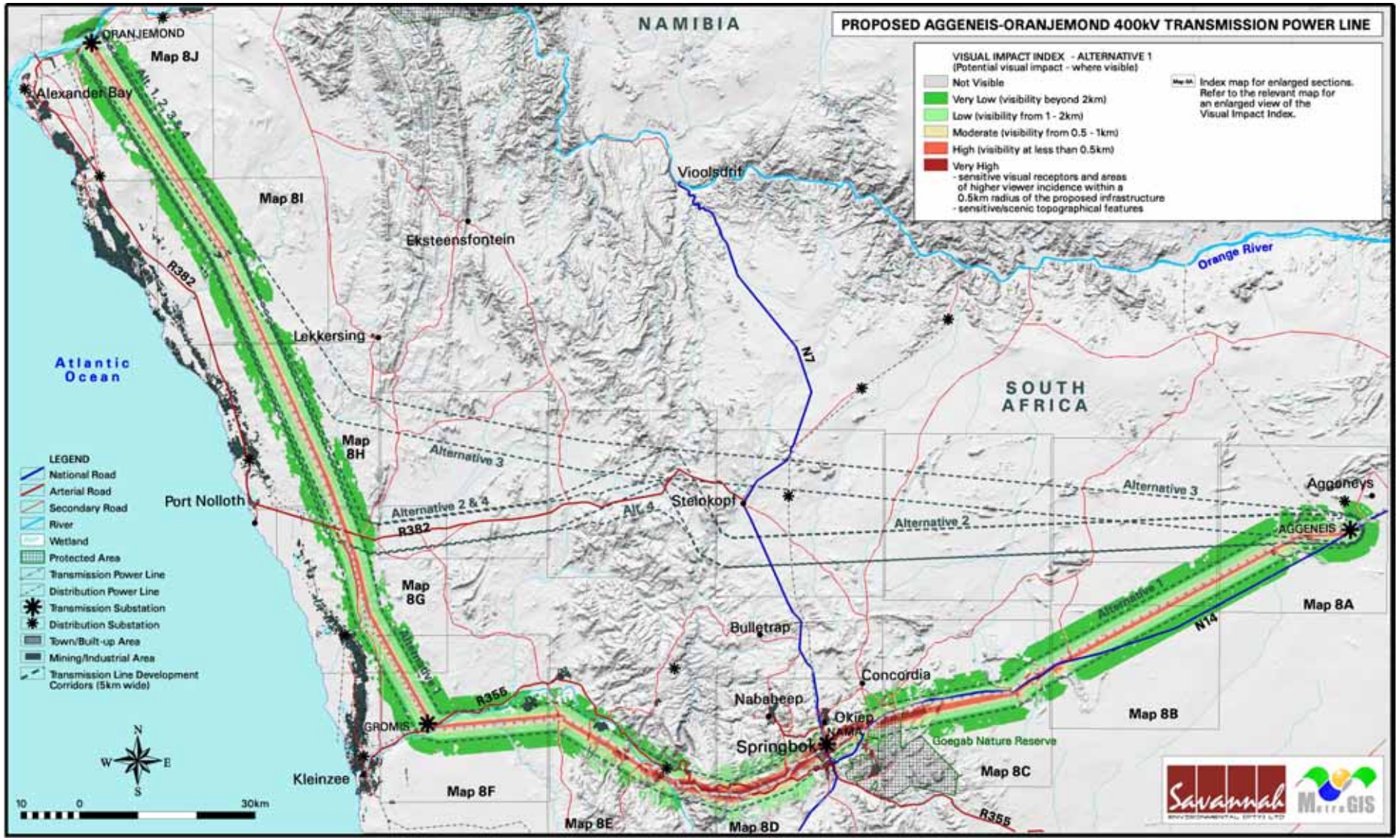

Figure 5.3: Visual impact index – Corridor 1

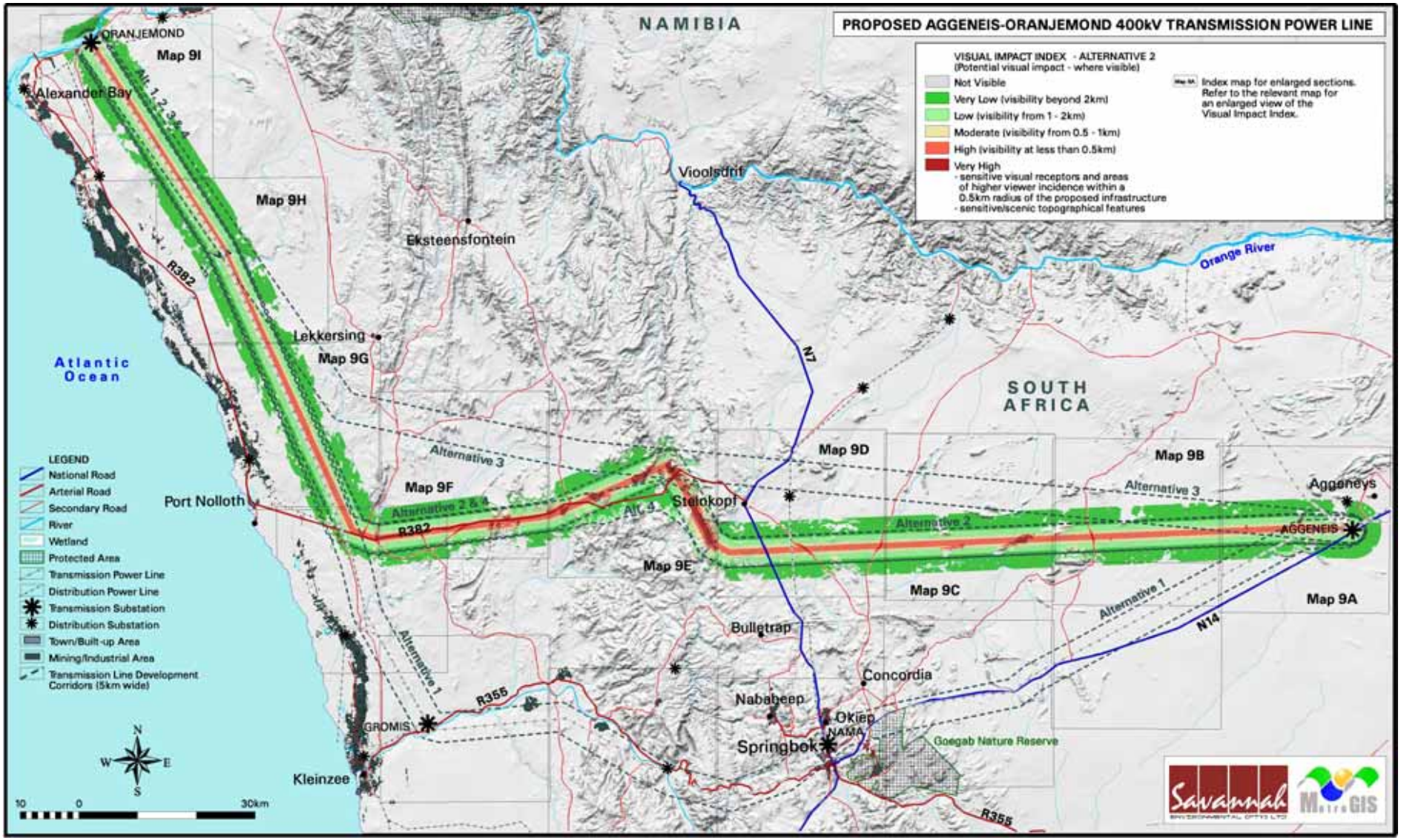

Figure 5.4: Visual impact index – Corridor 2

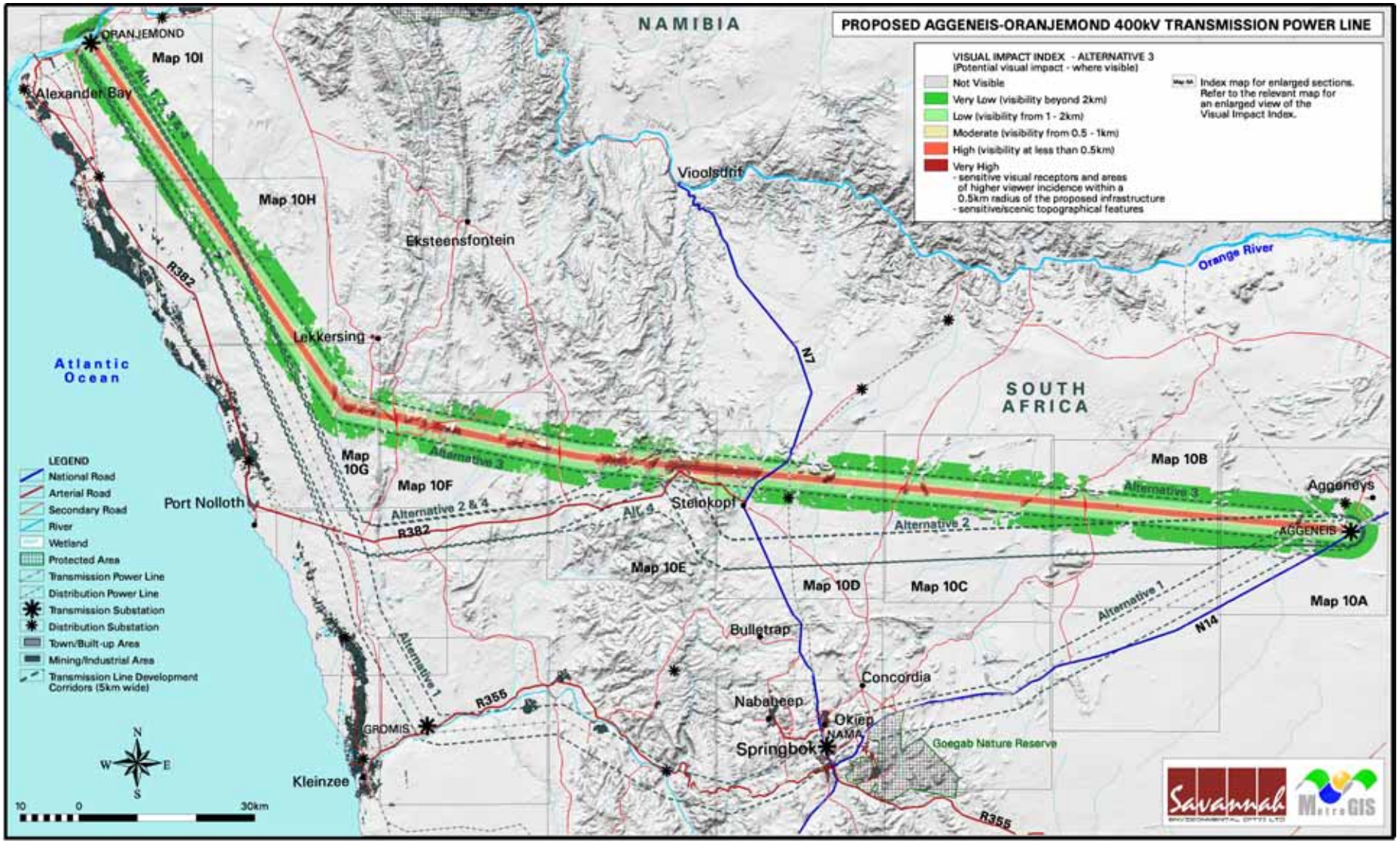

Figure 5.5: Visual impact index – Corridor 3

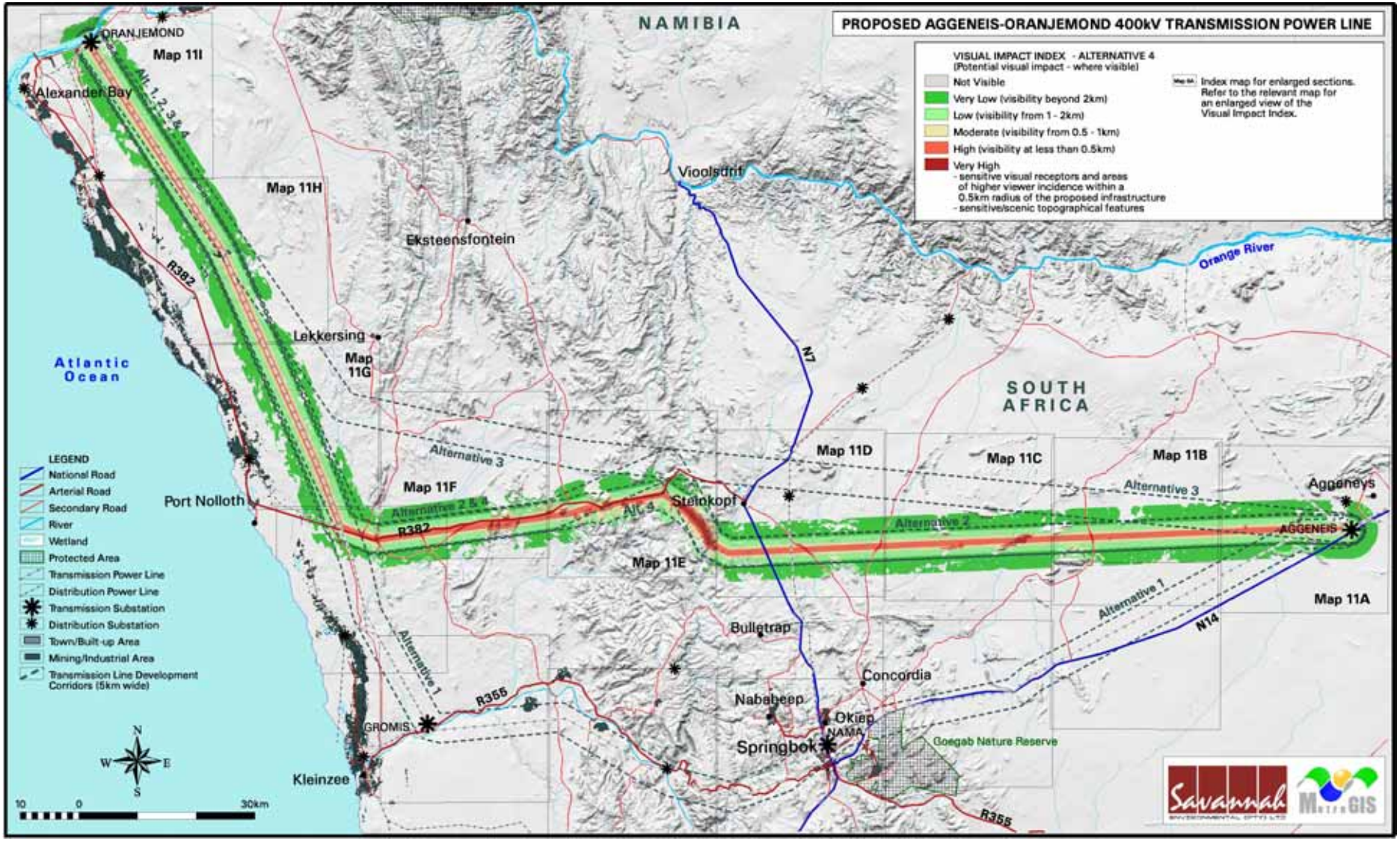

Figure 5.6: Visual impact index – Corridor 4

Impact tables summarising the significance of visual impacts associated with the alternative Transmission line corridors

Nature: Potential visual impact of construction on visual receptors in close proximity to the power line.

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and land owners in the area. Mitigation entails proper planning, management and rehabilitation of all construction sites to forego visual impacts. The table below illustrates the assessment of this anticipated impact, which is likely to be of moderate significance for all Alternatives, and may be mitigated to low.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)
Duration	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	High (4)	Improbable (2)	High (4)	Improbable (2)	High (4)	Improbable (2)	High (4)	Improbable (2)
Significance	**Moderate (44)**	**Low (18)**	**Moderate (44)**	**Low (18)**	**Moderate (44)**	**Low (18)**	**Moderate (44)**	**Low (18)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No	No	No	No	No	No	No
Can impacts be mitigated?	Yes							

Mitigation:

Proper planning, management and rehabilitation of the construction sites

Cumulative impacts:
None
Residual impacts:
None.

Nature: Potential visual impact on users of national, arterial and secondary roads in close proximity to the proposed power lines.

Potential visual impact on users of national, arterial and secondary roads in close proximity of the proposed power line (i.e. within 500m) are expected to be of high significance for Alternatives 1 and 2 and of moderate significance for Alternatives 3 and 4. No mitigation is possible.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a
Probability	Definite (5)	N/a	High (4)	N/a	Improbable (2)	N/a	Probable (3)	N/a
Significance	**High (90)**	**N/a**	**High (72)**	**N/a**	**Moderate (36)**	**N/a**	**Moderate (54)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a

Mitigation:

Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:

The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.

Residual impacts:

None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact on residents of Springbok in close proximity to the proposed power lines.

The potential visual impact on residents of Springbok within 500m of the proposed power line is expected to be of high significance for Alternative 1 only. Of relevance is the historic value of Springbok as a mid-19th century settlement.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Duration	Long term (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Magnitude	Very high (10)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Probability	Definite (5)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Significance	**High (90)**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**
Status (positive or negative)	Negative	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Reversibility	Recoverable (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Irreplaceable loss of resources?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Can impacts be mitigated?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a

Mitigation:

Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:

The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.

Residual impacts:

None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact on residents of settlements and farmsteads in close proximity to the proposed power lines.

The potential visual impact on residents of farmsteads and settlements within 500m of the proposed power line is expected to be of high significance for all Alternatives. No mitigation is possible.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a
Probability	High (4)	N/a	Definite (5)	N/a	High (4)	N/a	Definite (5)	N/a
Significance	**High (72)**	**N/a**	**High (90)**	**N/a**	**High (72)**	**N/a**	**High (90)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a

Mitigation:

Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:

The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.

Residual impacts:

None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact on sensitive visual receptors within the region.

Where these occur, the visual impact on the settlements and homesteads within the region (beyond the 500m offset) is expected to be of moderate significance for Alternatives 1 and 3 and of low significance for Alternative 2 and 4. No mitigation is possible.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	High (8)	N/a	High (8)	N/a	High (8)	N/a	High (8)	N/a
Probability	High (4)	N/a	Improbable (2)	N/a	Probable (3)	N/a	Improbable (2)	N/a
Significance	**Moderate (60)**	**N/a**	**Low (30)**	**N/a**	**Moderate (45)**	**N/a**	**Low (30)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a

Mitigation:
Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.
Cumulative impacts:
The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.
Residual impacts:
None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact on conservation areas

The potential visual impact on the Goegap Nature Reserve and the Hester Malan Nature Wild Flower Reserve is expected to be of moderate significance for Alternative 1 only.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Duration	Long term (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Magnitude	Very high (10)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Probability	Improbable (2)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Significance	**Moderate (34)**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**
Status (positive or negative)	Negative	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Reversibility	Recoverable (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Irreplaceable loss of resources?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Can impacts be mitigated?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a

Mitigation:

» Select corridor 2, 3 or 4 as the preferred option.

» Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:

The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.

Residual impacts:

None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact of access roads on observers in close proximity to the power line

Access roads will be required, firstly to construct the power line, and secondly to maintain it (operational phase). These access roads have the potential of manifesting as landscape scarring, and thus a potential visual impact within the viewshed areas. This is especially relevant for steep slopes where cut and fill may be required to render access possible in high lying areas and on steep slopes. Graded slopes could be vulnerable to erosion over time. This also represents a potential visual impact.

No dedicated viewshed has been generated for the access roads, nor is a proposed layout available for each corridor. However, it is assumed, but that the area of potential visual exposure will lie within that of the power line.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Duration	Long term (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Magnitude	Very high (10)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Probability	Improbable (2)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Significance	**Moderate (34)**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**	**N/a**
Status (positive or negative)	Negative	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Reversibility	Recoverable (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a

Irreplaceable loss of resources?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Can impacts be mitigated?	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
Mitigation: Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
Cumulative impacts: The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
Residual impacts: None. The visual impact of the power line will be removed after decommissioning.								

Nature: Potential visual impact on the visual character and sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role. A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. Specific aspects contributing to the sense of place of this region include the rugged, undeveloped nature of the area, the wide open vistas and the scenic beauty of the landscape and the mountains. The anticipated visual impact of the infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be of moderate significance for Corridor 1 and low for Corridors 2, 3 and 4.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	High (8)	N/a	High (8)	N/a	High (8)	N/a	High (8)	N/a
Probability	Probable (3)	N/a	Improbable	N/a	Improbable (2)	N/a	Improbable	N/a

			(2)				(2)	
Significance	**Moderate (45)**	**N/a**	**Low (30)**	**N/a**	**Low (30)**	**N/a**	**Low (30)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a
Mitigation: Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
Cumulative impacts: The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
Residual impacts: None. The visual impact of the power line will be removed after decommissioning.								

Nature: Potential visual impact on tourist routes, tourist destinations and tourist potential within the region.

The greater region is generally seen as having a high scenic value. The N14 is a primary tourist access route linking Gauteng with the Namaqualand and Springbok, while the N7 links Springbok with Cape Town. The arterial R382 and the R355 roads offer scenic drives through Namaqualand, especially where these traverse the escarpment. In this respect, the *Spektakel Pass*, located on the R555 some 25km west of Springbok (affected by Alternative 1) and the *Nonaams* and *Anenous Pass,* some 15km west of Steinkopf on the R382 (affected by Alternatives 2, 3 and 4) are of relevance.

In addition to their scenic offering, both these routes are primary access roads linking the N7 with Kleinzee and Port Nolloth respectively, and thus carry both commuters and tourists. The Namaqualand area is already a known tourist destination, specifically in terms of eco-tourism. The annual Namaqualand flower displays are a world renowned attraction. During the flower season, a number of secondary roads are favoured by tourists. These include the road to the east

of the N7 running from Okiep to Steinkopf and from Okiep via Concordia to the Orange River. Other roads include those linking the R382 with Eksteenfontein and Lekkersing in the Richtersveld. The latter roads are also used by the Richtersveld Community and visitors to the Richtersveld National Park and thus represent alternative access routes for many tourists.

Visual intrusion through the development of industrial type infrastructure within this environment could affect the area's tourism value and potential. The anticipated visual impact of the power lines on existing tourist routes, as well as on the tourism value and potential of the region is expected to be of **high** significance for Corridor 1 and of **moderate** significance for Corridors 2, 3 and 4.

There is no mitigation for this impact.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	Very High (10)	N/a	Very High (10)	N/a	Very High (10)	N/a	Very High (10)	N/a
Probability	High (4)	N/a	Probable (3)	N/a	Improbable (2)	N/a	Probable (3)	N/a
Significance	**High (68)**	**N/a**	**Moderate (51)**	**N/a**	**Moderate (34)**	**N/a**	**Moderate (51)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a

Mitigation:
Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:

The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.

Residual impacts:

None. The visual impact of the power line will be removed after decommissioning.

Nature: Potential visual impact on the declared and tentatively listed World Heritage Sites within the region.

In 2007 large portions of the Richtersveld National Park and surrounding communal lands were declared a World Heritage Site, namely the *Richtersveld Cultural and Botanical Landscape*.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed of all the power line corridors, although for Corridors 1, 2 and 4, this part of the Heritage Site is already impacted upon by the presence of the existing power line. Corridor 3 is the only corridor that does not correspond with the existing power line through the area in this part of the Heritage Site and therefore represents a new visual impact. This effectively increases the probability of this impact occurring.

In 2009, parts of Okiep, Springbok, Concordia and Port Nolloth as well as the historic railway line between Okiep and Port Nolloth[2] were nominated as the *Namaqualand Copper Mining Landscape* on South Africa's tentative list of World Heritage Sites[3]. This cultural landscape may be potentially impacted upon wherever the historic railway line falls within the viewshed. Visual intrusion through the development of industrial type infrastructure within this environment could affect the area's cultural and heritage value. The anticipated visual impact of the power lines on the declared and tentatively listed World Heritage Sites is expected to be of low significance for all Alternatives.

There is no mitigation for this impact.

[2] No complete spatial information on the alignment of this historic railway line is available, so it is assumed to run parallel to the N7 between Okiep and Steinkopf, and parallel to the R383 up to the Anenous pass and then straight cross country to Port Nolloth.

[3] Information sourced from the Heritage Impact Assessment: Proposed Aggeneis-Oranjemond 400kv Line and Substations Upgrade, Northern Cape Province (ACO Associates, 2011).

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	Minor (2)	N/a	Moderate (6)	N/a	Minor (2)	N/a	Low (4)	N/a
Probability	Improbable (2)	N/a	Improbable (2)	N/a	Probable (3)	N/a	Improbable (2)	N/a
Significance	**Low (18)**	**N/a**	**Low (26)**	**N/a**	**Low (27)**	**N/a**	**Low (22)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a
Mitigation: Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
Cumulative impacts: The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
Residual impacts: None. The visual impact of the power line will be removed after decommissioning.								

Nature: Potential visual impact of the proposed infrastructure on scenic and sensitive topographical features within the region.

The nature of the mountainous terrain is such that it offers some degree of visual absorption, but it is also sensitive to visual intrusion. The mountainous part of the study are also some of the most scenic, and the construction of a power line within such areas will constitute a visual impact, rendered more significant due to the sensitive nature of the natural features. Similarly, visual impact on the rivers of the region will be significant.

The anticipated visual impact of the power line on the scenic and sensitive mountains and rivers of the study area is expected to be of **moderate** significance for all Alternatives. There is no mitigation for this impact.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
Duration	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
Magnitude	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a
Probability	Probable (3)	N/a	Improbable (2)	N/a	Probable (3)	N/a	Improbable (2)	N/a
Significance	**Moderate (51)**	**N/a**	**Moderate (34)**	**N/a**	**Moderate (51)**	**N/a**	**Moderate (34)**	**N/a**
Status (positive or negative)	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
Reversibility	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a	No	N/a	No	N/a	No	N/a
Can impacts be mitigated?	No	N/a	No	N/a	No	N/a	No	N/a

Mitigation:

Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.

Cumulative impacts:
The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.
Residual impacts:
None. The visual impact of the power line will be removed after decommissioning.

5.3.3. Comparative Assessment

The following visual criteria are applied in order to comparatively assess the four alternative corridors under investigation:

» The **length** of the proposed transmission line corridor. The longer the alignment, the greater the visual impact, and therefore the less desirable the alternative.
» The exposure to **major roads** (national and arterial), based on the frequency of road crossings and / or the proximity of these roads within a 500m offset (i.e. along the length of the corridor). The greater the exposure, the greater the visual impact, and therefore the less desirable the alternative.
» The exposure to **secondary roads**, based on the frequency of road crossings and / or the proximity of these roads within a 500m offset (i.e. along the length of the corridor). The greater the exposure, the greater the visual impact, and therefore the less desirable the alternative.
» The exposure to **urban centres** and built up areas (i.e. Springbok) within a 2km offset. Only Corridor 1 will register a value here.
» The exposure to farmsteads and **settlements** based on the frequency of occurrence within a 2km offset. The higher the number of farmsteads and settlements, the greater the number of visual receptors, and therefore the less desirable the alternative.
» The exposure to conservation and **protected areas** within a 2km offset. Only Corridor 1 will register a value here.
» The exposure to scenic and sensitive topographical features based on the length of the section traversing **mountainous areas**. The longer the section of alignment through the mountains, the greater the visual impact, and therefore the less desirable the alternative.
» The proximity of **existing power lines** along the corridor. It may be argued that the presence of an existing visual impact will 'absorb' the potential visual impact of the power line to some extent. The concentration of linear infrastructure within this environment is considered preferable, as it localises the cumulative extent of potential visual impact. The shorter the section of corridor adjacent to existing power line infrastructure, the greater the visual impact, and therefore the less desirable the alternative.
» The significance of potential visual impacts on **tourism** (i.e. tourist routes, tourist destinations and tourist potential) within the region.

The table below shows the application of the above criteria to each Alternative Corridor. Values of 1-4 are used, with a value of 4 indicating the highest visual impact and a value of 1 indicating the lowest. These values are assigned on the basis of the above criteria.

The sum of accumulated values gives an indication of which alternative corridor is likely to have the greatest visual impact. The corridor with the highest total is the least desirable, while that with the lowest is the preferred option from a visual perspective.

Table 5.2: Comparative assessment of the alternative power line corridors

CRITERIA	CORRIDOR 1	CORRIDOR 2	CORRIDOR 3	CORRIDOR 4
Total length	**4** (302.989km)	**3** (275.593km)	**1** (248.861km)	**2** (270.570km)
Major roads	**4** (N14, R355, N7)	**3** (N14, N7, R382)	**1** (N14, N7)	**2** (N14, N7, R382)
Secondary roads	**4** (12 crossings)	**3** (8 crossings)	**2** (7 crossings)	**3** (8 crossings)
Urban centres	**1** (Springbok)	**0**	**0**	**0**
Settlements	**4** (Approx 12)	**3** (Approx 9)	**3** (Approx 9)	**3** (Approx 9)
Protected areas	**1** (Goegap NR)	**0**	**0**	**0**
Mountainous areas	**3** (Approx 65km)	**2** (Approx 40km)	**4** (Approx 70km)	**1** (Approx 35km)
Existing power lines	**1** (entire length)	**3** (last 25%)	**4** (last 10%)	**2** (last 30%)
Tourism	**4** (high impact)	**3** (moderate impact)	**2** (moderate impact)	**3** (moderate impact)
TOTAL	**26**	**20**	**17**	**16**

Overall, considering all relevant criteria, **Corridor 4 is considered most preferable**, while Corridor 1 is the least desirable from a visual perspective.

5.3.4. Implications for Project Implementation

» In terms of the alternative Transmission power line corridors, all four corridors will be visually exposed to large areas within their respective 2000m offsets. This is due to the tall (35m) transmission line infrastructure associated with 400kV power lines.
» There are not many options as to the mitigation of the visual impact of the power line. The infrastructure spans hundreds of kilometres and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions.
» The mountainous area leading up to and making up the escarpment is of particular scenic beauty, and the proposed power line is expected to transform the natural character of these ridges for the entire operational phase of the infrastructure. In addition, the tourism and heritage value of the region must

not be overlooked, specifically its location within Namaqualand, the Richtersveld Cultural and Botanical Landscape World Heritage Site and the tentatively listed Namaqualand Copper Mining Landscape World Heritage Site.

» Corridor 4 is the preferred corridor from a visual perspective.

5.4. Potential Impacts on Heritage Sites

It is expected that much of the impacts to the pre-colonial archaeological heritage of the region can be managed. The best way to do this is to avoid the sites. This means micro-siting of tower positions where feasible, or routing the servitude road around sensitive areas. If the avoidance of the resource is not possible, some degree of mitigation can be achieved by systematically removing the archaeological material from the landscape with a relevant permit issued by the relevant heritage authority. As impacts are expected to be similar for all corridors under investigation, there is no preferred corridor in terms of pre-colonial period heritage.

The physical built environment, such as historic farmsteads and other buildings, is unlikely to experience direct impacts as a result of the proposed power line. The stone kraals and outbuildings present in the study area are important components of historic farms and they must not be demolished or altered. Any physical remains relating to the copper mining industry (including old roads and railways) or to the Anglo-Boer War must be avoided. The preferred alternative in terms of built environment and colonial period heritage would be Corridor 3 (refer to comparative assessment below).

The construction of a transmission line over stockposts and semi-permanent settlements (Living Heritage) in the study area are likely to have significant social impacts. The inhabitants of these settlements must be consulted if they have to move their settlements to a new location. Some of the inhabitants have low levels of literacy and written notices and a general public meeting may not be sufficient. Discussions around alternative stockpost locations and the health hazards associated with transmission lines needs to be explained to local residents. This can be effectively achieved during the negotiation process.

The construction of the 400kV Transmission line through a corner of the Richtersveld World Heritage Site will require consultation with the Provincial Heritage Resources Authority and any management committees authorised to consider developments within the borders of the World Heritage site. All four proposed corridors pass through this area and therefore this consultation will be required regardless of which alternative is selected.

There is always a chance that archaeological material may be exposed during excavations for pylon foundations and access roads. All archaeological material is

protected by Section 35 of the National Heritage Resources Act and it is an offence to destroy material. Archaeological material may only be altered or removed from its place of origin under a permit issued by SAHRA. If archaeological material (including graves) is uncovered, all work must cease in that area, while the relevant heritage authorities are notified.

Impact tables summarising the significance of the impacts of the alternative Transmission line corridors on Heritage Sites (with and without mitigation)

Nature: Impacts to archaeological material

The construction of construction camps, service roads and the erection of towers may cause localised exposure and displacement of archaeological material, including graves.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (1)	Local (2)	Local (1)	Local (2)	Local (1)	Local (2)	Local (1)
Duration	Long Term (4)	N/A	Long term (4)	N/A	Long term (4)	N/A	Long term (4)	N/A
Magnitude	Low (4)	Minor (2)	Low (4)	Minor (2)	Low (4)	Minor (2)	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low (30)**	**Low (6)**	**Low (30)**	**Low (6)**	**Low (30)**	**Low (6)**	**Low (30)**	**Low (6)**
Status (positive or negative)	Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive
Reversibility	Not reversible							
Irreplaceable loss of resources?	Yes	No	Yes	No	Yes	No	Yes	No
Can impacts be mitigated?	Yes							

Mitigation:

An archaeologist should verify positions of the towers, servitude road and construction camp during the site-specific EMP phase, specifically where sensitive areas have been identified.

Cumulative impacts:

N/A

Residual impacts:

Once the towers are removed and the servitude roads are re-vegetated, there will be no further impacts on the archaeological landscape

Nature: Impacts to built environment and Colonial Heritage

Possible direct impacts on stone fortifications, roads, railways etc. resulting in their damage/destruction. Negative visual (indirect) impacts on areas of high sensitivity, such as the railway line descending the Anenous Pass and the historic "pass" at Nonaams , as well as impacts to the the Namaqualand Copper Mining Landscape.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)
Duration	Permanent (5)	N/a	Permanent (5)	N/a	Permanent (5)	N/A	Permanent (5)	N/a
Magnitude	High (8)	Minor (2)	High (8)	Minor (2)	Moderate (6)	Minor (2)	High (8)	Minor (2)
Probability	Highly Probable (4)	Possible (2)	Highly Probable (4)	Possible (2)	Probable (3)	Possible (2	Highly Probable (4)	Possible (2)
Significance	**High (64)**	**Low (6)**	**High (64)**	**Low (6)**	**Medium (42)**	**Low (6)**	**High (64)**	**Low (6)**
Status (positive or negative)	Negative	Neutral	Negative	Neutral	Negative	Neutral	Negative	Neutral
Reversibility	Not reversible							
Irreplaceable loss of resources?	Yes	No	Yes	No	Yes	No	Yes	No
Can impacts be mitigated during operational phase?	Yes							

Mitigation:

» Avoid placing power line in close proximity to areas of high sensitivity.

» Undertake a walk down of areas of high significance to verify road, turbine and construction camp positions.

» Implement general guidelines regarding buffer areas between homesteads and power lines.

Cumulative impacts:

The cumulative impacts on Corridor 1 will be high due to the presence of the existing 220kV line.

Residual impacts:

Once the towers are removed and the servitude roads are re-vegetated, there will be no further impacts on the archaeological landscape

Nature: Impacts to Living Heritage

Stockposts are difficult to identify from the air, and many do not show up on aerial photographs. The construction of the transmission line directly over these stockposts, particularly those of a semi-permanent nature, may result in the destruction of these settlements and families may be forced to move to new locations. Some stockpost locations have been utilized by families over many generations and are specifically chosen because of specific qualities.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (1)	Local (3)	Local (1)	Local (3)	Local (1)	Local (3)	Local (1)
Duration	Permanent (5)	N/A	Permanent (5)	N/A	Permanent (5)	N/A	Permanent (5)	N/A
Magnitude	High (8)	Low (3)	High (8)	Low (4)	High (8)	Low (4)	High (8)	Low (4)
Probability	Probable (3)	Improbable (2)	Probable (4)	Improbable (2)	Probable (4)	Improbable (2)	Probable (4)	Improbable (2)
Significance	**Medium (45)**	**Low (8)**	**High (64)**	**Low (10)**	**High (64)**	**Low (10)**	**High (64)**	**Low (10)**
Status (positive or negative)	Negative	Neutral	Negative	Neutral	Negative	Neutral	Negative	Neutral
Reversibility	Yes, once pylons are removed							
Irreplaceable loss of resources?	Yes, loss of connection with the land							
Can impacts be mitigated?	Yes							

Mitigation:

» Micro-siting of the towers will avoid a direct impact on stockposts.

» Consultation with stockpost owners will avoid significant impacts on traditional lifeways.

Cumulative impacts:

The construction of additional pylons and transmission lines in the future will alter the landscape, motivating different movements of stock farmers.

Residual impacts:

Once the towers are removed, the stock farmers will be able to re-settle.

Nature: Impacts to cultural landscape

Some of the areas traversed by the proposed transmission line have high cultural significance. The construction of the lines may result in changes to the feel, atmosphere and identity of the landscape. This intrusion is largely of a visual nature as it impacts on the sense of wilderness and remoteness experienced in this area. Many tourists visit the area to experience the remote and arid environment and it is important to, in the words of the Social Impact Assessment, avoid "sterilization of the land" for future tourism initiatives.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (4)	Local (3)	Regional (4)	Local (3)	Regional (4)	Local (3)	Regional (4)	Local (3)
Duration	Permanent (4)	N/A	Permanent (4)	N/A	Permanent (4)	N/A	Permanent (4)	N/A
Magnitude	Moderate (7)	Low (4)	Moderate (6)	Low (4)	High (8)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (4)	Improbable (1)	Probable (4)	Improbable (1)	Probable (4)	Improbable (1)	Probable (4)	Improbable (1)
Significance	**High (60)**	**Low (7)**	**Medium (56)**	**Low (7)**	**High (64)**	**Low (7)**	**Medium (56)**	**Low (7)**
Status (positive or negative)		Neutral	Negative	Neutral	Negative	Neutral	Negative	Neutral
Reversibility	Reversible with mitigation and if eventually removed.							
Irreplaceable loss of resources?	Yes, without mitigation all four corridors will impact on aspects of the cultural landscape.							
Can impacts be mitigated?	Yes							

Mitigation:

Use an amended Corridor 3 (link earlier with Corridor 1 which runs parallel to the existing 220 kV line) with placement of towers taking into account visual mitigation concerns.

Cumulative impacts:

The construction of additional towers and transmission line within Corridor 1, running in parallel to the existing 220 kV line will have a significant impact on cultural landscape of the area around Springbok, N14 and R355, while the impact of Corridors 2 and 4 will be high on the landscape around the Anenous Pass and R387.

Residual impacts:

Once the towers have been removed and the roads re-vegetated there will be no impacts.

5.4.1. Comparative Assessment

» **Corridor 3** is not visible from the N14 or the R382, and will have least impact on the Built Environment and Colonial Period heritage. It will however, clip the southern corner of the "Richtersveld World Heritage Site" and will require negotiation with the PHRA and possibly some alteration to a section of the corridor to mitigate the World Heritage Site crossing if required, possibly linking earlier with the existing power line corridor (Corridor 1). This is the preferred corridor from a heritage perspective.
» The second preferred option is Corridor 1 which is proposed to run in parallel with the existing 220kV line rather than replacing it. There are sections where an additional line is expected to have a significant cumulative impact, most notably east of Springbok where it crosses the Goegap Nature Reserve and along sections of the N14. Other visual impacts are likely to result where the power lines will cross the Spektakel Pass west of Springbok and the crossing over the Buffels River towards the coast.
» Corridor 2 is the third preferred option and follows Corridor 4 very closely, but does make a dogleg from Nonaams, along the back of the escarpment, so that it avoids the vista from the top of the Anenous Pass. However, it still has an impact on the old road over Nonaams and it will be visible along the length of the R382 to Port Nolloth.
» Corridor 4 is the least preferred option and crosses the most sensitive part of the study area, in terms of heritage. Its impact is pronounced where it descends the Nonaams and Anenous Pass, and it will be visible along the length of the R382 to Port Nolloth. If Corridor 4 is used, then this will require extensive mitigation on the escarpment area to the west of Steinkopf, to ensure that there are no direct impacts on the Anenous Pass, "Meulpad", old railway line or any other pre-colonial or colonial heritage resources which are concentrated in this area. This will require a walk down of the proposed location of the transmission lines and micro-siting of the towers to ensure that impacts are minimised.

5.4.2. Implications for Project Implementation

» In terms of overall impact on the heritage, the preferred alternative is Corridor 3.
» The other alternatives are considered acceptable with the implementation of appropriate mitigation measures.
» If Corridor 4 is used, then this will require extensive mitigation on the escarpment area to the west of Steinkopf, to ensure that there are no direct impacts on the Anenous Pass, "Meulpad", old railway line or any other pre-colonial or colonial heritage resources which are concentrated in this area. This will require a walk down of the proposed location of the transmission lines and micro-siting of the towers to ensure that impacts are minimised.

» A walk-down of sensitive locations along the final corridor of the power line and servitude road will be required and positions of construction camps should also be examined.
» Apply to the Northern Cape Provincial Heritage Authority for permits to demolish or alter any historic structures (buildings, historic passes, walls kraals etc.) if they are impossible to avoid.
» The public participation consultant and the Eskom negotiator must consult with local communities about the placement of the towers and power lines with respect to their stockposts and settlements
» Eskom must consult with the Provincial Heritage Resources Authority regarding the construction of the power line across the Richtersveld World Heritage Site.

It is recommended that the expansion of the Oranjemond Substation takes place towards the east or west of the site, but not to the north, where a small koppie shields the site from the Orange River.

5.5. Assessment of Potential Social Impacts

Impacts on the social environment as a result of the proposed Aggeneis-Oranjemond 400 kV Line and Substations Upgrade Project are expected to occur during both the construction and operational phases. In the event of eventual decommissioning of the infrastructure, impacts are expected to be similar to those experienced in the construction phase of the project.

Potential impacts on the social environment associated with the construction, maintenance and decommissioning activities of the proposed transmission power lines are likely to include:

» Employment opportunities
» Influx of job seekers
» Safety and security impacts
» Impacts on daily movement patterns
» Impact on tourism potential
» Impact on local economy and regional benefits
» Health Related Impacts
» Impact on local and regional economy
» Visual and aesthetic impact
» Dust and noise pollution
» Impact on game farms, nature reserves and conservation areas

The tables which follow provide a summary of the potential social impacts associated with the construction and operation of the proposed Transmission power line. Impacts associated with the substation upgrade are not considered to be significant and are not included within this assessment.

Impact tables summarising the significance of social impacts associated with construction phase

Nature: Temporary employment opportunities during the construction phase

Construction crews for the Transmission power line would constitute mainly skilled and semi-skilled workers. At this stage the total number of temporary construction workers required over the 24 month period to complete the construction of the Transmission power line is not known. The final figures can only be determined once a corridor has been authorised and would also depend on the technical specification and local conditions of that alignment. Usually for a transmission line of approximately 100 km in length, four to five teams of approximately 10 individuals each are employed (a construction team of a total of approximately 50 individuals). For this project, it is thus assumed that approximately 100 to hundred and fifty (150) employees could be involved in the construction process.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**	**Medium (33)**
Status (positive or negative)	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Positive impacts can be enhanced							

Mitigation:

» Appoint lower and semi-skilled construction workers from the local community whenever possible.
» Maximise local employment as far as possible.
» Appoint women wherever possible and feasible.
» A broad-based approach should be followed to identify and involve relevant organisations which could assist the main contractor and Eskom in identifying people whose skills may correspond with the job specifications
» Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMMEs from the local sector
» A local labour desk should be set-up (if not already established) in the beneficiary communities to co-ordinate the process of involving local labour
» Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations

Cumulative impacts:

The proposed project could provide opportunities for capacity building through on-site training and skills development opportunities for local community members which could further assist them in seeking employment elsewhere in future

Residual impacts:

» Improvement in quality of life even if only for a short duration
» Possible skills development

Nature: Influx of jobseekers during the construction phase

Job seekers would be defined as people from outside the affected municipality areas, as well as local unemployed persons in search of employment opportunities at the construction sites. This influx of jobseekers is often associated with construction projects, particularly in areas where high unemployment levels are prevalent. The size and profile of these jobseekers cannot be determined or controlled.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)	Site of development (construction sites) (2)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)

Magnitude	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes to some extent							

Mitigation:

» Establish a labour desk that deals with job seekers. The labour desk should act as an information centre to explain the recruitment process to job seekers to avoid unnecessary expectations regarding employment opportunities.
» Discourage the gathering of people at unsuitable localities. The contractor should clearly communicate the extent of the work and number of workers required to the affected Municipalities to avoid unnecessary expectations regarding employment opportunities.
» The contractor should be contractually obliged to give preference to a local labour force, as far as possible and technically feasible.
» Co-ordinate and work through the relevant Municipalities to identify an available workforce.
» The congregation areas for job seekers, should it be required, must not obstruct the view of motorists and should be equipped with appropriate sanitation facilities.

Cumulative impacts:

» Additional pressure on infrastructure and services, as well as possible environmental degradation (pollution and littering) should other large scale construction activities take place in the same areas.
» Additional influx of jobseekers should the construction phase coincide with the construction phase of solar and wind energy projects planned in the Aggenys area.

Residual impacts:

» Mismanagement of the recruitment process could result in conflict between locals and 'outsiders' and place pressure on existing infrastructure and services should jobseekers remain in the area.

Nature: Impacts of a Construction Camp during the construction phase

Due to the remoteness of the study area, limited towns in the area and scarcely populated farming and mining land, the establishment of a construction camp where workers would be housed for the duration of the construction period is highly likely. Different locations would be required as the construction camp would have to be moved along the line as the construction process progresses. Possible locations along the corridors for such an accommodation facility could be in close proximity to Aggeneys, Springbok and Oranjemond (Corridor 1) or Aggeneys, Steinkopf and Oranjemond (Corridors 2, 3 and 4). If it is required, the accommodation facility could be placed on private land for the northern sections of the corridors.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (27)**	**Medium (36)**	**Low (27)**	**Medium (36)**	**Low (27)**	**Medium (36)**	**Low (27)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» Establish construction camps away from homesteads and sensitive receptors, even if it is in close proximity to towns and settlements.
» The proposed accommodation facility should be situated and designed as such to have the least negative impact on the rural character and quality of life of the surrounding farmers and property owners where it would be located within the rural farmland.
» Fence off the construction camps and implement security measures to restrict unauthorised access.
» Construction workers to wear identity tags and are not allowed to trespass on private properties or work outside of designated areas.
» Appropriate sanitation and waste facilities to be provided to eliminate possible pollution problems. These facilities should be cleaned and maintained on a regular basis.
» Team members that would make use of Bed and Breakfast facilities in the study area should preferably make use of the local facilities available in close proximity to the site such as those located within the nearby towns of Springbok, Steinkopf and Aggeneys.

Cumulative impacts:

» Localised pollution, safety and security issues and intrusion impacts such as noise.

Residual impacts:

» Possible degradation of the environment and an increase in HIV/Aids and unwanted pregnancies due to promiscuous activities at the construction camps.

Nature: Impacts on local economy and regional benefits during the construction phase

As there would be a very limited number of locals that could secure part-time employment during the construction phase of the project, it is not anticipated that any noticeable economic spin-offs would be created due to increased income levels. A very limited increase in buying power around the construction sites, and small scale economic advancement of entrepreneurs (e.g. those selling food and goods to the construction workers) could materialise. The benefits of the temporary employment positions is short lived and of a restricted extent, but should still be regarded as positive.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Minor (2)	Low (4)	Minor (2)	Low (4)	Minor (2)	Low (4)	Minor (2)	Low (4)
Probability	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)

Significance	**Low (14)**	**Low (27)**	**Low (14)**	**Low (27)**	**Low (14)**	**Low (27)**	**Low (14)**	**Low (27)**
Status (positive or negative)	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» Local procurement should be aimed at local businesses as far as possible.
» Local sourcing of materials would assist in providing more economic and employment opportunities for the local people.
» Local procurement could result in indirect economic spin-offs and benefits such as increased income, and expansion of other local economic sectors
» Maximise the use of local labour even if the number of locals that would be employed would be limited.
» Accommodate, but regulate the activities of vendors in the vicinity of the construction areas and at the construction camps where workers could be housed.

Cumulative impacts:

» Stimulation of and support to local businesses and local economy which could ensure that benefits accrue to the local communities should other large construction related projects also occur in the study area during the same period

Residual impacts:

» Positive local economic stimulus

Nature: Disruption in daily living and movement patterns and impact on land use during the construction phase

Sheep and goat farming and to a lesser extent cattle farming, as well as mining activities mainly characterise the study area. Due to the vastness of the study area and size of the farms it is not expected that the construction of the proposed transmission line would have more than a very limited temporary intrusion impact on the daily living and movement patterns of the affected landowners. Stock posts found within the communal areas of Concordia and Steinkopf are scattered through the area. Due to the rural character, however, it would be possible to avoid these thereby having no negative impacts on these farmers'/residents' daily living and movement patterns. The possibility of stock losses due to theft and/or poaching, increase in noise and the actual construction activities placing stress on the animals, however, would remain of concern. Livestock should thus be moved away from the construction activities and/or be fenced off. This could intrude on the implementation of rotational grazing of some farmers.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	Possibly (e.g. erosion as a result of new access roads)							
Can impacts be mitigated?	Yes							

Mitigation:

» Conditions and/or specific requests relating to construction activity raised by property owners should be included in the site-specific EMP
» Livestock would have to be moved and fenced from the construction activities.
» Contractors should make sure that no materials are left on the properties after construction and maintenance activities have been completed
» The contractors should communicate the construction schedule and vehicle movements to the affected property owners and government departments.

Cumulative impacts:

» Possible cumulative impacts with regards to the influx of workers and jobseekers associated with other proposed energy related developments in the Aggeneys area.

Residual impacts:

» Possible erosion and negative long lasting impacts on farming activities (e.g. stock losses)

Nature: Impact on game farms, nature reserves and conservation areas during the construction phase

All four Corridors traverse the south westerly section of the Richtersveld World Heritage Site which spans a larger area than the actual Richtersveld National Park. With regards to Corridors 1, 2 and 4, these alignments would be parallel to an existing line. In the case of Corridor 3, a new servitude would be required (ACO Associates, 2011). Corridor 1 passes to the north of the Goegap Nature Reserve which is situated approximately 15 km east of the town of Springbok. The reserve hosts approximately 600 indigenous flower species and is also home to a wide range of mammal species, including springbok, gemsbok and the Hartman's mountain zebra, a large variety of bird species as well as several species of reptile and amphibian. Goegap further incorporates the Hester Malan Wild Flower Garden. Visitors can drive through the reserve, take nature walks and make use of the mountain bike and 4 x 4 trails. During the flowering season it thus receives various national and international tourists (www.namaqualand.com). Corridor 1, 2 and 4 also pass through an outlier section of the Richtersveld National Park just to the east of Port Nolloth.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Site of development (3)	Site of development (3)	Site of development (3)	Site of development (3)	Local (1)	Site of development (3)	Site of development (3)	Site of development (3)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Moderate (6)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Probable (3)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Medium (33)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (27)**	**Medium (33)**	**Low (27)**	**Moderate (6)**	**Low (27)**	**Medium (33)**	**Low (27)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	Possibly (e.g. erosion as a result of new access roads)							
Can impacts be mitigated?	Yes							

Mitigation:

» The proposed transmission line should not be placed within any conservation areas and/or nature reserves. Should this not be possible and the alignment would traverse such areas, the following mitigation measures should be put in place:
  * No bulldozers should be used within these areas during the construction phase.
  * Eskom should ensure that contractors are supervised and monitored by the Environmental Control Officer when undertaking construction activities.
  * Existing access roads should be used and no additional access routes should preferably be created. If new access routes would have to be constructed the mitigation measures proposed by the various specialist studies should be strictly implemented.
  * Satisfactory rehabilitation should be undertaken as soon as the construction activities in that area have been completed
  * Construction schedules, construction activities, and entries to the conservation areas and/or nature reserves should be discussed with and confirmed by the management of these areas
» Sensitivities with regards to game farms and/or farms with conservation worthy species should be considered when finalising a route alignment within the preferred corridor
» Within the Richtersveld World Heritage Site, it should be considered to link Corridor 3 with the existing corridor to limit additional negative impacts on this area.

Cumulative impacts:

» None anticipated

Residual impacts:

» Possible erosion and negative long lasting impacts on conservation activities

Nature: Impact on infrastructure and services during the construction phase

Transmission lines in close proximity to landing strips and helicopter pads could impact on the ability of the pilots to ensure a successful flight and landing. Lines in these areas should thus be placed outside the "safe zone" to ensure that the activities can proceed without any safety risks. This is especially important in the event of fires to ensure effective fire fighting services. Smaller existing airstrips and especially the one in close proximity to the Aggeneis Substation should be noted and avoided with all four proposed Corridors. Impacts on other infrastructure such as the provincial and local roads (N14, N7, R382 and R355) through the area, possible power outages during construction phases and so forth would only be temporary and intermittent. These possible impacts are expected to respond to mitigation measures.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***

Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low (21)**	**Low (14)**	**Low (21)**	**Low (14)**	**Low (21)**	**Low (14)**	**Low (21)**	**Low (14)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							
Mitigation: » Line alignment should aim to avoid landing strips.								
Cumulative impacts: » None anticipated								
Residual impacts: » None anticipated								

Nature: Safety and security impacts during the construction phase

Experience has shown that landowners perceive the construction of a power line to impact on their safety and security due to uncontrolled access on their properties and increase in livestock theft and/or damage or theft of rare plant species (succulents) during the construction phase of the project. Whether real or perceived, these risks would have to be addressed. Safety and security risks associated with the construction of power lines further refer to the increased risks of veld fires because of construction worker practises (e.g. cooking), the increased risk of vehicular and pedestrian accidents (even limited in the scarcely populated area with low traffic volumes).

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams and affected landowners.
» The presence of a Health and Safety officer during the construction phase is important.
» Wherever construction take place in close proximity to residential areas or homesteads, the construction site should be fenced off and measures should be implemented to restrict unauthorised access.
» The maintenance of fire breaks is of critical importance.
» Fire fighting equipment should be available on site and construction workers should be appropriately trained for fire-fighting.

Cumulative impacts:

» None anticipated

Residual impacts:

» None anticipated

Nature: Health related impacts due to poor management of the construction site of the Transmission power line

Poor management of the construction process and construction camp could contribute to water and other pollution problems (improper sanitation facilities, waste water and littering) and flies, rodents and pests, resulting in health issues for the workforce and the surrounding communities. People movement (workers and job seekers) and possible promiscuous activities at the construction camps, especially if located in close proximity to existing settlements and towns, could increase the risk of spreading HIV/Aids and other sexually transmitted diseases even though a limited influx of people are expected.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low (30)**	**Low (16)**	**Low (30)**	**Low (16)**	**Low (30)**	**Low (16)**	**Low (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» A Health and Safety Officer should be appointed for the duration of the construction period. The contact details of this person should be made available to the affected property owners to enable them to lodge complaints when problems with regards to community health arise.
» Provide adequate drinking water and appropriate sanitation facilities to the workers at the construction sites.
» Although the conduct of individuals cannot be easily controlled, the contractor and/or Eskom could assist to limit the risk of the spread of HIV/Aids by providing additional awareness campaigns prior to the construction phase.
» The appointment of local labour (where feasible) could assist to limit the spread of diseases as it would limit the number of outsiders coming to the area.

Cumulative impacts:

» An increase in health risks for the workforce and local communities due to migrant mine workers being present in sections of the study area.

Residual impacts:

» A possible increase in HIV/Aids occurrences and other STD's, subsequently placing additional pressure on public health resources.

Nature: Dust and noise pollution

This impact is expected to manifest during the construction of the proposed transmission line and refers to the inflow of construction teams, general construction activities, the movement of construction vehicles on gravel roads, noise as a result of the reverse indicator of the trucks and the creation of access routes. This would especially be evident in areas where the proposed line would be in close proximity to dwellings, as well as tourist related activities (e.g. accommodation facilities and other establishments) and where the heavy vehicles would have to make use of private access routes and gravel roads.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative

Reversibility	Reversible
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Yes
Mitigation: » Construction activities should be undertaken during normal working hours e.g. from 7 am until 5 pm. » Workers should ensure good conduct at all times » Construction vehicles should be in good working order and should keep to the speed limits at all times » A release form should be signed by the affected property owners ensuring that the construction areas have been left in a good condition	
Cumulative impacts: » None anticipated	
Residual impacts: » None anticipated	

Impact tables summarising the significance of social impacts associated with operational phase

Nature: Impact on employment opportunities during the operational phase

No additional permanent employment opportunities would be created by the proposed Aggeneis-Oranjemond project. It is expected that existing Eskom employees would be responsible for the maintenance of the line and servitude, although some temporary maintenance work could be undertaken by locals (e.g. repairing damaged roads or fences and so forth).

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)

Probability	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**
Status (positive or negative)	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes, to a limited extent							
Mitigation: » Where possible locals should be used for unskilled and semi-skilled maintenance work.								
Cumulative impacts: » None anticipated								
Residual impacts: » Possible skills development								

Nature: Impact on the devaluation of properties during the operational phase

Concerns are usually raised that the construction of a transmission line, irrespective of its specific location, could lead to the decrease of property values mainly due to the visual impact associated with these lines. Due to the sizes of the properties under discussion it is not anticipated that this would necessarily be the case, especially if the proposed transmission line runs parallel to existing lines or other infrastructure, or along property boundaries.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)

Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Neutral	Negative	Neutral	Negative	Neutral	Negative	Neutral
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» Careful consideration should be given to the final route alignment and tower placements to ensure minimal disruption of resources and infrastructure and the least possible visual impact.
» Careful consideration should be given to the tower designs in order to minimise impacts on existing structures and activities on affected properties.
» The mitigation measures proposed by the Visual Impact Assessment should be strictly implemented
» Where possible, towers should be placed on the border of properties

Cumulative impacts:

» Possible negative financial implications for property owners

Residual impacts:

» Possible negative financial implications for property owners

Nature: Impact of the Transmission power line on tourism potential

The four proposed alternative corridor alignments traverse the south westerly section of Richtersveld World Heritage Site which include areas that are widely known for its spectacular annual flower explosion of endemic succulents, which, for a short period every year, attracts thousands of tourists. Other tourists travel through the area to reach Namibia or the Richtersveld National Park. Various guesthouses are thus situated in the area, but the largest concentration of these is found within the towns such as Springbok, Aggeneys and Port Nolloth.

Within the Richtersveld Local Municipality, various conservation areas are encountered (Richtersveld Local Municipality, 2009). This conservation framework should thus be taken into consideration when finalising a route alignment in that section of the study area. It is anticipated that an alignment along the

existing line would have the least impact as this infrastructural feature and the negative impacts experienced have already been mitigated and have been reduced over time.

The majority of the tourism ventures in the area is nature-based and relies on the scenic beauty of the area with its mountainous territories and some protected natural areas such as the Goegap Nature Reserve (near Corridor 1) as well as an outlier of the Richtersveld National Park (Corridor 1, 2 and 4). The area is thus ideally situated for tourism and possesses a variety of natural resources to benefit its tourism potential. Development and marketing of the area as a prime tourist destination to increase the number of tourists to the area is a key priority, especially to lessen the dependency of the communities on the mining industry as employment creator.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (30)**	**Medium (36)**	**Medium (30)**	**Medium (36)**	**Medium (30)**	**Medium (36)**	**Medium (30)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» Avoid placing the transmission line in close proximity to the roads frequently used by tourists
» Avoid placing the transmission line in close view of tourist establishments where the visual beauty of the area is the main attraction point
» Avoid placing the transmission line across properties used for eco-tourism and leisure activities. Should avoidance not be possible, the alignment should avoid the main activity areas and preferably be placed on the border of the properties
» Avoid placing the transmission line across nature reserves or national parks at all costs

» Avoid negatively impacting on areas with potential for development as a key tourism node
Cumulative impacts:
» None anticipated
Residual impacts:
» Visual impact

Nature: Impact of the Transmission power line on daily living and movement patterns during the operational phase

Maintenance of the line and inspection of the servitude would be undertaken for the life of the line. It is not anticipated that this would have severe negative intrusions on the landowners, mainly due to the size of the affected properties (lines could be situated far away from homesteads and other dwellings) and the fact that stock farming activities such as grazing could continue underneath the proposed line and within the servitude. However, some typical complaints regarding the maintenance of power lines include the following:

» The need for additional access routes which could result in erosion, intrusion, loss of land and so forth;
» Maintenance personnel leaving gates open;
» Maintenance personnel driving on private roads;
» Maintenance personnel driving through the veld; and
» Littering.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative

Reversibility	Reversible
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Yes

Mitigation:

» Property owners should be notified of the maintenance activities to be undertaken on their properties
» Speeding on the local roads should be avoided for safety reasons and to limit dust creation.
» The local access roads should be regularly maintained to keep the local road conditions in a good quality state

Cumulative impacts:

» None anticipated

Residual impacts:

» None anticipated

Nature: Visual and aesthetic impact of the Transmission power line during the operational phase – impact on sense of place

A new transmission line is considered by most to be visually intrusive and the study area is characterised by limited existing disturbances by infrastructure such as roads, transmission lines, telephone poles, dwellings and so forth. Although all four corridors would be visible at specific sections for short distances from the N7 national road, the visual impact from a national road would be the greatest for Corridor 1, which for the most part, follows the N14 national road alignment from Aggeneis to Springbok. Even though the existing line already creates a visual impact, an additional transmission line could heighten the impact due to the possible difference in tower structure heights.

An alignment within Corridor 1 would also be visible for motorists travelling on the R355 on sections of the R355 west of Springbok. Again the presence of the existing line should be noted, but as indicated above the different heights of the towers could have some additional negative impact for some sections of the corridor. West of Steinkopf, Corridor 2, 3 and 4 follows the R382 in a westward direction and could have a visual impact for motorists travelling on this road towards Port Nolloth for sections of these corridors. Corridor 3 would have the least visual impact on any national or provincial road.

The intensity of the visual impact could therefore be high with regards to the open rural landscape found within the study area and tourist travelling on the national, provincial and local roads. It should, however, also be noted that the study area is not densely populated and the permanent visual impact would thus be limited to a small minority of residents. The number of receptors could again reduce the intensity and significance of the visual impact. Even though one would then deal with “less” concerns and an impact of limited extent, based on the population figures, the impact could still have a marked effect on these

residents' quiet, undisturbed rural lifestyle, their quality of life and their sense of place. As the residents are not exposed to various types of infrastructure, it is anticipated that the majority of residents would view the transmission line as having a significant negative impact on the beauty of the landscape and even being in discord with their farming practices, whereas a smaller proportion could associate such a line with progress.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)	Moderate (6)	Moderate (6)	Low (4)	Low (4)	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (52)**	**Medium (52)**	**Medium (39)**	**Medium (39)**	**Medium (33)**	**Medium (33)**	**Medium (39)**	**Medium (39)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Not reversible							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	No							

Mitigation:

» Removal of the power lines and ancillary infrastructure once the lifespan has expired (decommissioning).

Cumulative impacts:

» None anticipated

Residual impacts:

» Visual intrusiveness of tower structures

Nature: Safety and security impact of the Transmission power line during the operational phase

Safety and security impacts during the operational phase relate to the maintenance of the transmission line and emergency work to be undertaken. Although this would be done infrequently, maintenance could still have some negative impacts on the property owners' daily living and movement patterns and their sense of security. The intensity of this impact would be more severe if maintenance personnel access properties without prior notification. Additional safety risks during the operation phase relate to possible mechanical failures (e.g. collapse of pylons) or electrical failures which could cause injuries and in worst cases death. Although the possibility of such accidents happening is relatively low, this issue requires pro-active measures to be put in place.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (22)**	**Medium (33)**	**Low (22)**	**Medium (33)**	**Low (22)**	**Medium (33)**	**Low (22)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Yes							
Irreplaceable loss of resources?	No							
Can impacts be mitigated?	Yes							

Mitigation:

» The maintenance of fire breaks is of critical importance

» The servitude management should be monitored by the property owners and Eskom on an on-going basis. The property owners should thus be informed on the management process required and where they can submit queries or comments in this regard.

» Eskom should take a strong stance with regards to the illegal entering of the servitude areas.

» Eskom should, in conjunction with the local municipalities, develop an emergency management plan to specifically deal with the increased risk of fires
Cumulative impacts:
» None anticipated
Residual impacts:
» None anticipated

Nature: Health related impacts associated with the Transmission power line during the operational phase

With a project of this nature, health related concerns are also usually present with regards to the impact of the "electrical current" of power lines on people and animals. The impact of and exposure to Electromagnetic Fields (EMFs) on people and animals (e.g. the possible impact of EMFs on the fertility of animals) is usually raised by property owners and are expected to remain a concern in the study area.

Drawing on the existing body of research, the World Health Organisation has stated that it is becoming increasingly unlikely that exposure to EMFs constitutes a serious health hazard, although it concedes that some uncertainty remains. However, electric and magnetic fields can be reduced (through shielding, engineering techniques or line designs) and be decreased with an increase in distance from the line (Empetus CC., 2006). The 55 m servitude area limits the constant exposure to these EMFs and according to the Eskom regulations no one is allowed to live within the servitude.

	Corridor1		***Corridor 2***		***Corridor 3***		***Corridor 4***	
	Without mitigation	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***	***Without mitigation***	***With Mitigation***
Extent	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)	Regional (3)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)	Low (4)	Low (4)	Low (4)	Minor (2)	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)	Improbable (2)	Very improbable (1)	Very improbable (1)	Very improbable (1)	Improbable (2)	Very improbable (1)
Significance	**Low (26)**	**Low (22)**	**Low (22)**	**Low (11)**	**Low (11)**	**Low (9)**	**Low (22)**	**Low (11)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative

Reversibility	Yes
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Yes
Mitigation: » Eskom should ensure that no one is allowed to live within the servitude » In no cases should the 55 m servitude which functions as a buffer be relaxed	
Cumulative impacts: » None anticipated	
Residual impacts: » None anticipated	

5.5.1. Comparative Assessment of Alternatives

» Corridor 1 passes through the towns of Okiep and Springbok. This corridor is thus the closest to towns where social impacts could be anticipated. The area surrounding these towns are also characterised by various mountains and an alignment of the line to avoid the towns could be challenging as there is an existing line at present. Even though Corridor 1 runs parallel to an existing line and for large sections of the route also along the N14 and R355, and to the north of the Goegap Nature Reserve, as well as through an outlier section of the Richtersveld National Park, the possible negative impact on the tourism industry (travellers along these routes) due to the visual impact should be considered. Placement of the line along the existing line should therefore be pursued.

  Corridor 1 runs for most parts parallel to an existing power line alignment. Creating a so-called "industrial corridor" limits possible negative social impacts such as the impact on the sense of place of an undeveloped rural area. In contrast, the possible negative impact on travellers along the roads should be considered, whilst at the same time it should be noted that the negative visual impact becomes less over vast distances, which in this case, could occur.

  From a social perspective Corridor 1 could be implemented.

» Corridor 2 passes Steinkopf to the south. Due to the relatively flat landscape surrounding the town, it is anticipated that a suitable route alignment in this area avoiding negative social intrusion impacts near Steinkopf could be found. The tower positions of Corridor 2 should, however, still be carefully considered to avoid any possible negative impacts on the stock posts found in the communal areas.

  Avoiding existing and possible future mining areas along this alternative (northern section), as for the other corridors, could be challenging. An alignment along the existing line would thus be preferable.

  From a social perspective Corridor 2 could be implemented.

» Corridor 3 would also the least visual impact on any national or provincial road used by tourists. In this regard it should be noted that all four corridors traverse the Richtersveld World Heritage Site, but Corridors 1, 2 and 4 runs parallel to an existing corridor. Corridor 3, however, would create a new corridor through this section of the study area. For some sections of this corridor, the creation of access routes could be required. The negative

impacts in this regard could be mitigated by linking Corridor 3 to the existing power line alignment.

From a social perspective Corridor 3 could be implemented.

» Corridor 4 follows the same alignment as Corridor 2 for the majority of the route, except for a stretch to the west of Steinkopf, where the corridor deviates away from Corridor 2 towards the north west and then again in a south westerly direction where it joins up with Corridor 2 again. The tower positions of Corridor 4 should, however, still be carefully considered to avoid any possible negative impacts on the stock posts found in the communal areas.

From a social perspective Corridor 4 could be implemented.

All four corridors traverse the south westerly section of the Richtersveld World Heritage Site. All four corridors however can be pursued taking the sensitivities with regards to this section of the study area into consideration.

From a social perspective, though, **Corridor 3 would be the preferred corridor**. This is based on the limited anticipated visual impact of this corridor on any national or provincial road of all the corridors assessed. In addition, Corridor 3 does not pass by any towns or settlements. The fact that Corridor 3 traverses the Richtersveld World Heritage Site could be mitigated by linking this section of the corridor with the existing power line alignment in this area.

If Corridor 3 cannot be linked to the existing alignment through the Richtersveld World Heritage Site, Corridor 1 would be the second preferred option as it would run parallel to an existing line. Creating a so-called “industrial corridor” limits possible negative social impacts such as the impact on the sense of place of an undeveloped rural area.

5.5.2. Implications for Project Implementation

The following general recommendations are made to limit the negative social impacts associated with the various power line corridors under investigation:

» Based on the anticipated social impacts associated with each corridor, Corridor 3 is the preferred corridor, followed by Corridor 1. In the event that one or more of the other corridors are preferred by the various specialist studies, Corridors 2 and 4 can also be implemented, providing that an alignment in close proximity to homesteads, other dwellings, stock posts and sensitive areas is avoided.

» For the most northern section of the study area (i.e. in the vicinity of Alexander Bay), an alignment next to the existing alignment is proposed to limit any possible impacts on future mining activities and to avoid construction of new access routes.
» Within the Richtersveld World Heritage Site, it should be considered to link Corridor 3 with the existing corridor as soon as possible in order to limit additional negative impacts on this area.
» The proposed transmission line should not be placed within any conservation areas and/or nature reserves.
» Appoint lower and semi-skilled construction workers from the local community whenever possible.
» Eskom should undergo an intensive consultation process with the affected property owners within the selected corridor to determine the best possible routes for the construction of the access roads.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 6

In response to the growing electricity demand within the Northern Cape and to address current supply problems in the area, Eskom Holdings Limited is proposing the establishment of a new 400kV Transmission line which will connect the Aggeneis and Oranjemond substations over an approximate distance of 240km.

The proposed project will include the following:

» The construction of a new **400 kV transmission power line** which will connect the Aggeneis and Oranjemond substations. The transmission power line is expected to be approximately 240 km in length, depending on the final alignment. It is proposed that the transmission line will be constructed as a 400kV line but will be operated at 220kV for the first 5-10 years. A new servitude of 55m will be required to be secured for this power line.
» The **expansion** of both the Aggeneis and Oranjemond Substations to accommodate the new power line. This expansion is proposed to be within the footprint of the existing substations.
» **Associated works** to integrate the proposed new transmission power line into Eskom's electricity Transmission grid (including the construction of service/access roads where required, etc.).

The Environmental Impact Assessment (EIA) for the proposed Aggeneis-Oranjemond 400 kV Line and Substations Upgrade Project has been undertaken in accordance with the EIA Regulations GNR543, published in Government Notice 33306 of 18 June 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The EIA Phase aimed to achieve the following:

» Provide an overall description and assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
» Comparatively assess identified feasible alternative Transmission power line corridors.
» Nominate a preferred Transmission power line alternative corridor for consideration by DEA.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.

» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

Four alternative Transmission line development corridors have been considered within this EIA process in order to link the existing Aggeneis and Oranjemond substations (Refer to Figure 6.1).

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

6.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - J provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA process by providing a summary of the conclusions of the assessment of the alternative Transmission line corridors identified for the 400kV Transmission power line. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

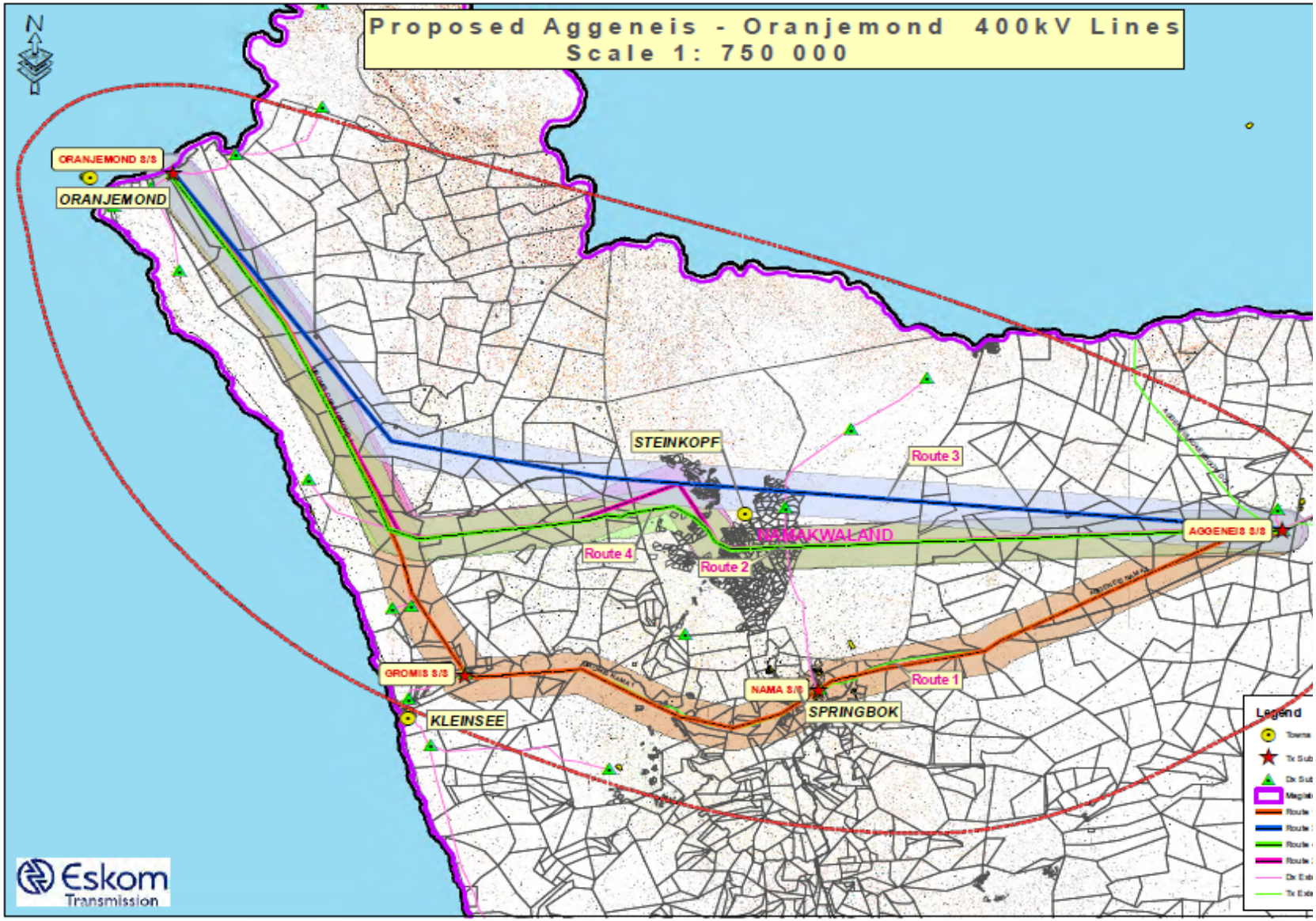

Figure 6.1: Map showing alternative Transmission power line corridors considered in the EIA Study

6.1.1. Conclusions and Recommendations drawn from the Assessment and Comparison of the Transmission Power Line Alternatives

The transmission power line alternatives proposed for the Aggeneis-Oranjemond 400kV Transmission power line cross various habitat sensitivity classes and potentially impacts on numerous land uses and communities. From the conclusions of all specialist studies undertaken a number of impacts of high significance have been identified which renders certain corridors to be less desirable than others. Table 6.1 provides a summary of the preferred alternatives as concluded by the various specialist studies (refer to Chapter 5 and Appendices F – J).

Table 6.1: Rating of alternative corridors as per the EIA specialist studies undertaken

	Corridor 1	***Corridor 2***	***Corridor 3***	***Corridor 4***
Ecological Impact Assessment	Least preferred, but acceptable	Acceptable	***Most Preferred***	Acceptable
Avifaunal Impact Assessment	***Most preferred***	Can be considered	Least preferred but can still be considered	Can be considered
Visual Impact Assessment	Least preferred	Third preferred	Second preferred	***Most preferred***
Heritage Impact Assessment	Second preferred	Third preferred	***Most preferred***	Can be considered with extensive mitigation
Social Impact Assessment	Could be implemented – Second preferred	Could be implemented	***Most preferred***	Could be implemented

The following can be concluded from the table above:

» From an Ecological perspective, all four corridors are acceptable, with Corridor 3 being the most preferred. Corridor 1 is the least preferred although it is still viewed as being acceptable.
» From an avifauna perspective, Corridor 1 is the most preferred option. Corridor 2, 3 and 4 re considered acceptable and could also be considered for the proposed Transmission power line. Even though Corridor 3 is the least preferred option, it could still be considered due to no fatal flaws having been identified, provided that the necessary mitigation measures are implemented in terms of the findings of the Avifaunal Impact Assessment. .

» In terms of the Visual Impact Assessment, Corridor 4 is viewed as the most preferred option and Corridor 1 as the least preferred option. Corridor 3 is the second preferred option, while Corridor 2 is the third preferred option.
» The most preferred corridor identified by the Heritage specialist is Corridor 3, with Corridor 4 being the least preferred. All corridors could, however, be considered with the implementation of appropriate mitigation measures.
» It was recommended in the Social Impact Assessment that any of the four corridors could be implemented. However Corridor 3 was still elected as being the most preferred option.

From the above, it can be concluded that, although all corridors investigated could be considered environmentally acceptable with the implementation of appropriate mitigation measures, **Corridor 3 is the most preferred option** from an environmental perspective, followed by Corridor 2. From a technical and economic perspective, however, Corridor 4 is considered to be the preferred option as this alternative largely avoids the mountainous areas which would pose technical constraints from a design, construction and operations perspective. However, should Corridor 4 be selected as the overall preferred option, then this will require extensive mitigation on the escarpment area to the west of Steinkopf, to ensure that there are no direct impacts on the Anenous Pass, “Meulpad”, old railway line or any other pre-colonial or colonial heritage resources which are concentrated in this area. This will require a walk down of the proposed location of the transmission lines and micro-siting of the towers to ensure that impacts are minimised.

It is considered vital that construction of the power line within the authorised corridor take the recommended conditions identified by the specialist studies into account. In addition, should the project be authorised by DEA, the final routing of the power lines within this corridor should be undertaken in consultation with the affected landowners and the following specialists:

» Biodiversity specialist
» Avifauna specialist
» Heritage specialist

In addition, once the final transmission power line alignment has been negotiated and the tower positions surveyed and pegged, a walk-though survey must be undertaken by these specialists in order to minimise potential environmental impacts associated with the proposed project.

6.2. Overall Conclusion (Impact Statement)

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» Although some impacts of potential high significance are associated with the proposed Aggeneis-Oranjemond 400 kV Transmission Line and Substation Upgrade Project, there are no environmental fatal flaws that should prevent the proposed line from being constructed provided that the recommended mitigation measures are implemented.
» From an environmental perspective, it is recommended that the **Oranjemond Substation** be expanded towards the east or west within the existing substation site, but not to the north, where a small koppie shields the site from the Orange River.
» Although all corridors are considered acceptable from an environmental perspective (provided appropriate mitigation is implemented), **Corridor 3** is nominated as the preferred option for the construction of the proposed Transmission line, followed by Corridor 2.
» The significance levels of the majority of identified negative impacts can be minimised by implementing the recommended mitigation measures.

6.3. Overall Recommendation

Based on the nature and extent of the proposed project, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Aggeneis-Oranjemond 400 kV Line and Substation Upgrade Project be authorised by DEA to include the following:

» Construction of the new Aggeneis-Oranjemond 400 kV Transmission line within **Corridor 3**. Eskom must negotiate the most appropriate route within this corridor with the affected landowners.
» Expansion of the **Oranjemond Substation** to take place towards the east or west within the existing substation site, but not to the north, where a small koppie shields the site from the Orange River.

The following conditions of this recommendation must be included within the authorisation issued:

» All mitigation measures detailed within this report and the specialist report contained within Appendices F to J must be implemented.

- The draft Environmental Management Programme (EMP) as contained within Appendix K of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed Aggeneis-Oranjemond 400 kV Line and Substation Upgrade Project, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- Applications for all other relevant and required permits required to be obtained by Eskom must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site and disturbance of protected vegetation.
- An ornithologist must identify the exact power line spans requiring marking in order to minimise the risk of collision of birds with the earth wire. Install suitable anti-collision marking devices on earth wires as per Eskom Transmission guidelines, on high risk sections of line as identified during the avifaunal walk through. Recommendations must be made regarding the installation of Bird Guards on all self-supporting towers according to the existing Eskom guidelines. This will prevent birds from perching in high risk areas on the towers directly above live conductors.
- An ecological specialist must conduct a final walkthrough before construction in order to identify and relocate any possible plant species of conservation importance as well as the location and number of protected tree species. If any populations of species of concern are encountered, then the individual tower structure must be shifted to avoid striking the specific habitat of concern.
- A heritage specialist must conduct a final walkthrough before construction in order to identify any important heritage resources. Transmission lines can be rerouted or realigned in order to avoid heritage sites and heritage resources can be conserved unaffected underneath power lines. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
- Eskom must consult with the Northern Cape Heritage Authority regarding the crossing of the Richtersveld World Heritage Site.
- As far as possible, modify the alignment of the power line to keep it outside the boundaries of any affected reserves / parks.
- Before construction, demarcate the approved servitude and ensure that construction impacts are contained within this area.
- Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld.
- Where possible, position infrastructure so that individuals of protected trees are not affected.

» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Mitigation of the visual impact though conventional visual impact mitigation measures (i.e. vegetation screening, landscaping or design) is highly unlikely to succeed due to the inherent functional design of the substation structures and transmission line infrastructure. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.
» The process of communication and consultation with the community representatives must be maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

REFERENCES CHAPTER 7

ACOCKS, J.P.H. 1988. Veld types of South Africa (3rd edn.). *Mem. Bot. Surv. S. Afr.* No 28. Government printer, Pretoria.

ANDERSON, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Anthing, L. 1863. Letter to the Cape Parliament. Cape Blue Book.

ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria

ARC-ISCW, 2008. Agromet Climate Information System. ARC-Institute for Soil, Climate and Water, Pretoria

AVIAN POWER LINE INTERACTION COMMITTEE (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute. Washington D.C.

BARNES, K.N. (ed.) (2000) The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

BARNES, K.N. (ED.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.BirdLife South Africa: Johannesburg.

Beaumont, P. B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

BRANCH, W.R. (1988) South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.

Burdge, R.J. 1995. A community guide to Social Impact Assessment. Social Ecology Press. Middleton

Census 2001 Community Profiles Database. Statistics South Africa

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral maps and digital data.*

CSIR/ARC, 2000. National Land-cover Database 2000 (NLC 2000)

Deacon, J. nd. Archaeological Impact Assessment - specialist input to planning and design. Unpublished notes compiled for the National Monuments Council.

DENT, M.C., LYNCH, S.D. & SCHULZE, R.E. 1989. Mapping mean annual and other rainfall statistics in southern Africa. Department of Agricultural Engineering, University of Natal. ACRU Report No. 27. Massachusetts: Clark University.

Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Northern Cape Province (ENPAT Northern Cape).*

Dewar, G. & Orton, J. in press. Subsistence, settlement and material culture on *the central Namaqualand coastline.*

DRIVER, A., DESMET, P., ROUGET, M, COWLING, R.M. and MAZE, K. 2003. Succulent Karoo Ecosystem Plan: Biodiversity component technical report. Cape Conservation Unit, Report No. CCU 1/03, Botanical Society of South Africa.

DRIVER, A., MAZE, K., ROUGET, M., LOMBARD, A.T., NEL, J., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K and STRAUSS, T. 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

DU PREEZ, L. & CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Random House Struik, Cape Town.

Dunn, E. J. 1931. The Bushmen. London: Charles Griffin & Co.

FAIRBANKS, D.H.K., THOMPSON, M.W., VINK, D.E., NEWBY, T.S., VAN DEN BERG, H.M & EVERARD, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. S.Afr.J.Science 96: 69-82.

FRIEDMANN, Y. & DALY, B. (eds.) 2004. The Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

Geological Survey, 1984. Geological Map of South Africa. Department of Mineral and Energy Affairs, Pretoria.

GERMISHUIZEN, G. & MEYER, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. Strelitzia 14. National Botanical Institute, Pretoria.

GERMISHUIZEN, G., MEYER, N.L., STEENKAMP, Y and KEITH, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.

Greater Randburg&Sandton areas - Avifaunal assessment.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V AND BROWN, C.J. (EDS). 1997. The atlas of southern African birds. Vol. 1&2.BirdLife South Africa: Johannesburg.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book - Butterflies. South African National Scientific Programmes No. 158, Foundation for Research Development, CSIR, Pretoria.

IUCN (2001). IUCN Red Data List categories and criteria: Version 3.1. IUCN Species Survival Commission: Gland, Switzerland.

Khai-Ma Local Municipality. 2010. Integrated Development Plan (IDP) 2010

MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. S. Afr. J. Agric. Extension, 3(3): 1-4.

MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

Miller, D.E. & Yates, R. 1994. Report on an archaeological reconnaissance of the Richtersveld National Park and surrounding areas. Unpublished report.

MILLS, G. & HES, L. 1997. The complete book of southern African mammals. Struik Publishers, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. and KLOEPFER, D. (eds.) 2004. Atlas and Red Data Bookof the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

MITTERMEIER, R.A., GIL, P.R., HOFFMANN, M., PILGRIM, J., BROOKS, T., MITTERMEIER, C.G., LAMOREUX, J. & FONSECA, G.A.B. DA (eds.) Hotspots revisited. CEMEX, pp.218–229. ISBN 968-6397-77-9

MONADJEM, A., TAYLOR, P.J., COTTERILL, E.P.D. & SCHOEMAN, M.C. 2010. Bats of southern and central Africa. Wits University Press, Johannesburg.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. South African Archaeological Bulletin 46:115-124.

Morris, D. & Webley, L. 2004. Cultural Heritage Sites in the Namaqualand National Park. Unpublished report.

Morris, D. 1999a. Archaeological impact assessment, 'Southern Option', powerline 'Schuitdrift' to 'Paulputs', Pofadder District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 1999b. Archaeological impact assessment, Skuitklipkop Microwave Tower, Kenhardt District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 2000a. Gamsberg Zinc Project environmental impact assessment specialist report: archaeology.

Morris, D. 2000b. Archaeological impact assessment, Black Mountain Mine, Aggeneys, Northern Cape. Unpublished report to Walmsley Environmental Consultants.

Morris, D. 2000c. Archaeological specialist report: desktop assessment of possible archaeological resources along the proposed route, Helios to Aggeneis, Northern Cape. Appendix G in Eyethu Engineers CC: Scoping report: environmental impact assessment for the proposed Aggeneis to Helios 400 kV transmission line. Eskom Transmission Group.

Morris, D. 2001. Gamsberg Zinc: supplementary report on archaeological resources at Gamsberg. Unpublished report for Gamsberg Zinc Project.

Morris, D. 2010. Cultural Heritage Assessment: Gamsberg. Supplementary observations to a previous specialist report on archaeological resources. Unpublished report to SRK Consulting.

MUCINA, L, BREDENKAMP, G.J., HOARE, D.B & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa South African Journal of Science 96: 1–2.

MUCINA, L. AND RUTHERFORD, M.C. (editors) (2006). Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, National Botanical Institute, Pretoria.

MUCINA, L. AND RUTHERFORD, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C. AND POWRIE, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.

MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., HOARE, D.B., BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. Nama-Karoo Biome. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

MUCINA, L; RUTHERFORD, C. 2006.The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.

Nama Khoi Local Municipality. 2010. Integrated Development Plan (IDP) 2010-2011

Namakwa District Municipality. 2006. Integrated Development Plan (IDP) 2006-2011

National Botanical Institute (NBI), 2004. Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)

PASSMORE, N.I. & CARRUTHERS, V.C. (1995) South African Frogs; a complete guide. Southern Book Publishers and Witwatersrand University Press. Johannesburg.

Penn, N. 2005. The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century. Athens, Ohio and Cape Town: Ohio University Press and Double Storey Books.

Prinsloo, H.P. 1998. Argeologiese omgewingsverslag: Pofadder en Aggeneys omgewing. For Klopfer Environmental Consultants.

Richtersveld Local Municipality. 2009. Integrated Development Plan (IDP) 2009

Robinson, A.M.L. (ed) 1978. Selected articles from the Cape Monthly Magazine NS, 1870-1876. Cape Town: Van Riebeeck Series Second Series No 9.

Sampson, C. G. 1974. The Stone Age archaeology of South Africa. New York: Academic Press.

Savannah Environmental. 2010. Background Information Document: Northern Cape Strengthening Project – Proposed Aggeneis – Oranjemund 400 kV Transmission Power Line and Substations Upgrade, Northern Cape Province

Smalberger, J.M. 1975. A history of copper mining in Namaqualand. Cape Town: C. Struik,

SMALLIE, J. 2007. Strategic Environmental Assessment for Electrification Master Plan

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Thompson, G. 1827. Travels and adventures in Southern Africa. Reprint, Cape Town: Africana Connoisseurs Press, 1962.

VAN ROOYEN, C.S. 1998. Raptor mortality on power lines in South Africa. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

VAN ROOYEN, C.S. 1999. An overview of the Eskom - EWT Strategic Partnership in South Africa.(EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

VAN ROOYEN, C.S. 2000."An overview of Vulture Electrocutions in South Africa." Vulture News, 43, pp 5-22. Vulture Study Group: Johannesburg, South Africa.

VAN ROOYEN, C.S. 2003. Mitigation programme for Avian Collisions with Eskom Transmission Lines. Unpublished Progress Report, September 2003. Endangered Wildlife Trust, Johannesburg, South Africa.

VAN ROOYEN, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

VAN ROOYEN, C.S. AND LEDGER, J.A. 1999. "Birds and utility structures: Developments in southern Africa" in Ferrer, M. &G..F.M. Janns. (eds.) Birds and Power lines.Quercus: Madrid, Spain, pp 205-230

VAN ROOYEN, C.S. AND TAYLOR, P.V. 1999.Bird Streamers as probable cause of electrocutions in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina)

VAN WYK, A.E. & SMITH, G.F. 2001. Regions of floristic endemism in southern Africa. Umdaus press, Hatfield.

Webley, L. 2007. Archaeological evidence for pastoralist land-use and settlement in Namaqualand over the last 2000 years. Journal of Arid Environments 70:629-640.

WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNISO vegetation map of Africa. Natural Resources Research 20. Unesco, Paris.

Whitelaw, G. 1997. Archaeological monuments in KwaZulu-Natal: a procedure for the identification of value. Natal Museum Journal of Humanities. 9:99-109.

www.demarcation.org.za
www.northerncape.gov.za
www.northerncape.org.za
www.richtersveld.gov.za
www.sanparks.org
www.sa-venues.com
www.southafrica.info
www.terradaily.com