DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The Proposed Aggeneis-Paulputs 400kV Transmission Powerline and Substations Upgrade, Northern Cape Province

September 2017

Submitted to:

National Department of Environmental Affairs

DEA REF: 14/12/16/3/3/2/1012

MOKGOPE consulting

082 567 3099/082 554 4032
086 607 9481
49 3rd Avenue, Highlands North, 2192
P.O. Box 2363, Highlands North, 2037
Mokgopeo@gmail.com; enquiries@mokgope.co.za
www.mokgope.co.za
CK No. 2007/194916/23 - Income Tax Registration: 9455120162

EXECUTIVE SUMMARY

Eskom Holdings SOC Ltd (hereafter to be referred as Eskom) intends to establish a new 400 kilovolt (kV) transmission powerline from the existing Aggeneis substation near Aggeneys mining town to Paulputs substation near Pofadder town in the Northern Cape Province. The total length of the transmission powerline from Aggeneis to Paulputs substation would be approximately 97km. Furthermore, the proposed 400kV transmission powerline would be associated with upgrades at both substations to accommodate the powerline. The line will be constructed at 400kV. However, it will be operated at 220kV until such a time where the need arises for it to be operated at 400kV.

Three main alternative corridors, each with a width of 2km (1km from either side of the centre line) are being considered by Eskom. The corridors closer towards Paulputs substation will be 4km wide. This is to allow sufficient space within the corridors to locate the powerline and to avoid clashes with the Independent Power Producers (IPPs) in proximity to Paulputs substation. The proposed corridors will be assessed during the Environmental Impact Assessment (EIA) process to determine the most environmentally feasible route corridor. After the final route corridor is granted Environmental Authorisation (EA), a servitude width of 55m (27.5m on either side of the centre line) would be required to accommodate the installation of towers upon which the transmission powerline would be strung. Eskom would need to negotiate for legal right of the servitude with individual landowners along the authorised route corridor.

The main purpose for the proposed Aggeneis-Paulputs powerline is to improve the Paulputs N-1 reliability[1]. At the moment, the Paulputs network does not meet the minimum reliability standards of the South African Grid Code which require minimum N-1 reliability for the transmission network. This needs to be resolved as it is a mandatory requirement. Furthermore, the transmission capacity will soon be exhausted at Paulputs if interest by Independent Power Producers (IPPs) continues at present levels. Therefore, the construction of the Aggeneis-Paulputs 400kV line will ensure that the network is firm for N-1 contingency, and to ensure that there is sufficient line capacity to evacuate potential IPPs in the area. The advantages of the proposed transmission powerline would include: avoiding total loss of supply following the loss of the existing 220 kV line; contributing towards a more flexible electrical network; improvement in the overall reliability of the electrical systems, which would benefit electricity users in the region; and to sustain economic growth in the Northern Cape Province.

The construction of the 400kV transmission powerline including associated structures is an activity identified in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), in respect of the Environmental Impact Assessment (EIA) Regulations No. R982 of 2014, as amended on 07 April 2017, GN R326, and may not commence without Environmental Authorisation from the National Department of Environmental Affairs.

Mokgope Consulting has been appointed by Eskom to conduct an EIA process for the proposed development. The EIA process comprises the Scoping phase and the EIAR phase. The Scoping

[1] N-1 means: for multiple transmission lines delivering power to the same point, if one of the lines goes out of service, the remaining lines must be able to carry both the load they were carrying before the event, plus the load carried by the line that is out of service.

process formed part of the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application. The Scoping phase was approved by the Authorities in August 2017. In the EIAR phase, the preferred alternative corridor was chosen on the basis of specialist findings. In addition, all comments and issues raised by interested and affected parties (I&APs) will be recorded and considered by the Environmental Assessment Practitioner (EAP) to finalise the Environmental Impact Report. The construction of the proposed 400kV transmission powerline will only take place after the Department of Environmental Affairs (DEA) has granted Environmental Authorisation and any appeals from I&APs have been dealt with successfully.

I&APs and stakeholders have been identified, contacted and informed of the EIAR phase and the availability of the draft Environmental Impact Assessment Report (EIAR) through electronic mailing system, and hard copies of notification letters were sent through the post. Furthermore, site notices of the project and invitation to attend the public meetings were posted at towns (Aggeneys, Pella and Pofadder) within the project study area. Notices of the project were also published in English and Afrikaans in the newspapers commonly read in those towns. All I&APs and stakeholders are afforded an opportunity to raise objections, issues and comments on the draft EIAR from 20 September to 23 October 2017 and send all their comments and issues to judy@mokgope.co.za / 076 876 2672.

Specialist findings were assessed and summarised in this report. Potential environmental impacts associated with the proposed transmission powerline are expected to occur during the construction and operational phases. Some of the identified potential impacts and recommended mitigation measures in the specialist studies include the following:

- **Vegetation impacts** are due to the removal of vegetation for the purpose of the powerline servitude and the tower footprints. In particular, the clearance of vegetation and plants of conservation concern would cause habitat loss. Mitigation measures should take the form of preventing construction of towers in / on ecologically sensitive areas. Where possible, construction activities must be restricted to previously disturbed areas.

- **Fauna impacts** are due to the disturbance of habitats within the powerline servitude and the tower footprints. Mitigation measures should take the form of preventing construction of towers in / on ecologically sensitive areas. Furthermore, ensure disturbance sources such as machinery and personnel movement are kept to a restricted construction area.

- **Avifauna impacts** are as a result of collisions of birds with powerlines and habitat destruction during construction phase. To minimise this impact would require marking the earth wires of the proposed powerline with a suitable anti-collision marking device. These markers must be no more than 20m apart on each earth wire and must be placed along the full length of the earth wire.

- **Wetland impacts** are as a result of changing the sediment amount entering water resources and loss of watercourse habitat due to infrastructure construction. Towers and construction camps should not be constructed within watercourses. This is by maintaining “no disturbance buffer zones” (50m from the watercourses).

- **Agricultural impacts** are caused by the transmission powerline constructed on agricultural potential land. This results in loss of agricultural land. Mitigation measures should take the form of minimizing the footprint to ensure that as little physical disturbance as possible occurs during the construction phase.

- **Visual impacts** are as a result of construction activities on the desolate sense of place and the farming land use that primarily utilises the natural landscape. Construction camps will cause unsightly views during the construction phase. Mitigations should take the form of avoiding natural landscapes that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill. Do not locate the construction camps within 1km from any residential area or visually sensitive area. Clearly demarcate the construction site to limit the area of disturbance.

- **Heritage site impacts** are caused by disturbance or destruction during construction phase. Mitigation measures should take the form of isolating known sites and declare them as no-go zones with sufficient associated buffer zones around them for protection. The SAHRA would have to be notified to this regard.

- **Social impacts** are as a result of disturbance on land use and hence affecting adjacent landowners. As a mitigation measure, the final route must avoid crossing areas of value such as agriculture farms properties and tourism. In addition, during the construction phase, the workers must be requested to respect the peacefulness and quiet of the area so as not to disturb the rural nature of the area. A positive impact would be the creation of temporary unskilled employment opportunities for local communities during construction phase.

- **Cumulative impacts:** Considering the potential cumulative impacts, it is unlikely that any of the assessed impacts will result in spatial and temporal cumulative change. With mitigation measures, all the assessed cumulative impacts can be regarded as marginal / slight / minor. The significance of cumulative impacts can be further reduced should existing infrastructure features be used, such as existing access roads/tracks present in Corridor 1 and 2. This will further reduce cumulative impacts in biodiversity and watercourses.

Recommendations:

Corridor 1 is considered to be a suitable route alignment for the proposed 400kV transmission powerline. Corridor 1 has the existing 220kV powerline along most of its entire length (Figure 10). This is of special significance due to the presence of existing servitudes and access roads and disturbed areas. Corridor 1 is recommended to be granted Environmental Authorisation to satisfy the purpose and need of the proposed project. In this regard it is fundamental that the EMPr and all other mitigation measures in this EIAR be instituted during all phases of the proposed project. The key conditions are as follows:

- A walk-down by the relevant specialists will be required prior to the construction phase in order to confirm: tower positions; the location of the construction camps; and access routes.

- An independent ECO must be appointed to audit compliance with the EMPr during the construction of the line and to audit compliance of rehabilitation in post construction phase.

- Prior to construction phase, it is relevant to obtain the other necessary Environmental Authorisations in terms of other legislations. For example: Water Use License and Vegetation Clearance Permits.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOGRAPHS

LIST OF ANNEXURES

Annexure A:	Substations Layout Plans
Annexure B:	Locality and Sensitivity Maps
Annexure C:	Impact Assessment – Significant Scoring Matrix
Annexure D:	EAP's signed oath document and Declaration of Independence
Annexure E:	EAP and Specialists' Curriculum Vitae (CV)
Annexure F:	Site Inspection Photographs
Annexure G:	BID Document
Annexure H	Proof of Newspaper Adverts; Registered Mails and E-mail Notifications
Annexure I	Interested and Affected Party Register
Annexure J	Site Notice Photographs
Annexure K	Minutes and Attendance Registers
Annexure L	Comments and Response Report, Authority Letters and E-mail Correspondences
Annexure M	Specialists Reports
Annexure N	Draft Environmental Management Programme (EMPr)

LIST OF ABBREVIATIONS AND ACRONOMYS

Alternating Current	AC
Background Information Document	BID
Basic Assessments	BA
Department of Agriculture	DOA
Department of Economic Affairs, Environment and Tourism	DEAET
Department of Energy	DOE
Department of Environmental Affairs	DEA
Department of Environmental Affairs and Tourism	DEAT
Department of Minerals and Energy	DME
Department of Water Affairs	DWA
Development Facilitation Act	DFA
Draft Scoping Report	DSR
Environmental Assessment Practitioner	EAP
Environmental Impact Assessment	EIA
Environmental Impact Assessment Report	EIAr
Environmental Management Programme	EMP
Final Scoping Report	FSR
Geographic Information Systems	GIS
Government Notice Regulation Number	GNR
High Voltage Direct Current	HVAC
Interested and Affected Parties	I&APs
Integrated Energy Plan	IEP
Integrated Resource Plan	IRP
Kilo Volts	kV
National Energy Regulator of South Africa	NERSA
National Environmental Management Act of 107 1998	NEMA
National Environmental Management: Protected Areas Act 57 of 2003	NEMPAA
National Heritage Resources Act	NHRA
National Integrated Resource Planning	NIRP
Promotion of Administrative Justice Act	PAJA
Plan of Study	PoS
Public Participation Process	PPP
Transmission Development Plans	TDP
Terms of Reference	ToR
South African Heritage Resources Agency	SAHRA

TITLE AND APPROVAL

DEA REF NO	14/12/16/3/3/2/1012
TITLE:	Draft EIAr of the Proposed Aggeneis-Paulputs 400kV Transmission Powerline and Substations Upgrade
CLIENT	Eskom Holdings SOC Ltd
PREPARED BY	Judith Fasheun Mokgope Consulting CC 49 3rd Avenue Highlands North Johannesburg, 2036
PROJECT STATUS	Draft EIA PHASE
REVIEW PERIOD	**September 2017**

APPROVED BY:

ESKOM PROJECT MANAGER: **Mpilo Masondo**

_____ _____

Signature Date

MOKGOPE CEO: **Manako Matemane**

_____ _____

Signature Date

1. PROJECT BACKGROUND

1.1 INTRODUCTION

Eskom is planning to construct a 400kV transmission powerline of approximately 97km connecting from Aggeneis substation to Paulputs substation. Both substations and the proposed powerline are located within the Khai-Ma Local Municipality and located within the jurisdiction of Namakwa District Municipality in the Northern Cape Province. The proposed powerline will consist of three alternative route corridors from Aggeneis to Paulputs. The corridors will be 2km wide (1km from either side of centre line). In addition, the corridors closer towards Paulputs substation will be 4km wide. This is to allow sufficient space within the corridors to locate the powerline and to avoid clashes with the Independent Power Producers (IPPs) in proximity to Paulputs substation. The proposed project also entails the upgrade of the existing substations to accommodate the proposed powerline.

1.2 NEED AND DESIRABILITY

Eskom has a major role to generate, transmit and distribute electricity used in South Africa. The electricity is generated at power stations located in the Mpumalanga coal fields as well as from the Western Cape at Koeberg Nuclear Power station, which is instantly transmitted via kilometres of high voltage transmission lines to major substations around the country. Voltage is reduced at the major substations for further distribution to smaller substations, from where the electricity is distributed to the customer (Eskom annual report, 2009). The following is a simple illustration of the electricity supply chain from the power station to customer.

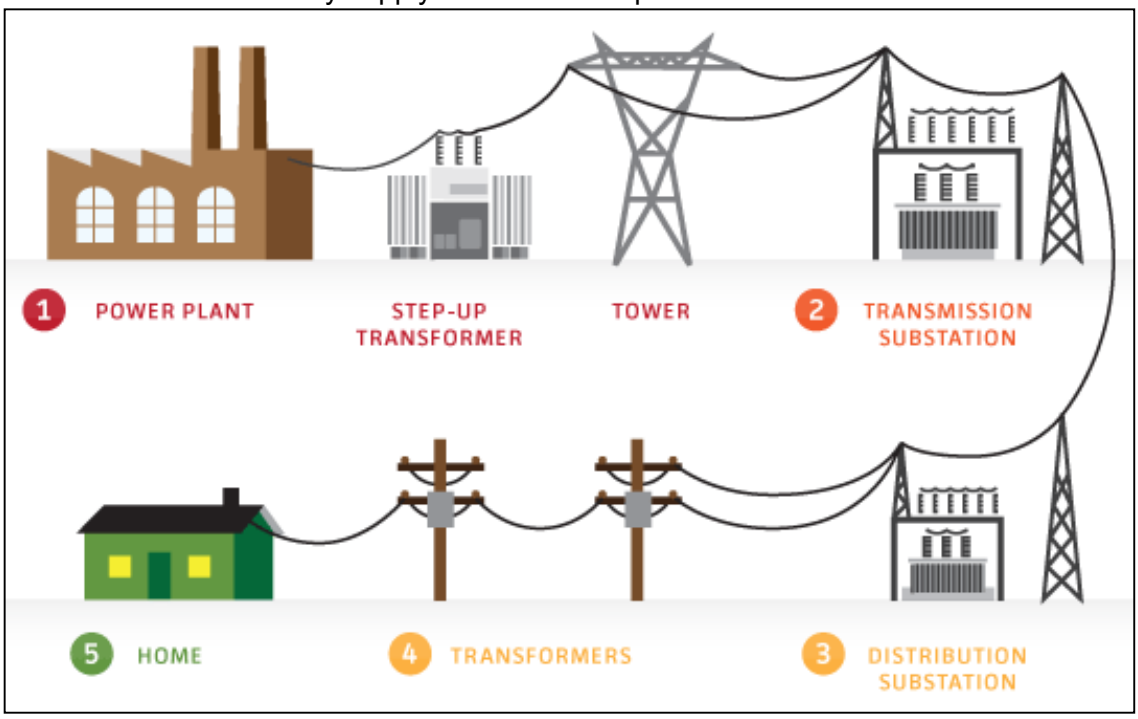


Figure 1: Electricity from power station to end-user (Source: google images)

Eskom has to supply reliable power to meet the increasing needs of electricity users. Therefore on a continuous basis, Eskom needs to construct, maintain and upgrade its infrastructure of transmission powerlines and substations. According to Eskom's Transmission Development Plan (TDP) for 2016–2025, some of the goals are to implement transmission network strengthening plans and reliability projects, which would ensure that the transmission system reliability and adequacy are sustained as load demand increases on the network. Furthermore, in terms of the network reliability criteria, as approved by the National Energy Regulation of South Africa (NERSA), compliance to the N-1[2] criterion is required.

At present, the Namaqualand Customer Load Network (CLN) is supplied via the Aggeneis Main Transmission Substation (MTS). The Aries-Aggeneis 400kV line is the only main feed into the Namaqualand CLN. This network cannot be back-fed via either the Kokkerboom (Habib)-Aggeneis 220kV or the Aggeneis-Paulputs 220kV. Voltage collapse and associated power outages cannot be avoided if the transmission line supply is lost.

The current Aggeneis-Paulputs network's main problem is the reliability, which does not meet the minimum reliability standards of the South African Grid Code which require minimum N-1 reliability for the transmission network. The other problem faced by the Aggeneis-Paulputs network is that planned transmission capacity will soon be exhausted at Paulputs if electricity generation by Independent Power Producers (IPPs) continues at present levels.

Therefore, to address the N-1 reliability, the construction of the Aggeneis-Paulputs 400kV line is a preferred solution. It ensures the network is firm for N-1 contingency, as well as to ensure that there is sufficient line capacity to evacuate potential IPPs in the area.

1.3 PROJECT DESCRIPTION

The proposed 400kV overhead transmission powerline would be constructed from Aggeneis substation (approximately 5km south west of the mining town of Aggeneys) to Paulputs substation (approximately 35km north east of the town Pofadder) in the Northern Cape Province. The length of the proposed line is approximately 97km, depending on the final route alignment.

To facilitate final route determination, three possible alternative route corridors of 2km wide (1km on either side of the centre line) were identified. The purpose of having a 2km corridor is to ensure more space for biodiversity assessment surveys along the corridor and to avoid any environmentally sensitive features during the powerline construction along the route. In addition, the corridors closer towards Paulputs substation will be 4km wide. This is to allow sufficient space within the corridors to locate the powerline and to avoid clashes with the Independent Power Producers (IPPs) in proximity to Paulputs substation. Once the final route corridor is authorised, a 55m servitude (27.5m on either side of the centre line) would be negotiated and acquired within the final corridor with the affected landowners (prior to construction phase).

[2] The N-1 means that the system is planned such that, with all transmission facilities in service, the system is in a secure state, and for any one credible contingency event, the system moves to a satisfactory state. However, if more than one contingency event was to occur, load may have to be shed to return to a satisfactory state.

Furthermore, the transmission powerline would require support structures and towers which would be spaced at approximately 400m intervals along the powerline route, depending on the towers to be used and the prevailing environment. In addition, vehicular access may be required along the route for construction and maintenance purposes.

The construction on the transmission line process generally follows this sequence:

- Aerial survey of the route;
- Determine technically feasible alternative transmission line corridors (the 2km corridors);
- Investigate the environmental feasibility of alternative corridors and recommend a preferred corridor (Determining the corridor is part of this EIA process);
- Environmental Authorisation with regard to the preferred corridor (part of this EIA process);
- Negotiation of final route within the corridor with landowners;
- Selection of best-suited structures and foundations;
- Final design of line and placement of towers;
- Establishment of construction camps and construction of access roads;
- Vegetation clearance and gate erections;
- Construction of foundations;
- Assembly and erection of towers;
- Stringing of conductors;
- Rehabilitation of working areas and protection; and
- Testing and commissioning of the powerline.

During the operation phase, ongoing maintenance would need to be in accordance with an approved Operational Environmental Management Programme, including:

- aerial inspections;
- vehicle patrols;
- live-line maintenance using helicopters;
- periodic clearing and pruning of servitude vegetation; and
- periodic clearing of the centre line track.

1.3.1 Associated work at Substations

The project will entail the upgrade of the capacity of the existing Paulputs substation, to accommodate additional transmission capacity. Eskom also plans to equip a feeder bay at Aggeneis substation for the Aggeneis–Paulputs 2nd Line. Furthermore, Aggeneis and Paulputs substations would require footprint expansions.

Upgrade at Aggeneis substation:

- Aggeneis is an existing substation with a footprint of approximately 11.6ha (Figure 2).
- The substation will require future footprint extensions.
- The substation will be populated by the designated 2nd feeder bay on the 400kV side

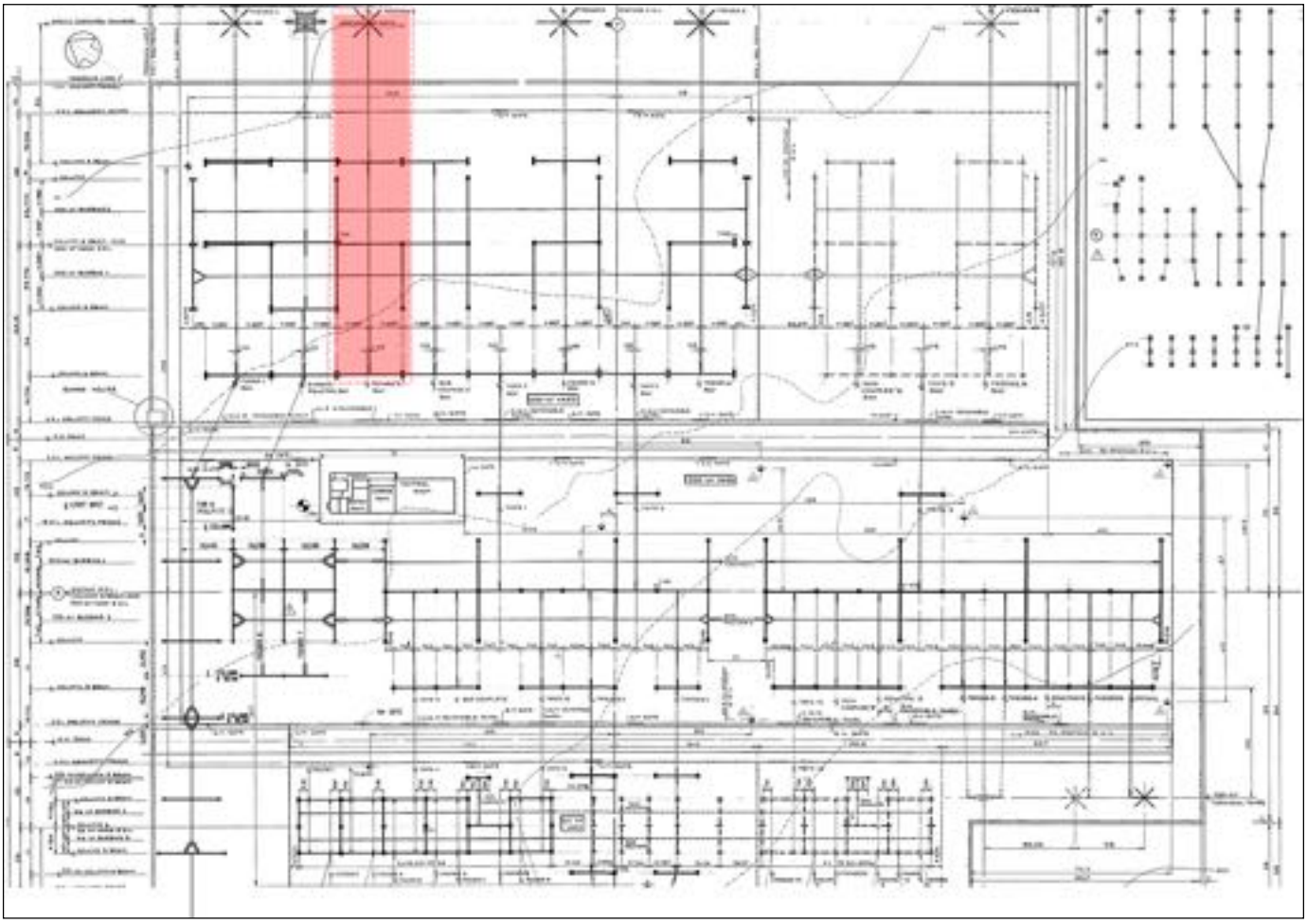


Figure 2: Aggeneis Substation Key Plan

The above image is provided in **Annexure A.**

Upgrade at Paulputs substation:

- Paulputs is an existing substation with a current footprint of approximately 3ha (Figure 3).
- The substation will be expanded by approximately 7.8ha on the south easterly side of the proposed 400kV terrace;
- The Paulputs substation will be populated by the designated 2nd feeder bay on the 220kV side; and
- There will be an addition of a 500MVA 400/132kV transformer, which will require an oil collection dam for storage of the transformer oil.

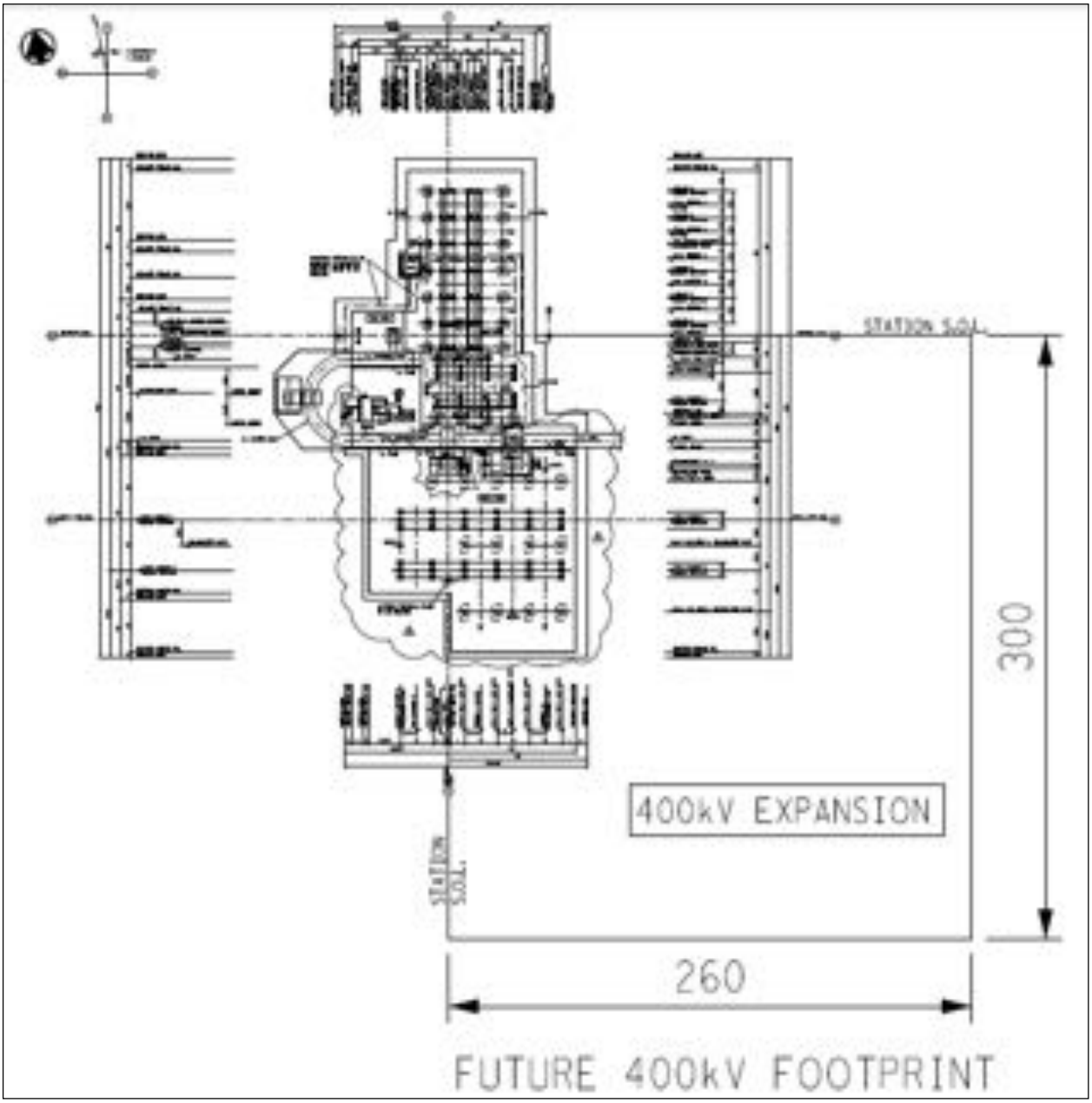


Figure 3: Paulputs Substation Key Plan

The above image is provided in **Annexure A.**

1.3.2 Storage of Transformer Oils

At Paulputs substation, storage of diesel vehicle fuel will be required. The volume of diesel vehicle fuel that is required to be stored in containers (at a time) is approximately 10m^3 at the substations for refuelling construction vehicles. Furthermore, transformer oil will be stored at Paulputs substation. The oil collection dam would be built to collect and store the transformer oils in cases of spillages. The oil collection dam capacity will be approximately 120m^3.

1.3.3 Tower Types

The proposed powerline tower types would approximately be 30m to 35m in height and a footprint area ranging from approximately 64m^2 to 3 400m^2, depending on the tower type used. The distance between each tower would be spaced at intervals of approximately 400m. The actual number of towers, the type of towers and other support structures associated with the proposed powerline would be confirmed and detailed at a later stage following approval of the proposed development.

In general, the type of towers to be used would consider weight, the area (e.g. topography characteristic), height, costs and erection time. In addition, transmission powerline routes are planned with as few bends as possible.

Examples of some of the towers that Eskom is likely to use for the proposed 400kV transmission powerline and which have been widely used in similar development are illustrated below.

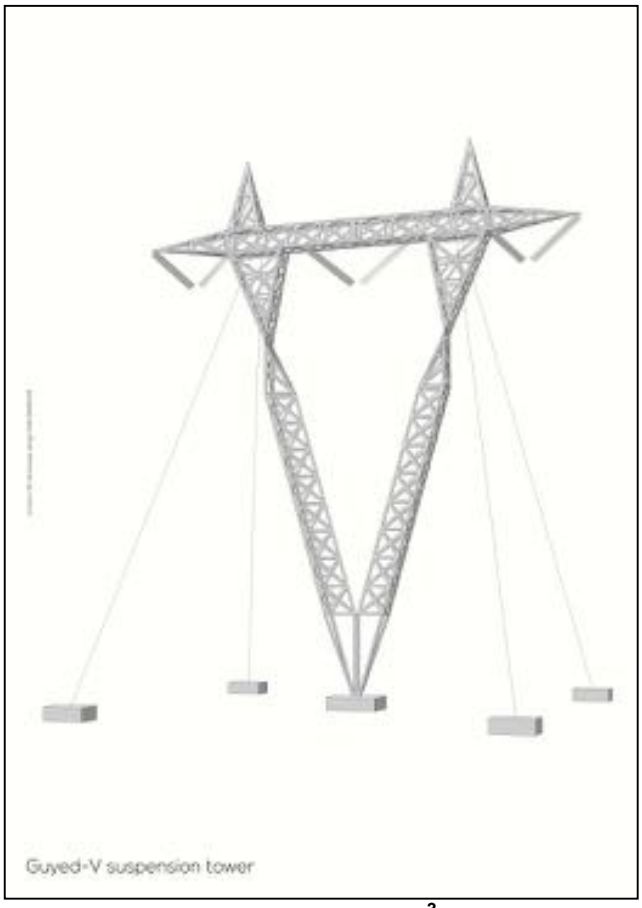


Figure 4: Guyed-V Suspension Tower[3]

[3] Source for figures 4,5 and 6: Envision 3D Landscape Design

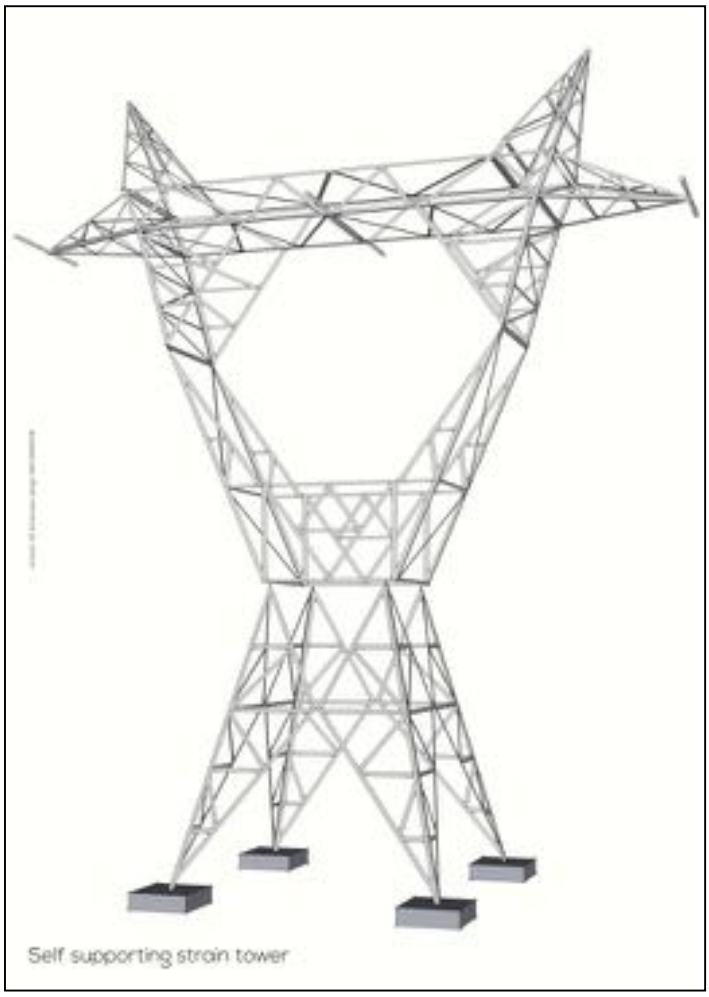


Figure 5: Self Supporting Strain Tower

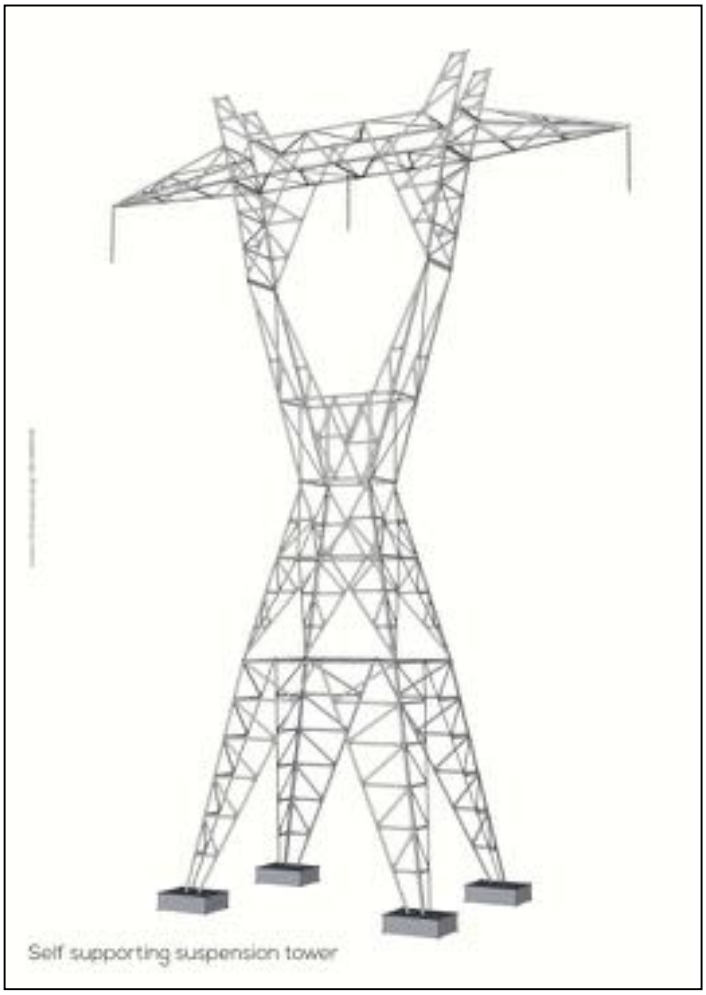


Figure 6: Self Supporting Suspension Tower

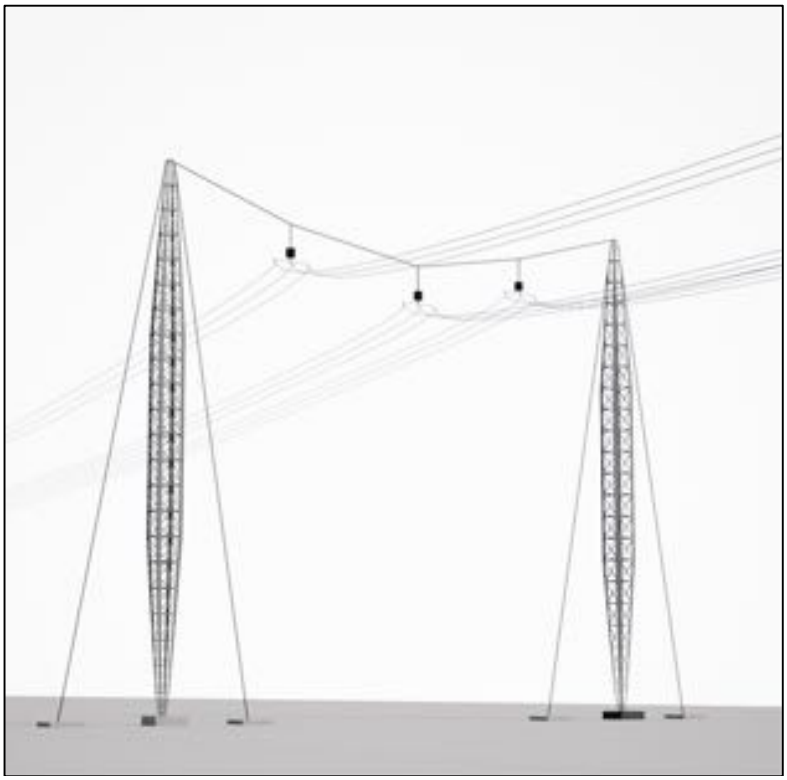


Figure 7: Crossrope Tower (source: www.spacedesignstudio.co.za)

1.3.4 Servitude Requirements

After Environmental Authorisation (EA) of the preferred 2km corridor, Eskom will need to register a servitude width of 55m (27.5m on either side of the centre line) against the title deeds of the properties that would be traversed by the proposed transmission powerline. The servitude would allow Eskom Transmission certain rights and controls that support the safe and effective construction, operation and maintenance of the powerline.

1.3.5 Clearances

The minimum vertical clearance to buildings, poles and structures not forming part of the 400kV powerline must be 3.8m. The minimum vertical clearance between the conductors and the ground should be 8.1m (See figure below). The minimum distance of a 400kV transmission powerline structure from proclaimed public roads is 95m from the centre line of the structure to the centre line of the road (OHSA, 1993).

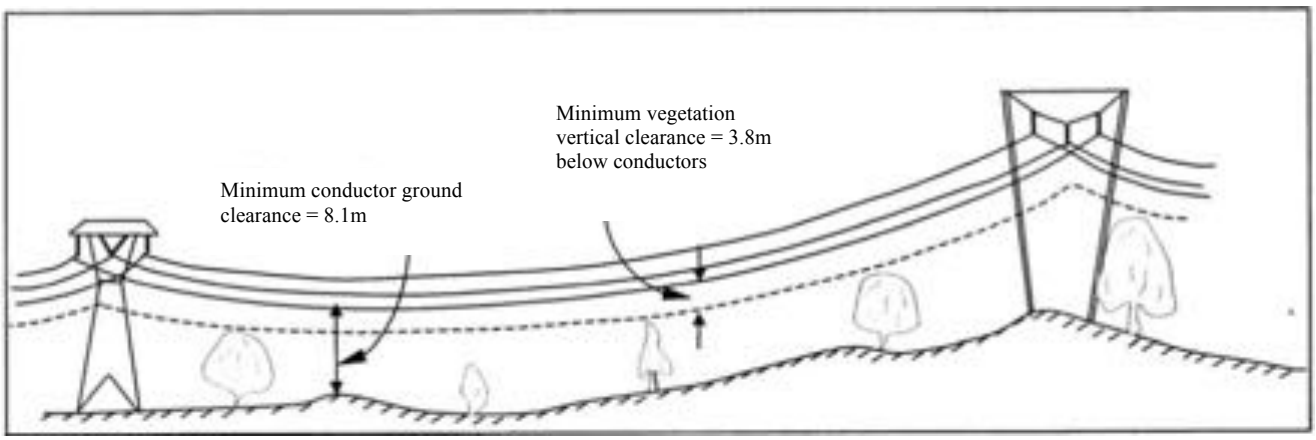


Figure 8: Servitude requirements in terms of vegetation clearing under conductors and minimum ground clearance (Source: BE, 2006)

An approximate 8m wide strip is generally required to be cleared of all trees and shrubs down the centre of a transmission powerline servitude for stringing purposes only. Any tree or shrub in other areas that will interfere with the operation and/or reliability of the transmission powerline must be trimmed or completely cleared (CEA, 2003).

Vegetation clearance for the proposed powerline will be minimal due to the characteristic low-growing plant species predominant in the study area. The clearing of vegetation would be undertaken in accordance with the minimum standards to be used for vegetation clearing for the proposed new powerline construction as listed in Table 1 (CEA, 2003).

Table 1: Minimum standards to be used for vegetation clearing for the construction of the proposed Aggeneis-Paulputs 400kV transmission powerline (CEA, 2003)

ITEM	STANDARD	FOLLOW UP
Centre line of the proposed transmission powerline	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 100mm of the ground and treated with herbicide, as necessary.
Inaccessible valleys (trace line)	Clear a 1m 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 regrow.
Access/service roads	Clear a maximum (depending on tower type) 6m wide strip for vehicle access within the maximum 8m 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 support/stay wire position	Clear all vegetation within proposed tower position in an area of 20 x 20m (self-supporting towers) and 40 x 40m (compact Crossrope 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.	Re-growth to be cut at ground level and treated with herbicide as necessary.
Indigenous vegetation within servitude area (outside of maximum 8m strip)	Area outside of the maximum 8m 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 powerline.	Selective trimming
Alien species within servitude area (outside of maximum 8m strip)	Area outside of the maximum 8m strip and within the servitude area, remove all vegetation within servitude area and treat with appropriate herbicide.	Cut and treat with appropriate herbicide.

The minimum safety clearances in terms of typical electric magnetic field levels in powerline environment where the public may be exposed has been set by the International Commission on Non-Ionising Radiation Protection (ICNIRP) (see table below).

Table 2: 50Hz Electric and Magnetic Continuous Field Exposure Limits Set by ICNIRP

Exposure	Electric Field (kV/m)	Magnetic Field (μT)
Occupational – whole working day	10	500
General public – up to 24h per day	5	100

1.3.6 Access Roads

A vehicle access road is usually required to be established to allow access along the entire length of the servitude. Access is required during both the construction and operation/maintenance phases of the transmission powerline life cycle. Any new access roads that are required will be established during the construction phase and are more established by vehicle passage than by grading or blading. In order to reduce potential impacts associated with the construction of new access roads, existing roads will be used as far as possible where available and new access roads will be constructed by means of driving over the vegetation where possible to avoid permanent removal of the existing vegetation (BE, 2006).

However, if new access roads cannot be established by means of driving over the vegetation, then Eskom would have to construct a gravel road wider than 4m with a reserve less than 13,5m. Furthermore, the proposed Corridor 1 from Aggeneis to Paulputs follows the existing 220kV Powerline which already has an existing access road. If Corridor 1 becomes the chosen final route, then the existing road will require widening by 4m.

Establishment of new access routes during the construction phase would need to be negotiated with the relevant landowners concerned once Environmental Authorisation has been obtained (BE, 2006).

2 PROJECT LOCALITY

The proposed Aggeneis-Paulputs 400kV Transmission Powerline is located within the Khai-Ma Local Municipality, within the jurisdiction of Namakwa District Municipality in the Northern Cape Province. The study area covers the area between the Aggeneis substation (approximately 5km south west of a mining town of Aggeneys) to Paulputs substation (approximately 35km north east of the town called Pofadder). The approximate length of the proposed transmission line is 97km.

The Aerial Photograph and Locality Map are illustrated below in Figure 9 and Figure 10 respectively.

Figure 9: Aerial photo of locality area (Source: Google Earth)

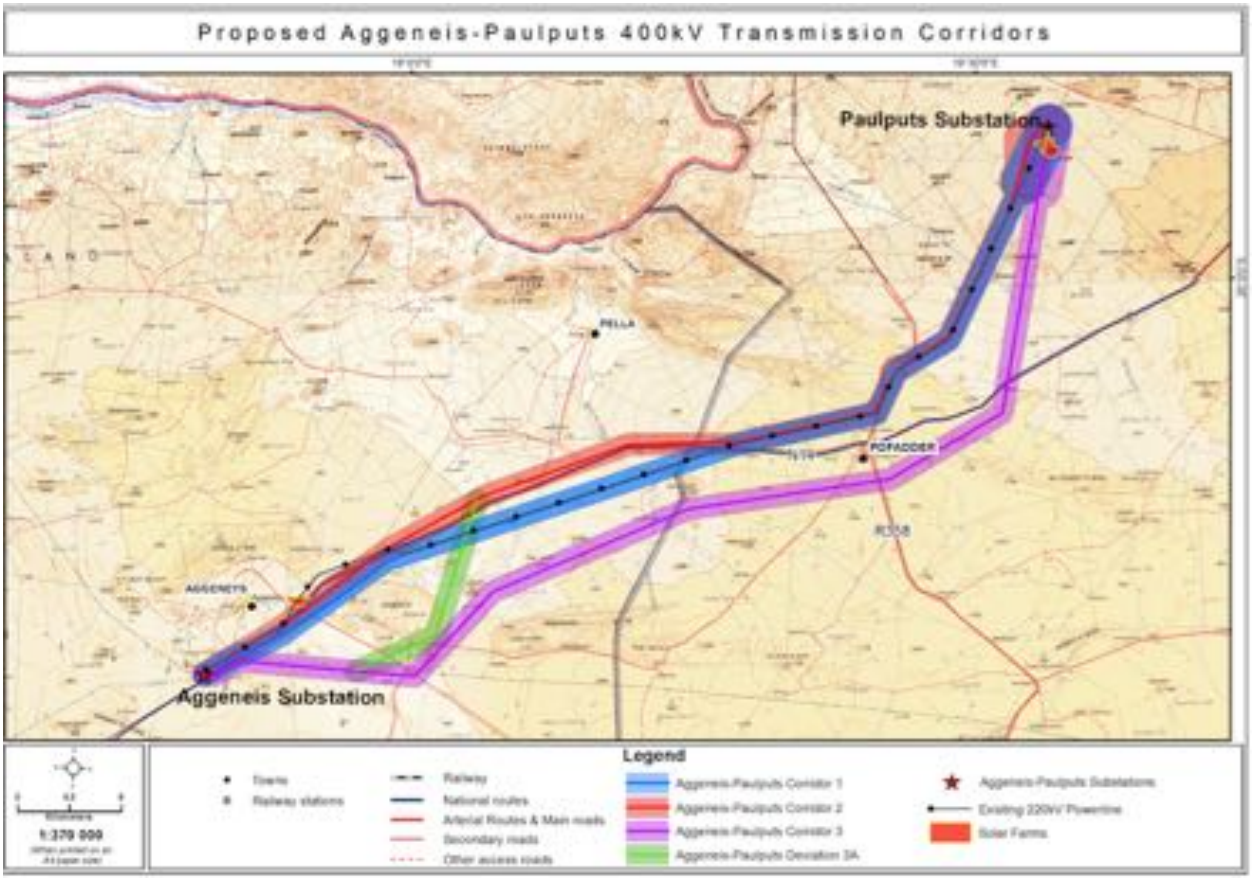


Figure 10: Locality Map

The above map is provided in **Annexure B**.

2.1 COORDINATES

The approximate coordinates are provided below:

Table 3: Approximate Coordinates between Aggeneis and Paulputs substations

	Alternative Route Corridor 1	Alternative Route Corridor 2	Alternative Route Corridor 3
Start point at Aggeneis	29°17'51.4"S 18°48'17.4"E	29°17'51.4"S 18°48'17.4"E	29°17'51.4"S 18°48'17.4"E
Mid-point	29°8'9.477"S 19°14'13.806"E	29°7'5.347"S 19°18'34.388"E	29°10'13.002"S 19°16'28.034"E
End point at Paulputs	28°52'42.4"S 19°33'53.4"E	28°52'42.4"S 19°33'53.4"E	28°52'42.4"S 19°33'53.4"E

2.2 LAND OWNERSHIP AND SERVITUDE

The proposed 400kV powerline is approximately 97km in length. It will require a 55m wide servitude (27.5m on either side of the centre line) to be secured along the approved corridor before construction of the powerline commences. The process requires Eskom to negotiate servitude rights with each of the affected landowners. Servitude rights means Eskom has the right of way to convey electricity across the land, subject to conditions agreed with the affected landowners. The servitude would provide Eskom certain rights such as: Access to erect a transmission line along a specific agreed route; Reasonable access to operate and maintain the line inside the servitude area; and the removal of trees and vegetation that will interfere with the operation of the line.

The proposed transmission line could affect many aspects of the environment along the course of the activity such as: crossing fences, boreholes, existing buildings, mine infrastructure, pipelines, watercourses as well as existing and proposed solar energy facilities, amongst others. The landowners affected by the linear activity could significantly assist with identifying any features of concern on their land that could potentially be affected by the proposed powerline. Please see a map provided in **Annexure B,** illustrating where the proposed corridors traverse the affected farms.

3. IDENTIFICATION OF ALTERNATIVE SCENARIOS

In accordance with the EIA Regulations GN R982 of 2014, as amended as GN R326 of 2017, the EIA process is required to involve the identification of alternatives based on the locality and technical feasibility. The alternatives that are identified must be feasible. The options should also include the do-nothing alternative. The EIA study involves assessment of these alternatives in terms of their potential impacts on the surrounding biophysical and socio-economic environment. Therefore, the least environmentally intrusive and consequently most feasible option of the proposed alternatives would be determined after thorough assessments have been conducted and recommended by the specialists. The specialist studies will be conducted during the EIA phase of the process.

The alternative scenarios that were investigated for this project comprise: location alternatives; process and technical alternatives; and the do-nothing alternative.

3.1 LOCATION ALTERNATIVES

The figure below shows the three proposed alternative corridors considered for the construction of the transmission powerline. Alternative corridors 1, 2 and 3 run the entire length of the development between Aggeneis and Paulputs substations (see Figure 11).

The key determinants in identifying the different route options include:

- Terrain (certain mountainous areas are a challenge for powerline construction);
- Environmentally sensitive areas (wetlands, pristine areas, national protected areas; protected plants, amongst others);
- Mining areas;
- Solar energy facilities;
- Game farms;
- Existing infrastructures (roads, railways, buildings, community dwellings); and
- Future developments that may clash with the proposed powerline.

Not limited to the above-mentioned determinants, there is a variety of other considerations that must be taken into account since there may be legislative restrictions that have to be adhered to. Another key determinant is of “economic factor”. The shorter and straighter (with few bends) the route is, the more feasible from a construction perspective it is to build the proposed powerline.

Figure 11: Proposed Alternative Route Corridors

3.1.1 Alternative Route 1 (Blue Line)

This route is approximately 94km in length and aligns parallel to an existing powerline (about 50m to the east thereof). From the Aggeneys substation, Route 1 stretches north-east to pass north of the town of Pofadder, from where it turns more northwards to reach the Paulputs substation from the substation's southern side.

3.1.2 Alternative Route 2 (Red Line)

This route is approximately 96km in length and follows the same alignment as Route 1 for much of its extent. Where Route 1 aligns south of the N14 between Aggeneys and Pofadder, Route 2 aligns north of the N14. Prior to reaching the Paulputs substation, Route 2 makes a short deviation westward then another deviation eastward to enter the Paulputs substation from its western side.

3.1.3 Alternative Route 3 (Purple Line)

This route is the longest at approximately 101km. Differing from Route 1 and 2, this route aligns eastward from the Aggeneys substation and passes between two inselbergs east of Aggeneys town. It also passes south of the town of Pofadder where after it aligns northward towards the Paulputs substation. Furthermore, route 3A deviates from route 3 about 14km from Aggeneis

substation. Route 3A also passes between Inselbergs (one of them being Gamsberg Inselberg, west of deviation 3A) to join routes 1 and 2. Deviation 3A was suggested by landowners affected by Route 3, which they oppose.

3.2 PROCESS AND TECHNICAL ALTERNATIVES

Five technical alternatives relevant to a 400kV powerline other than the "Do-Nothing" Alternative are described below.

3.2.1 Option 1: 2nd Aggeneis-Paulputs 220kV Line Built at 400kV (93km)

Option 1 entails the construction of the 2nd Aggeneis-Paulputs 220kV line (93km). The second phase of the project (beyond 2030) will entail, the introduction of 400kV and 400/132kV transformation at Paulputs substation, energising the 2nd Aggeneis –Paulputs 220kV line to 400kV to become the 1st Aggeneis –Paulputs 400kV line and construction of a 35km Paulputs to a new Switching station) and looping in and out of the existing Aries-Kokerboom 400kV line into the new switching station. The switching station will have a 100MVar shunt reactor for voltage control.

Eskom had an Environmental Authorisation for this option, however, it lapsed in October 2016.

3.2.2 Option 2: 1st Gromis-Paulputs 220kV Line (260km)

Option 2 entails the construction of the first Gromis-Paulputs 220kV line (constructed at 400kV). This option does not align with the strategic corridors as it links the Western Coastal Corridor with the Solar Corridor.

3.2.3 Option 3: Loop In and Out of Aries-Kokerboom 400kV Line

This option entails the introduction of 400kV and 400/132kV transformation at Paulputs substation, construction of a 35km line at Paulputs to a new switching substation and looping in and out of the existing Aries-Kokerboom 400kV line into the new switching station. The new switching station will have a 100MVar shunt reactor for voltage control. The construction of the first Aggeneis-Paulputs 400kV line will be done as the second phase in 2030. This option aligns with the strategic corridor.

3.2.4 Option 4: Loop In and Out of Aries-Kokerboom 400kV and Integrate with 132kV Underlying Network

Option 4 entails the introduction of 400kV and 400/132kV transformation at Paulputs substation, construction of a 35km line at Paulputs to a new Schuitdrift 400/132kV substation integrating into the existing Schuitdrift Dx 132kV substation and looping in and out of the existing Aries-Kokerboom 400kV line into the new Schuitdrift 400/132kV substation (see figure 12). The new Schuitdrift 400/132kV substation will have a 100MVar shunt reactor for voltage control. Phase 1

will have two phases, where the Paulputs transformation will be done as Phase 1A and the Schuitdrift transformation as Phase 1B. The construction of the first Aggeneis-Paulputs 400kV line will be done as the second phase in 2030. This option is aligned with the strategic corridor.

The advantage of this option over Option 3 is that it creates a new renewable point of connection along the Solar Corridor.

Figure 12: New Switching Station at the existing Schuitdrift Distribution Substation

3.2.5 Option 5: 1st Aggeneis-Paulputs 400kV Line (93km)

Option 5 entails the construction of the 1st Aggeneis-Paulputs 400kV line (93km), introduction of 400kV at Paulputs and 400/132kV transformation. This is similar to Option 1 but operating the proposed line at 400kV immediately.

3.3 DO NOTHING ALTERNATIVE

The "Do Nothing" Alternative is the option of not undertaking the proposed development, which implies that the 400kV overhead powerline would not be constructed. Retention of the status quo would mean that the South African Grid Code N-1 requirement will not be met. The loss or outage of the existing line would mean loss of supply to the area and other surrounding towns fed by the substation with associated economic hardship and total loss of or inability to evacuate renewable generation in the Paulputs network into the national grid.

This option is not economically feasible because electricity users such as mining companies, farmers, and domestic users would be unable to avoid interruptions. Consequently, without the proposed new powerline there is an increasing possibility that outages could occur, resulting in economic losses in the area.

4. LEGAL REQUIREMENTS

South Africa's policy and legislation for environmental management, including biodiversity conservation, has undergone profound changes in the past decade. The proposed project was considered in accordance with the legislation described below.

Of importance are also all provincial and municipal by-laws and regulations that are not listed here but which would be complied with during all phases of the proposed development. Some of the acts may have changed or are in the process of change. However, once the construction phase commences, legislation and all amendments that are current at that time will apply.

4.1 LEGISLATION RELATED TO PROPOSED PROJECT

4.1.1 Constitution of South Africa (Act 108 of 1996)

The Constitution (Act No. 108 of 1996) provides the legal basis for allocating powers to different spheres of Government and contains a number of rights specifically relevant to the national energy policy. The Constitution states that Government must establish a national energy policy to ensure that national energy resources are adequately tapped and delivered to cater for the needs of the nation. Energy should be made available and affordable to all citizens, irrespective of geographic location. The production and distribution of energy should be sustainable and lead to an improvement in the standard of living of citizens (DME, 2003b:6).

Section 24 of the Bill of Rights provides that:

"Everyone has the right:

a) to an environment that is not harmful to their health or well-being; and
b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that:
    i. prevent pollution and ecological degradation;
    ii. promote conservation; and
    iii. secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development."

4.1.2 Energy Policy

The White Paper on Energy Policy (DME, 1998) sets out Government Policy with regard to the supply and consumption of energy for the next decade. The policy strengthens existing energy systems in certain areas, calls for the development of underdeveloped systems and demonstrates a resolve to change in a number of areas. The policy addresses most elements of the energy sector.

Furthermore, the White Paper on Energy Policy identified the need to undertake an Integrated Energy Planning (IEP) process in order to achieve a balance between the energy demand and

resource availability, whilst taking into account the health, safety and environmental parameters. In addition, the policy identified the need for the adoption of a National Integrated Resource Planning (NIRP) approach to provide a long-term cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

4.1.3 Electricity Regulation Act of 2006

The proposed development is aligned to the following objectives (DME, 2006b:6):

- achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;
- ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency, effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in South Africa;
- facilitate investment in the electricity supply industry;
- promote the use of diverse energy sources and energy efficiency; and
- facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public.

In addition, the Electricity Regulation Act (Act No 4 of 2006) in terms of section 46 (2, c) determined that projects involving new generation capacity that is needed to ensure the continued uninterrupted electricity supply would require authorisations or exemptions in terms of NEMA (No 107 of 1998) or as may be required by any other law for the purpose of authorisation for proposed Eskom developments (DME, 2006).

4.1.4 Integrated Energy Plan (IEP) – 2003

The Department of Minerals and Energy (DME) commissioned the IEP to provide a framework in which specific energy policies, development decisions and energy supply trade-offs could be made on a project-by-project basis. The framework was intended to create a balance in providing low cost electricity for social and economic development, ensuring a security of supply and minimizing the associated environmental impacts. The IEP projected that in the years to come the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa. Therefore, contemporary concerns relate to electricity transmission capacity to accommodate growth in demand (DME, 2003a).

4.1.5 Integrated Resource Plan (IRP) – 2009

The Department of Energy, under the New Generation Capacity regulations has authorised the System Operations and Planning Division in Eskom to produce the IRP for electricity in consultation with the Department and the National Energy Regulator of South Africa (NERSA) (DOE, 2009). The objective of the IRP is to develop a sustainable electricity investment strategy

for generation capacity and transmission infrastructure for South Africa over the next 25 years. In summary, the IRP is intended to:

- Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development
- Ascertain South Africa's capacity investment needs for the medium term business planning environment;
- Consider environmental and other externality impacts and the effect of renewable energy technologies.
- Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies) as envisaged in the New Generation Capacity regulations.

4.1.6 The National Heritage Resources Act (No. 25 of 1999)

The proposed development comprises certain activities (*e.g*. changing the nature of a site exceeding 5 000 m^2) that require authorisation in terms of Section 38 (1) of the Act. Section 38 (8) of the Act states that if heritage considerations are taken into account as part of an application process undertaken in terms of the NEMA, there is no need to undertake a separate application in terms of the National Heritage Resources Act. Although the heritage impacts are assessed in terms of NEMA – comment and authorisation is still required from the relevant heritage authority in the form of permits and /or comment on the EIAR. The requirements of the National Heritage Resources Act can thus be addressed as an element of the EIA process, specifically by the inclusion of a Heritage Impact Assessment (South Africa, 1999). In addition, NEMA section 24 (4) (b) (iii) appears to reinforce the provisions of NHRA by requiring that procedures for assessing impacts including heritage impacts for most of NHRA sections 38 (1) activities be addressed in an application for environmental authorisation.

4.1.7 Minerals and Petroleum Resources Development Act (No. 28 of 2002)

It is possible that quarry material may be required for maintenance work on the new access roads along the powerline servitude, which may require new borrow pits to be opened. Should this be necessary then the necessary applications will be made to the Department of Mineral Resources (DMR). In terms of the Act, the sourcing of material for road construction purposes (*i.e*. the use of borrow pits) is regarded as mining and accordingly is subject to the requirements of the Act. Only where the organ of state has obtained formal exemption from the Minister, the organ of state has to compile an EMPr per borrow pit and submit these to DMR for approval (DME, 2002). In this case, an EMPr would be appropriate for approval.

4.1.8 Integrated Environmental Management

The general approach to this proposed development has been guided by the principles of Integrated Environmental Management (IEM). IEM is a procedure for ensuring that environmental considerations are fully integrated into all stages of the development process. Hence the IEM philosophy aims to achieve a desirable balance between conservation and development. The IEM guidelines encourage a pro-active approach to sourcing, collating and

presenting information in a manner that can be interpreted at all levels. In addition, IEM guides projects to adopt an open, transparent approach which encourages accountable decision-making.

4.1.9 National Environmental Management Act (Act No. 107 of 1998)

In terms of the NEMA (Act No. 107 of 1998), the proposed activity is identified in Government Notice R982 EIA Regulations of 2014 as *(activity no.9 of GN R984), as amended in 2017 (activity no.9 of GN R325) "The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex."* Other listed activities associated with the proposed development are outlined in Table 4 of this report. As identified listed activities in GN R982, *as amended in 2017* as GN R326, the proposed development will require the submission of a Scoping Report and an Environmental Impact Assessment Report (EIAR) to the relevant authorities as part of the Environmental Authorisation process.

4.1.10 National Environmental Management: Biodiversity Act (No. 10 of 2004)

The NEM: Biodiversity Act 2004 (Act No. 10, 2004) may be significant and associated with the proposed development. The activities of the proposed development may pose a threat to biodiversity, particularly during the construction phase. Provisions of this Act which are relevant to this study are, the guiding principles relating to threatened and protected ecosystems and species, species and organisms posing a threat to biodiversity. Cognisance is also taken of the list of critically endangered, vulnerable and protected species as listed in the Government Notice No. R151 of 23 February 2007. Certain permits or authorisations may be required in terms of this Act. The applicable permits will only be determined with reasonable certainty once the relevant activity has been approved by DEA.

4.1.11 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources, vegetation and the combating of weeds and invader plants; and for matters connected therewith. Since the alternative routes would be located in the vicinity of agricultural resources, impacts from soil erosion, flooding, pollution must be avoided by all means.

4.1.12 National Water Act (No 36 of 1998)

The National Water Act aims to manage the national water resources and courses to achieve sustainable use of water for the benefit of all water users. The purpose of the Act is to ensure that the nation's water resources and watercourses are protected, used, developed, conserved, and managed in a sustainable manner.

Linear projects such as this proposed development, may find it a challenge to avoid crossing close to watercourses such as wetlands, pans and riparian areas. Hence during the construction and maintenance phases, it is imperative to manage these resources in ways which reduce and prevent pollution and degradation of water resources and watercourses. General Authorisations and / or Water Use Licenses may be required to be applied for depending of the level of impact the activity may pose on the watercourses.

4.1.13 National Environmental Management: Protected Areas Act (Act 57 of 2003) (NEMPAA)

NEMPAA provides for protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. The Act also supports the establishment of a national register of all national, provincial and local protected areas, for the management of those areas in accordance with national norms and standards, for intergovernmental cooperation and public consultation in matters concerning protected areas, for continued existence, governance and functions of South African National Parks and for matters in relation to protected areas.

Although the proposed development would traverse environmentally sensitive areas, mitigation measures will be adhered to with regards to avoid and / or minimise detrimental impacts on the environmental sensitive areas.

4.2 LISTED ACTIVITIES

EIA Regulations of 2014 promulgated in terms of NEMA under Government Notice (GN) No. 982 outline the activities for which EIAs should apply. Amendments to the 2014 EIA Regulations were promulgated with effect from 7 April 2017. The 2017 amendments retain the ethos of the 2014 EIA Regulations with some aspects clarified or deleted.

Developments which trigger activities within GN R983 and R985 (replaced by GN R327 and GN R 324 respectively) require a Basic Assessment application process and those that trigger GN R984 (GN R325) activities require a full S&EIAR application process. The proposed transmission line and substations upgrades are undergoing an S&EIAR application process as the project triggers Listing Notice 2 activities.

The table below outlines the proposed project activities, their potential impacts and mitigation measures in relation to the activities applied for in terms of the EIA Regulations 2014, as amended. Furthermore, the description of the proposed project including its associated infrastructure, unpacks the activities applied for, provided in Sections 1.3 in this report.

Details of the Impact Assessment are provided in **Annexure C**. It outlines the potential impacts that the proposed alternative route corridors may have on the environment and communities that may be affected. It also outlines the significance of the impacts with and without mitigation measures.

Table 4: Activities listed within Government Notice No. R327, R325 and R324 applicable to this project (as per numbering in the Government Notice)

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
GN R327: LN 1 of 2014 EIA Regulations, as amended on 07 April 2017			
14 The development and related operation 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 $80m^3$ or more but not exceeding $500m^3$.	Oil collection dams will be built to collect and store transformer oils in cases of spillages at Paulputs substation only. The transformer oil is used to cool the transformer windings. The oil collection dam will be built to accommodate a capacity of $120m^3$ of transformer oil. Therefore the capacity of the oil dam will exceed the threshold of $80m^3$ but less than $500m^3$.	• Soil contamination, vegetation loss and vegetation disturbance due to diesel fuel, transformer oil and other chemical spills. • Spillage of contaminants, which could result in contamination of ground and surface water resources.	• Appoint competent personnel responsible for chemical management on site. • Maintain equipment and vehicles, ensuring they do not leak fuel or oil. • Ensure that equipment needed to contain and remediate spills is kept on site. • Store chemicals lawfully in bunded (and roofed if necessary) storage areas. • Utilise chemicals in a responsible and lawful fashion.
19 The infilling or depositing of any material of more than $10m^3$ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than $10m^3$ from a watercourse...	During the construction phase, the construction vehicles will require to transport construction materials along the powerline route alignment. Should there be no river crossings with causeways along the route, there will be removal or moving of soil, sand, pebbles or rock of more than $10m^3$ from a watercourse, to enable easy vehicle access.	• Driving through watercourses during the construction and operational phases of the project will result in soil compaction within watercourse; • The above will further affect watercourse vegetation and result in erosion; • Flow, sedimentation and erosion changes in watercourses due to infrastructure construction refers to changes in the pattern of surface and subsurface flow in	• Driving should be done on existing roads and tracks as far as possible, in order to prevent vehicle track entrenchment and avoid the potential for new channel initiation and erosion. • Where this is unavoidable crossing structures can be put in place across channelled watercourses along with a relevant Water Use License requirements; • If the construction of a crossing is unavoidable make sure that substrate continuity in the watercourse is maintained within upstream and downstream

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
		watercourses, as well as resultant sediment depositional impacts and erosion impacts, which are associated with new access road crossings through, and tower positioning within watercourses.	portions of the channel bed. • Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads that have to be constructed. To minimise sediment load, an unsealed road network should have an emphasis on slowing drainage flows and dispersing them more frequently.
32 The continuation of any development where the environmental authorisation has lapsed and where the continuation of the development, after the date the environmental authorisation has lapsed, will meet the threshold of any activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014.	This proposed development is a continuation of the previous "proposed construction of a 220kV transmission line from Aggeneis to Paulputs substations including the associated substation upgrades". The Environmental Authorisation was granted (date: 20 October 2011).	• The proposed powerline will improve electrical capacity in the Aggeneis-Paulputs grid and reliability of supply, conforming to the NERSA N-1 standards.	This is a positive impact.
47 The expansion of facilities or infrastructure for the transmission and distribution of electricity where the expanded capacity will exceed 275	Both the Aggeneis and Paulputs substations will require expansion of their capacity: which will be populated by the designated 2nd feeder bay; and with an addition of the 400/132kV Transformer to accommodate the proposed	• Vegetation destruction due to the increased footprints of substations during construction.	• Avoid the unnecessary removal of vegetation. • Incorporate proper planning for construction to avoid threatened or small vegetation communities where possible. • Erosion control should be

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
kilovolts and the development footprint will increase.	400kV Powerline. A 400kV powerline has a bigger footprint and a wider servitude area than a 275kV powerline. In particular, Paulputs substation footprint will be expanded by approximately 7.8ha on the south easterly side of the proposed 400kV terrace.		implemented in all areas where soil erosion can be foreseen (e.g. slopes, destabilised soil and/or soils with high erodibility). • Areas utilised temporarily where the vegetation cover has been affected, would require rehabilitation post construction.
48 The expansion of: (i) infrastructure or structures where the physical footprint is expanded by 100m^2 or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100m^{2}or more; where such expansion occurs: (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32	During the construction phase, the construction vehicles will require to transport construction materials along the powerline route. Should there be river crossings along the route with causeways that are too small to accommodate the construction vehicles, then the existing causeway crossings will require expansion by more than 100m^2.	• Driving through watercourses during the construction and operational phases of the project will result in soil compaction within watercourse; • The above will further affect watercourse vegetation and result in erosion; • Flow, sedimentation and erosion changes in watercourses due to infrastructure construction refers to changes in the pattern of surface and subsurface flow in watercourses, as well as resultant sediment depositional impacts and erosion impacts, which are associated with new access road crossings through, and tower positioning within	• Driving should be done on existing roads and tracks as far as possible, in order to prevent vehicle track entrenchment and avoid the potential for new channel initiation and erosion. • Where this is unavoidable crossing structures can be put in place across channelled watercourses along with a relevant Water Use License requirements; • If the construction of a crossing is unavoidable make sure that substrate continuity in the watercourse is maintained within upstream and downstream portions of the channel bed. • Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads that have to be constructed. To minimise sediment load, an unsealed road

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
metres of a watercourse, measured from the edge of a watercourse…		watercourses.	network should have an emphasis on slowing drainage flows and dispersing them more frequently.
GN R325: LN 2 of 2014 EIA Regulations, as amended on 07 April 2017			
9 The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is: (a) temporarily required to allow for maintenance of existing infrastructure; (b) 2 kilometres or shorter in length; (c) within an existing transmission line servitude; and (d) will be removed within 18 months of the commencement of	The proposed project involves the construction of a 400kV transmission powerline, to be operated at 220kV until future need for it to be operated at 400kV. The powerline will connect from the Aggeneis substation (approximately 5km south west of a mining town of Aggeneys) to Paulputs substation (approximately 35km north east of Pofadder town) in the Northern Cape Province. The length of the powerline will be approximately 97km, depending on the final route alignment.	Destruction of vegetation due to clearance on tower footprints	• Incorporate proper planning for construction to avoid threatened or small vegetation communities where possible. • Construct towers on disturbed or transformed areas. • Erosion control should be implemented in all areas where soil erosion can be foreseen (e.g. slopes, destabilised soil and/or soils with high erodibility). • In general, all construction and maintenance activities in any natural habitat along the route of the powerline should be carried out in accordance with best environmental practice principles so as to minimize disturbance of any natural habitat.
		Collision of birds with the powerline earth wires and conductors.	• The most effective anti-collision markers available at the time must be installed along the entire length of the powerline. This installation must be done according to Eskom best practice at the time.

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
development.			
GN R324: LN 3 of 2014 EIA Regulations, as amended on 07 April 2017			
4: (g) ii (bb) (ee): The development of a road wider than 4 metres with a reserve less than 13,5 metres. (g) Northern Cape province: ii. Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas; and (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	During the operation phase of the powerline, the access road within the negotiated servitude of approximately 55m will be a gravel road wider than 4m with a reserve less than 13,5m. Negotiations between the landowner, contractor and Eskom Transmission will be undertaken in order to determine the final access routes. <u>Geographical Areas</u> The powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out its extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats (Eyssell, 2016). The majority of the southern extent (heading towards Aggeneis substation) of all three proposed powerline corridors will traverse the Kamiesberg Bushmanland Augrabies Focus Area. This focus	• Vegetation clearance and soil disturbance caused by the development of access roads.	• Restrict movements of personnel and equipment to designated construction areas and roads. • Utilise existing municipal and private (with consent) roads where possible. • Incorporate proper planning of access roads to ensure that (a) ecologically sensitive areas are avoided (including quartz fields) and previously disturbed areas are utilised; (b) vegetation removal is minimal; and (c) soil erosion is prevented (e.g. avoiding slopes and ensuring adequate drainage). • Areas and roads utilised temporarily where the vegetation cover has been affected, would require rehabilitation post construction.
		• Increased dust during road construction.	• Promote awareness among personnel to limit the creation of unnecessary dust. • Apply water to roads to dampen soil.

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
	area represents the largest remaining natural area for the expansion of the protected area network and forms part of the planned Lower Orange River Trans-frontier conservation area (Eyssell, 2016).		
12: (g) (ii): The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (g) In Northern Cape (ii) Within any critically biodiversity area identified bioregional plans.	The working areas for tower construction will range from approximately 64m^2 to 3 400m^2. The working area footprints that are more than 300m^2 will require vegetation clearance of 300m^2 or more, where the vegetation cover constitutes indigenous vegetation. <u>Geographical Areas</u> The powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out its extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats (Eyssell, 2016).	• Clearing of surface vegetation that will expose the soils, which in rainy events would wash down into wetlands, causing sedimentation. • Indigenous vegetation communities are unlikely to colonise eroded soils successfully. In addition, seeds from proximate alien invasive trees can spread easily into these eroded soil.	• Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area • A vegetation rehabilitation plan should be implemented. Grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks. • Remove only the vegetation where essential for construction and do

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
			not allow any disturbance to the adjoining natural vegetation cover.
		Destruction of vegetation due to clearance on tower footprints	• Incorporate proper planning for construction to avoid threatened or small vegetation communities where possible. • Construct towers on disturbed or transformed areas or areas that will be under land uses such as agriculture, mining or urban development. • Erosion control should be implemented in all areas where soil erosion can be foreseen (e.g. slopes, destabilised soil and/or soils with high erodibility).
14: (ii) (a) (c) (g) ii: (bb) (ff) The development of: (ii) infrastructure or structures with a physical footprint of $10m^2$ or more; Where such development occurs: (a) within a watercourse;	The footprint working area for each of the tower structures to be constructed will range from approximately $64m^2$ to 3 $400m^2$, depending on the type of towers to be used at different points along the route alignment. The area footprints exceed the threshold of $10m^2$. Some of the tower structures will be constructed within 32m of a watercourse. The proposed powerline routes will overlap with numerous non-perennial rivers and drainage lines. The watercourses that will	Changing the quantity and fluctuation properties of the watercourse due to: • Construction of towers within 32m of water resources e.g. tower footprint within wetland, pan or riparian area, thereby diverting or impeding flow; and • Lack of adequate rehabilitation resulting in invasion by woody invasive plant species.	• No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a tower footprint and no access roads can be considered. This is subjected to authorization by means of a water use license. • Construction around watercourses should be restricted to the dry season. • A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environments. The works areas would include the servitude, areas where material is stored and the

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
and (c) if no development setback has been adopted, within 32m of a watercourse, measured from the edge of the watercourse. excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. (g) In Northern Cape: ii. Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas; and (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans	be affected will be determined along the final chosen route alignment prior to construction phase of the project. Applications for water use licenses and rehabilitation will be undertaken prior to the operational phase. <u>Geographical Areas</u> The powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out its extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats (Eyssell, 2016). The majority of the southern extent (heading towards Aggeneis substation) of all three proposed powerline corridors will traverse the Kamiesberg Bushmanland Augrabies Focus Area. This focus area represents the largest remaining natural area for the expansion of the protected area network and forms part of the planned Lower Orange River		actual footprint of the tower. • Prevent pedestrian and vehicular access into wetlands buffer areas as well as riparian areas. • Consider the various methods of stringing and select whichever methods that will have the least impact on watercourses e.g. shooting a pilot cable and pull cables with a winch, or flying cables over. • Stringing should preferably not make use of vehicles in watercourses. If unavoidable, plan stringing activities in wetland areas to take place within the drier winter months and use equipment with the smallest possible footprint e.g. quad bikes. • Plan stringing through watercourses to take place at pre-determined points such as where the wetland width (and thus area to be impacted) is the smallest. • Access roads and bridges should span the wetland area, without impacting on the permanent or seasonal zones. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
adopted by the competent authority or in bioregional plans.	Trans-frontier conservation area (Eyssell, 2016).		• Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse. • Planning of construction site must include eventual rehabilitation / restoration of indigenous vegetative cover. • Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction. • The amount of vegetation removed should be limited to the least amount possible. • Rehabilitation of damage that arise as a result of construction must be implemented immediately upon completion of construction. • In particular for agricultural impacts: Ensure towers are sited away from any areas of intensive cultivation, such as areas of irrigation. Most of these areas have been identified close to rivers.
18: (g) ii (bb) (ee): of Listing Notice 3 of the 2014 EIA Regulations, as amended in 07 April	The proposed Corridor 1 from Aggeneis to Paulputs follows the existing 220kV Powerline which already has an existing access	• Vegetation clearance and soil disturbance caused by the development of access roads.	• Restrict movements of personnel and equipment to designated construction areas and roads. • Utilise existing municipal and

Activity Number	Reasons For Listed Activities Triggered	Potential Impacts	Mitigation Measures
2017 The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. (g) Northern Cape province: ii. Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas; and (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	road. If Corridor 1 becomes the chosen route for the construction of the proposed 400kV powerline, the existing road will require widening by 4m. <u>Geographical Areas</u> The powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out its extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats (Eyssell, 2016). The majority of the southern extent (heading towards Aggeneis substation) of all three proposed powerline corridors will traverse the Kamiesberg Bushmanland Augrabies Focus Area. This focus area represents the largest remaining natural area for the expansion of the protected area network and forms part of the planned Lower Orange River Trans-frontier conservation area (Eyssell, 2016).		private (with consent) roads where possible. • Incorporate proper planning of access roads to ensure that (a) ecologically sensitive areas are avoided (including quartz fields) and previously disturbed areas are utilised; (b) vegetation removal is minimal; and (c) soil erosion is prevented (e.g. avoiding slopes and ensuring adequate drainage). • Areas and roads utilised temporarily where the vegetation cover has been affected, would require rehabilitation post construction.
		• Increased dust during the existing road upgrade.	• Promote awareness among personnel to limit the creation of unnecessary dust. • Apply water to the road to dampen the soil.

5. APPOINTMENT OF ENVIRONMENTAL CONSULTANTS

Mokgope Consulting cc has been appointed by Eskom Holdings SOC Ltd to undertake an Environmental Impact Assessment (EIA) for a linear activity of the proposed Aggeneis-Paulputs 400kV Transmission Powerline and Substations Upgrade. The proposed powerline development is identified as an activity that may have significant detrimental effects on the environment, as defined by the EIA Regulations of 2014 and amendments of 2017. The EIA process which is to be followed is in compliance with the National Environmental Management Act (NEMA), (Act No 107 of 1998), as amended, and the EIA Regulations as published in GN R982 of 2014 as amended as GN R326 of 7 April 2017.

5.1. THE ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

(a) Name of EAP: Dr Mpho Nenweli

Description: PhD Climate Change; Master of Environment and Society; and MBA:

Graduated from Vista University with a BA (Geography and English) and a BA Hons (Geographical Sciences). Mpho also completed a Masters (Environment and Society) from the University of Pretoria, and a Masters in Business Administration (MBA) from the Management College of Southern Africa (MANCOSA). He also possesses a PhD on informal settlements and climate change adaptation in the City of Johannesburg through the University of the Witwatersrand. Mpho began his career as a Supplemental Instructor at Vista University in 1998. In 2001 he joined KNA Consulting Engineers as an Environmentalist responsible for compiling EIA applications. In 2003 he was employed by the Western Cape Provincial Department of Environmental Affairs and Development Planning as an Environmental Officer, handling EIA reviews for inter alia, dams, roads, petrol stations, cellular masts, wine cellars, shopping centres, residential areas, etc, and was promoted to the position of Senior Environmental Officer in 2003. He became Assistant Director in the National Department of Social Development in 2004. In 2005, he became Deputy Director: Local Integrated Development Planning in the National Department of Social Development. He later became Deputy Director: International Population Affairs where he was involved in inter alia, facilitating and managing the development, implementation, monitoring and evaluation of South African international strategy on population and development. He is the founding Member of Mokgope Consulting.

(b) Name of EAP: Judith Fasheun

Description: Master of Environment and Development:

Graduated from the School of Environmental Sciences, University of KwaZulu-Natal (UKZN). Judith majored in Geography and Environmental Management, studied a B.Sc honours degree in the latter, and completed a Master's degree through the Department of Centre of Environment, Agriculture and Development (CEAD) at UKZN. In terms of environmental consulting, Judith has more than 7 years relevant experience, and has been involved in undertaking a number of EIAs associated with Eskom powerline projects. Judith is a member of the International Association for Impact Assessment (IAIA) and a member of the South African Council of Natural Scientific

Professions (SACNASP) registered as *Cert Sci Nat 300019/14.*

The EAP has signed undertakings regarding correctness of information and level of agreement in front of a commissioner of oaths. The signed oath document together with the declaration of independence from the EAP, are provided in **Annexure D**. The EAPs' Curriculum Vitae (CV) are provided in **Annexure E**.

5.2 EAP COMPANY BACKGROUND

Mokgope is an independent black women-owned company with its headquarters in Highlands North, Johannesburg. The company renders services in Environmental Impact Assessments, Town and Regional Planning, Development Facilitation, Project Management and Consultancy. The company has undertaken projects with various clients that range from private individuals to private companies.

Mokgope Consulting is a company with 75% shareholding owned by black women and 100% black owned. Mokgope Consulting is categorised as a Level 3 Broad Based Black Economic Empowerment Company. The members of the company have immense experience in Town Planning and Environmental Management Systems. The staff and its strategic partners are ready to perform work of good quality to promote sustainable development in South Africa.

5.3 STRATEGIC PARTNERS

Mokgope Consulting operates largely with a well-managed network of strategic partnerships to create synergies that further enhance its project management solutions, specialist knowledge and expertise. The following is the structure of our networks:

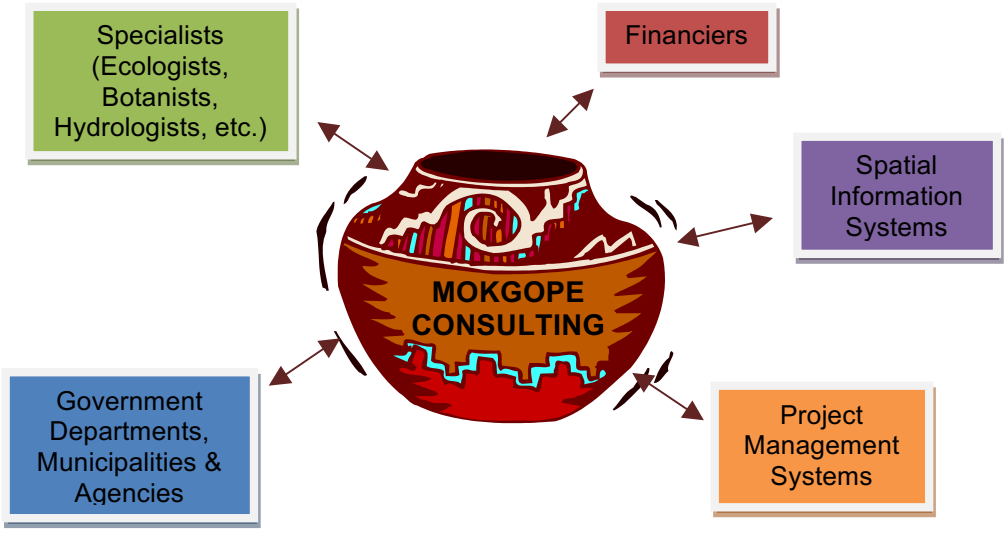


Figure 13: Strategic Network Partners

This network has provided alternatives that give the company competitive edge on the efficient and effective delivery of projects. With these strategic partners, Mokgope Consulting is able to offer an integrated solution for all environmental, technical and social projects.

5.4 CORE PROJECT TEAM

Mokgope Consulting has employees that are highly conversant with South African legislation and guidelines and procedures that provide insight on how to conduct EIAs, Basic Assessments (BA) and other environmental permits. The team is experienced in conducting the following environmental management services:

- Basic Assessments;
- Full scoping and EIA process;
- Developing Environmental Management Programmes (EMPr); and
- Monitoring of compliance to Records of Decision (ROD), now known as Environmental Authorisations (EA) and EMPr.

We have skills that enable us to handle ecologically and socially sensitive projects. We also have well developed and seamless processes that enable us to deliver good quality projects on time.

Table 5 includes professionals that are involved in the running and execution of the EIA for the proposed Aggeneis-Paulputs 400kV transmission powerline project. Table 6 includes the specialists that are involved in the assessment of the various specialist studies.

Table 5: Core EIA Project Team for Aggeneis-Paulputs project

TEAM MEMBER MOKGOPE CONSULTING	FUNCTION
Mpho Nenweli	Project Director: Responsible for managing the project, peer reviewing of specialist reports, Scoping, EIA and EMPr reports. Also involved in the appointment of the project team and their management thereof.
Judith Fasheun	EIA Process: Responsible for compiling the Scoping, EIA and EMPr Reports. Public Participation Process: Responsible for the identification of I&APs. Also involved in stakeholder engagement and the public participation meetings.
Victoria Somo	Project Administration and Coordination; and facilitating in the Public Participation Process.

Table 6: Team of Specialists Appointed

FIELD	NAME	EXPERIENCE	FUNCTION
Vegetation	**Antoinette Eyssell (Dimela Eco Consulting)**	BSc (Agric, 1996), BSc (Hons, 1999) MSc Environment, 2010. Pr Sci Nat (400019/11) Ecological Science. Antoinette works privately as a vegetation specialist with more than 9 years' experience.	To conduct studies on the impact of the proposed transmission line and substations on local vegetation and ecosystems.
Fauna	**James Harvey (Harvey Ecological)**	BSc (Zoology, Hydrology), BSc (Hons) (Hydrology), MEnvDev (Environmental Management). James works privately as an ecological researcher and consultant and has seven years consulting experience.	To conduct studies on the impact of the proposed transmission line and substations on local animals and their habitats. Emphasis will be placed on endangered species that may occur within the study area.
Avifauna	**Jon Smallie (Wildskies Ecological Services)**	BSC Hons – Wildlife Science, MSC Env Management. 16 years of experience conducting avifaunal specialist studies for electrical infrastructure. SACNASP accredited	To conduct studies on the impact of the proposed development on birds.
Wetland	**Retief Grobler (Imperata Consulting)**	BSc (Botany, 2002), BSc (Hons) (Botany, cum laude, 2004); MSc (Botany, cum laude, 2009). Pr. Sci. Nat registered specialist with 11 years of wetland/watercourse consulting experience in Gauteng, Mpumalanga, North-West, Limpopo, Northern Cape, Free State, Eastern Cape and KwaZulu-Natal Provinces	To conduct wetlands assessment on the impact of the proposed transmission line and substations on existing wetlands in the area
Agriculture	**Garry Paterson (ARC Institute for Soil, Climate and Water)**	PhD (Soil science), University of Pretoria in 2014. He is currently working as a senior soil scientist as the ARC-Institute for soil, climate and water. His specialty includes	To conduct an agriculture impact assessment on the impact of the proposed development on the existing area.

FIELD	NAME	EXPERIENCE	FUNCTION
		soil classification and mapping, soil surveys and environmental assessments. He has done a number of agricultural potential assessments for Eskom with excellent reporting skills and knowledge of soils.	
Visual	**Mader van den Berg (I-Scape Landscape Design)**	Masters in Landscape Architecture (University of Pretoria, 2004). 11 year experience in Visual Impact Assessments.	Undertaking the aesthetic impacts of the proposed transmission line and substations.
Heritage	**Dr David Morris (McGregor Museum)**	An archaeologist (PhD, UWC) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists and has previously carried out surveys in the vicinity of the proposed activity (Morris 1999a-b, 2000a-c, 2001, 2009, 2011, 2016).	To conduct a heritage impact assessment on the proposed transmission line and substations.
Social	**Alum Mpofu (Private Consultant)**	BA Comparative Government and Politics MA (Applied Linguistics)	To conduct a social impact assessment on the social environment affected by the proposed development

For more information on the specialists and EAPs, refer to their CVs and or profiles provided in **Annexure E**. The Declaration of Interest forms are provided in **Annexure D**.

6. OVERVIEW OF THE RECEIVING ENVIRONMENT

This section discusses the key characteristics of the biophysical and biodiversity aspects of the potentially affected area. For this project, the study area is defined as the development footprint and its immediate surroundings as well as to a larger scale; the local municipal areas, the broader district and region.

The information pertaining to the receiving environment has been compiled with information from desktop studies, which represent basic literature survey and a review of available spatial data. Nonetheless, information gathered during the field survey is available in **Annexure M**, to inform the description of the various specialist assessments within the proposed powerline corridors.

6.1 BIOPHYSICAL ENVIRONMENT

6.1.1 Climate and Topography

The Northern Cape Province is considered semi-arid and the western portion of this province receives rainfall in winter, whereas the eastern portion usually receives summer rainfall. Rainfall increases to the east of the province and average approximately 400mm per annum. This study area falls in-between these two regions with most rain experienced during the autumn months (March-April) and range between 23mm and 34mm per year. A small increase in rainfall could be expected in spring. The average midday temperatures in the area range from 14°C in July to 29°C in January, with July being the coldest month (Weatheronline.com) (see figure 14).

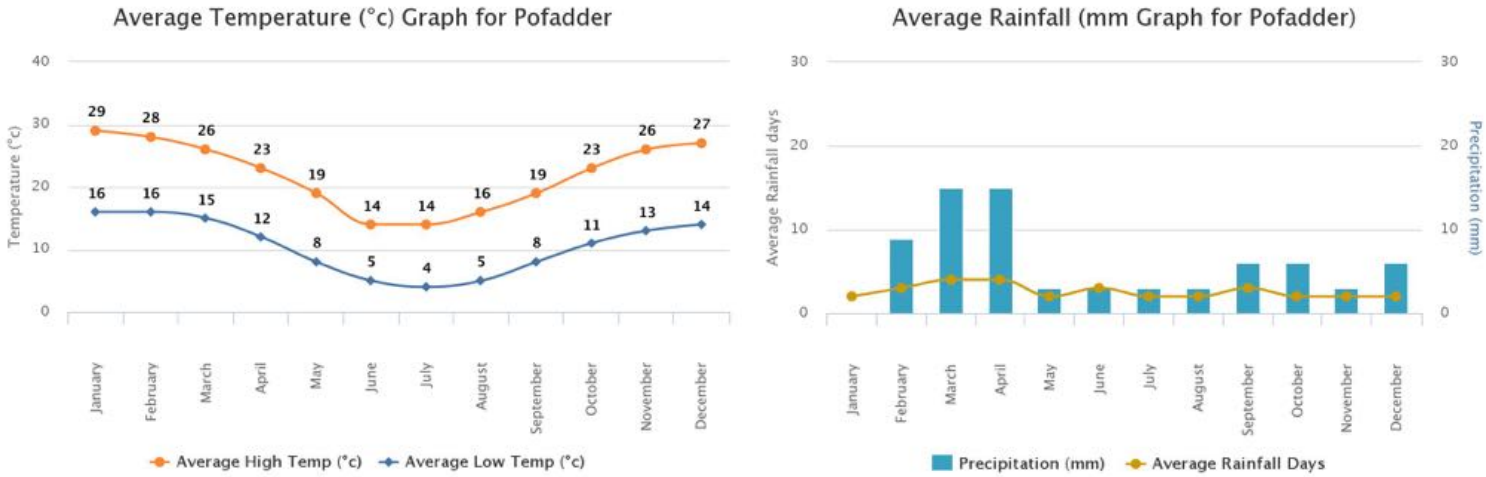


Figure 14: Average temperatures and rainfall for the study area around Pofadder

The study area comprises mainly of plains, often sloping or irregular in between surrounding rocky hills, inselbergs and mountains (Mucina & Rutherford, 2006). See figure 15 below.

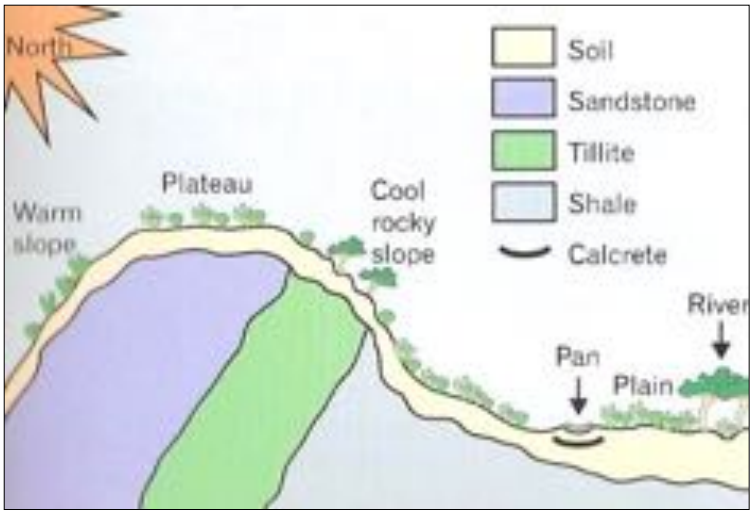


Figure 15: Topographic features common in the Karoo (picture taken from Esler et al, 2006)

Aggeneis substation is situated at an elevation of approximate 790m and Paulputs substation at approximate 820m. The lowest areas in between these points comprise of drainage lines or typical wash vegetation in the breaks between the mountains or inselbergs which constitutes the highest points along the routes. The above figure shows areas with slopes of 5 degrees or higher along the routes. These areas are usually characterized by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions (GDACEL, 2001; Esler *et al,* 2006). Higher biodiversity and thus ecological sensitivities can be expected here.

The national land cover data set indicates that much of the area along the proposed route corridor alternatives are bare or non-vegetated, vegetated with low shrubland and small portions of grassland.

6.1.2 Geology

In terms of geological types, a large portion (±50%) of Khai Ma is underlain with the Kalahari Group. The Kalahari basin is a flat, sand-covered, semi-desert region which contains some large pans north of Upington, dry river beds and dunes. Outcrops are scarce in this region. Okiep, Bushmanland, Korannaland and Geelvloer are the second most dominant geology type. From a geological perspective “no development areas” include areas affected by undermining, dolomite and areas where heaving clays are present. These features are not present in Khai Ma.

Khai Mai’s economic geology offers opportunities for development. The geological composition provides numerous mining opportunities. Khai Ma is rich in minerals and metals such as sillimanite, zinc, copper, lead, granite, quartz and aventurine originating from the geology groups above. Lead-zinc-copper-silver ore is exploited at Aggeneis. Of the four ore bodies, only

one is presently being mined, whilst a second is being prepared for future mining. The ore is concentrated on site and then transported first by road to the Sishen-Saldanha rail, then by rail to Saldanha from where the concentrates are either exported or distributed to local refineries. (Council for Geoscience, 2010). Barite is produced from Gamsberg near Aggeneis. The Gamsberg zinc deposit near Aggeneis and the Black Mountain deposit at Aggeneis are being mined.

6.1.3 Watercourses

Catchment and River Characterisation: The study area is located in a portion of the Northern Cape Province that is commonly known as Bushmanland. It falls mainly within the Nama Karoo eco-region, while a small portion overlaps with the Orange River Gorge eco-region. Rivers present within the study area are located in six quaternary catchments, all of which drain towards the Orange River and form part of the Lower Orange Water Management Area (WMA), (Figure 16).

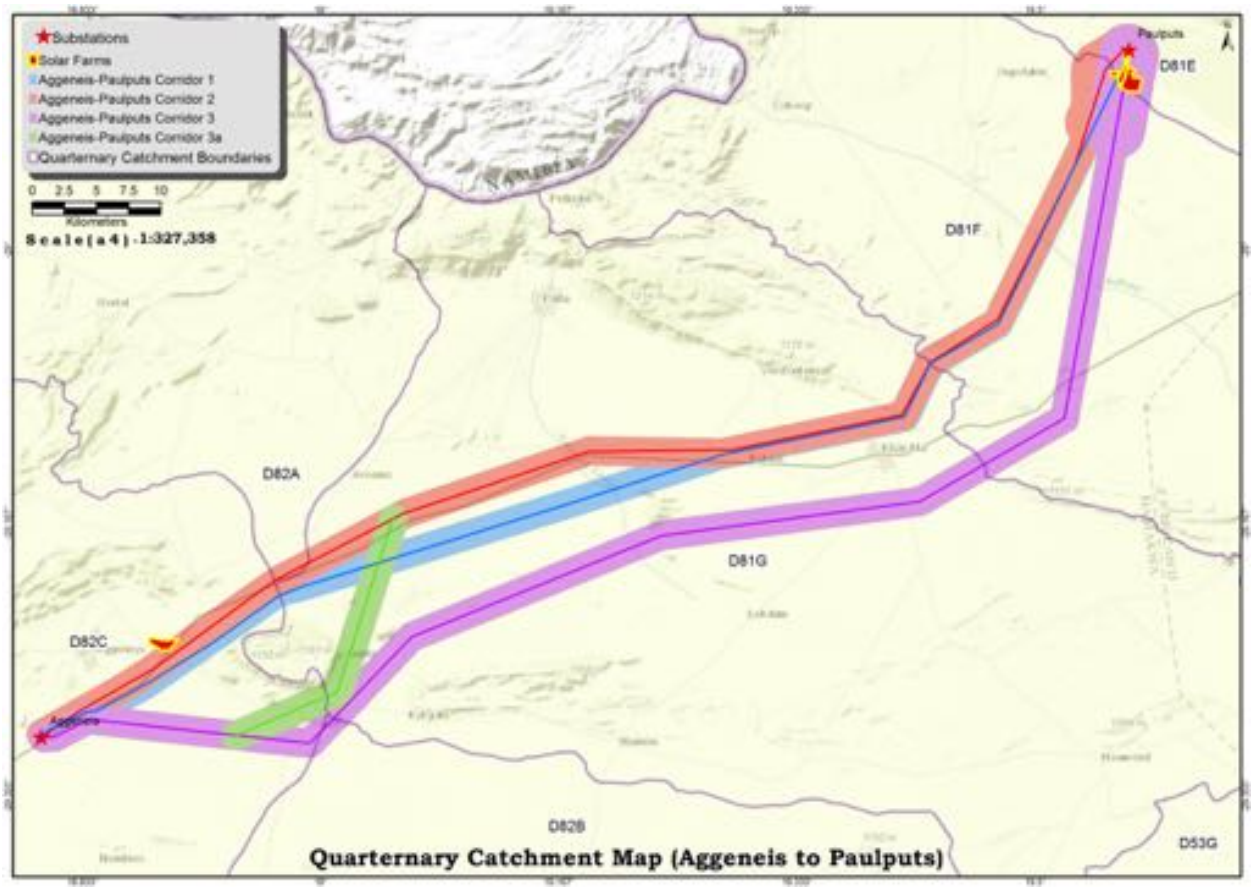


Figure 16: Route corridor alternatives associated with the 400kV Aggeneis-Paulputs powerline and their quaternary catchment

Several river crossings are present within the study area, with route corridors 1 and 2 both containing 7 river crossings, while route corridor 3 only has 4. Route corridor 3 also has a significantly shorter length of combined river segments compared to route corridors 1 and 2 (Figure 17). All of the rivers are ephemeral in nature, have an intact condition, a largely natural Present Ecological State and a mostly Endangered conservation status.

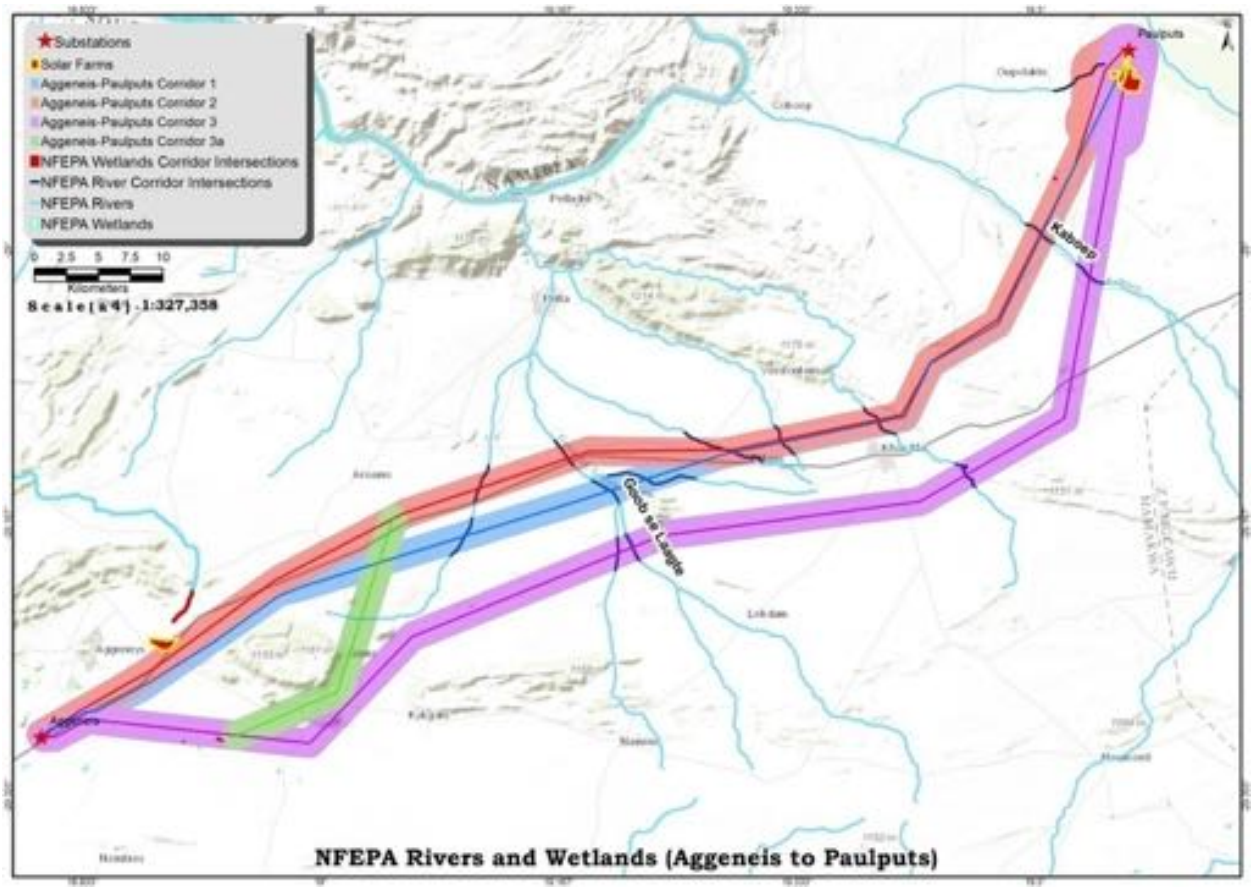


Figure 17: Illustrates rivers and wetlands from the National Freshwater Ecosystem Priority Areas spatial datasets (Nel et al., 2011) present within the study area and its surroundings

6.2 BIODIVERSITY ENVIRONMENT

6.2.1. Overview of the Vegetation Types

The study area stretches over three South African Biomes. The majority of the proposed powerline route corridor alternatives are situated within the Nama-Karoo Biome. Outliers of the Succulent Karoo Biome, as well as the Desert Biome will also be traversed.

Biomes can be divided into smaller units known as bioregions, each comprising of a number of vegetation types wherein the vegetation, soil and landscapes are similar (Mucina & Rutherford, 2006). The majority of the proposed corridors are situated in the Bushmanland Bioregion of the Nama Karoo with a portion of the lines between Pofadder and the Paulputs substation situated in the Gariep Desert Bioregion. The Richtersveld Bioregion of the Succulent Karoo comprises of small outliers on inselbergs and rocky areas (Table 7). The Succulent Karoo vegetation types are likely the most sensitive vegetation within the study area.

The proposed powerline corridors could impact on six (6) vegetation types as listed in Table 7 and geographically represented in figure 18 (Mucina & Rutherford, 2006). One of these vegetation types, Bushmanland Inselberg Shrubland, is not directly traversed, but occurs within the corridors of all three routes. The inselbergs support a high number of local endemics, especially succulents of the families Aizoaceae, Apocynaceae, Crassulaceae, Portulacaceae (Avonia, Anacampseros) and closely related Didiereaceae (Ceraria) (Mucina & Rutherford, 2006). Mining around the town of Aggeneys poses a potential threat to this vegetation type.

The remainder of the vegetation types along the proposed alternative powerline corridors are not considered to be threatened. Although classified as Least Threatened, very little or none of these vegetation types are formally protected e.g. in reserves or other protected areas (Table 7).

Table 7: Vegetation types that will be traversed by the proposed routes

Biome	**Bioregion** (vegetation organisation level between that of vegetation type and biome)	Vegetation Type	Conservation Status
Nama-Karoo	Bushmanland Bioregion	1. Bushmanland Arid Grassland The vegetation comprises sparse grassland, dominated by white grass (*Stipagrostis* species) on plains on a slightly sloping plateau. In some areas, low shrubs of *Salsola* change the vegetation structure. Good rainfall years result in rich display of annual herbs.	Least Threatened. Small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve and the vegetation is mostly untransformed.
		2. Bushmanland Sandy Grassland Dense, sandy grassland plains dominated by white grasses (*Stipagrostis* & *Schmidtia* species) and abundant drought-resistant shrubs. After rainy winters rich displays of ephemeral spring flowers can be seen	Least Threatened although none conserved in statutory conservation areas. Very little of the area has been transformed but the invasive tree *Prosopis sp.* can be seen as a threat.

Biome	**Bioregion** (vegetation organisation level between that of vegetation type and biome)	Vegetation Type	Conservation Status
Succulent Karoo	Richtersveld Bioregion	3. Bushmanland Inselberg Shrubland Occurs on a group of prominent inselbergs and smaller koppies. The vegetation comprises shrubland with both succulent and non-succulent elements and with sparse grassy undergrowth on steep slopes of the inselbergs.	Potentially threatened by mining around Aggeneys
		4. Aggeneys Gravel Vygieveld Flat or sloping plains at foothills or on pene plains of inselbergs, scattered between Pofadder and Aggeneys. The plains appear as distinctly white surface quartz layers against the background of red sand or reddish soil and supporting sparse, low-growing vegetation dominated by small leaf-succulents, with some perennial component.	Least Threatened, albeit poorly protected. Due to low vegetation cover, grazing is not a threat and very little threat from invasive species has been recorded
Desert	Gariep Desert	5. Eastern Gariep Plains Desert Comprises sheet wash, often sloping plains between the surrounding rocky hills and mountains. The vegetation is grassland, dominated by 'white grasses', some spine scent (*Stipagrostis* species), on much of the flats with additional shrubs and herbs in the drainage lines or on more gravelly or loamy soil next to the mountains.	Least Threatened Although not statutorily conserved a few intact examples of this vegetation remain. Heavy grazing and arid climate have significantly altered the structure and composition of vegetation of this unit. In some areas the invasive tree *Prosopis glandulosa* could become a serious problem.
		6. Eastern Gariep Rocky Desert Occurs on all the rocky desert areas along the Orange River, including mountainous areas. Bare rock outcrops are covered with very sparse shrubby vegetation in crevices and are separated by broad sheet-wash plains	Least Threatened None of this vegetation is statutorily conserved in South Africa

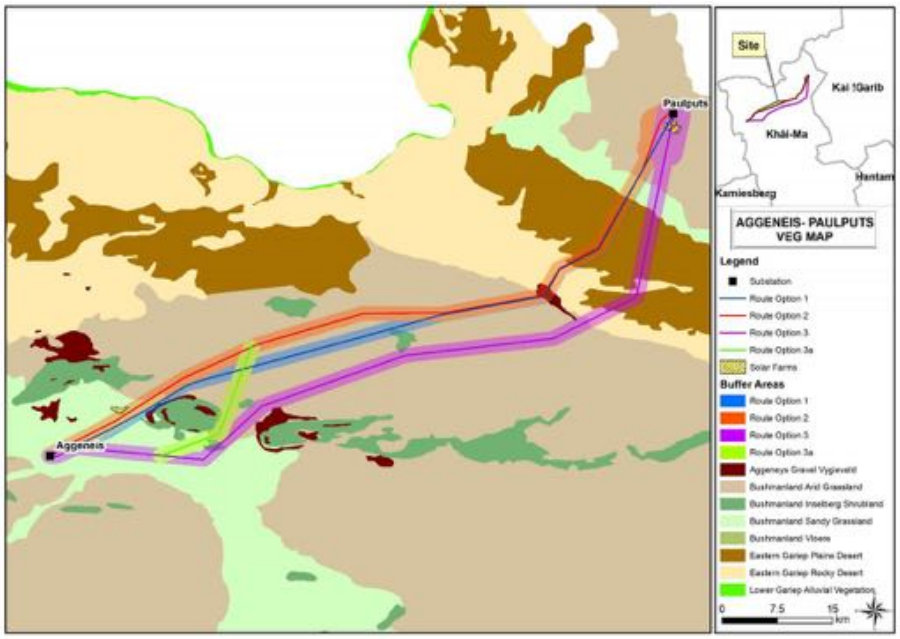


Figure 18: Vegetation types occurring within and in proximity to the proposed Aggeneis-Paulputs route alternative corridors

Namakwa Biodiversity Sector Plan (Bioregional Plan)

The Namakwa Biodiversity Sector Plan was prepared in 2008 for the Namakwa District which includes the area through which the powerline is proposed (Namakwa District, 2008). This Biodiversity Sector Plan maps areas of biodiversity concern to ensure that biodiversity information can be accessed and utilized by local municipalities to inform land use planning and development as well as decision making processes within the NDM (Namakwa District, 2008). The Namakwa Districts biodiversity map indicates where Critical Biodiversity Areas (CBAs), as well as Ecological Support Areas (ESAs) occur along the alternative route corridors (Figure 19).

CBAs are Terrestrial (T) and Aquatic (A) features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). Furthermore, CBAs are areas of the landscape that need to be maintained in a *natural or near-natural state* in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. The CBA's are ranked as follows:

- CBA 1 (including PA's, T1 and A1) which are natural landscapes with no disturbances and which is irreplaceable in terms of reaching conservation targets within the district
- CBA 2 (including T2 and A2) which are near natural landscapes with limited disturbances which has intermediate irreplaceability with regards to reaching conservation targets

ESAs on the other hand, support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors such as ridges) in the landscape. ESA's are functional landscapes that are moderately disturbed but maintain basic functionality that connect CBAs.

The alternative powerline route corridors traverse CBAs (T1 and T2) as well as ESAs throughout their extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats.

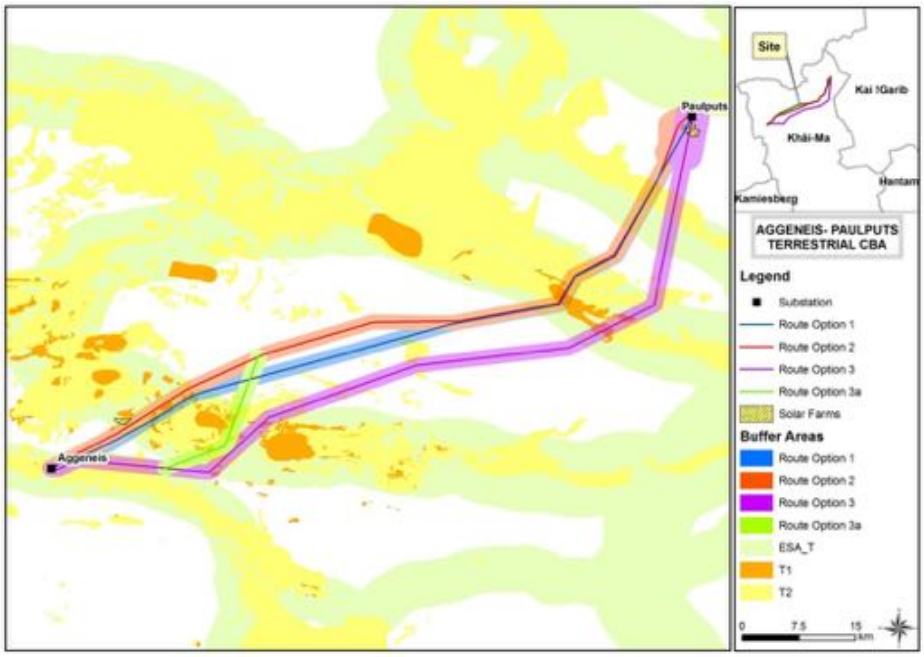


Figure 19: Critical Biodiversity Areas (T2) as well as ESA's along all three proposed route corridors

Nationally Protected Plants (Plants of Conservation Concern)

A list of plants of conservation concern was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist on the Plants of Southern Africa Website (POSA)(SANBI, 2009), Raimondo *et al*, (2009) and literature pertaining to the area that the corridors are situated in. At least thirty plant species of conservation concern could occur within the proposed corridor alternatives (Table 8). Three of these species were confirmed in the area. and are printed in **bold** in Table 8.

Table 8: Species of conservation concern that occur in the study area

Specie	Conservation status	Suitable habitat on site / potential to occur
Anginon jaarsveldii	Endangered	Only known from one very isolated mountain, Pellaberg, near Pofadder. *Unlikely to occur as the known locality or similar habitat is not traversed by either of the corridors*
Aloidendron dichotomum	**Vulnerable**	**From Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia. On north facing rocky and sandy flats.** ***Confirmed to occur scattered throughout the alternative corridors.***

Specie	Conservation status	Suitable habitat on site / potential to occur
Avonia herreana	Vulnerable	Richtersveld, on quartz outcrops. Range restricted, endemic species. *Suitable habitat exists and therefore a potential to occur, albeit slight.*
Conophytum achabense	Vulnerable	Namiesberge, near Poffader. On thin scree in a quartz outcrops on the rocky, west facing slope. A highly restricted species and potentially threatened by mining. *Only route alternative 3 passes in close proximity to the Namiesberge, but is unlikely to impact on this species habitat.*
Lithops dinteri subsp. *frederici*	Vulnerable	Pella, in the Einiqua Plains Desert. Only known from one location, a small area near Pella (near Pofadder) in Northern Cape. *Unlikely to occur as the known locality is not traversed. However, similar habitat is traversed by all three corridors north and north-east of Pofadder*
Lithops olivacea	Vulnerable	Aggenys to Pofadder on quartzite. This species has a restricted habitat within Bushmanland. *Not observed in the areas sampled, however, it is highly likely to occur in quartzite patches, particularly north of Pofadder*
Strumaria massoniella	Vulnerable	Kamiesberg to Loeriesfontein Semiarid flats in deep sand. *Unlikely to occur as the known locality is not traversed. However, similar habitat is traversed by the corridors and therefore there is a slight possibility of occurrence*
Conophytum limpidum	Near Threatened	Inselbergs in Bushmanland. Verticle crevices generally preferring shaded situations. Known from fewer than 10 locations this species is potentially threatened by mining. *Highly likely to occur on inselbergs within the study area. Only route alternative 3 will traverse this species habitat directly.*
Bulbine striata	Critically Rare	Amongst quartz pebbles and rocks in well-drained soil on the upper and middle slopes below sheer rock faces. Pellaberg, inaccessible. *Unlikely to occur as the known locality is not traversed by either of the corridors, however, similar habitat is present north of Pofadder*
Adromischus diabolicus	Rare	Quartzite inselbergs on south-facing aspects or steep, inaccessible cliff faces. Vioolsdrift to Pofadder *Suitable habitat is present on inselbergs in the study area. However, only route alternative 3 will traverse such habitat directly.*
Aloe dabenorisana	Rare	Occurs on two mountains along the Orange River valley, northern Cape. Steep vertical south-west facing upper slopes in crevices of quartz rock at an altitude of 900 - 1000 m. *Suitable habitat within the rocky desert and rocky outcrops, although the known distribution is more northward than the study area.*

Specie	Conservation status	Suitable habitat on site / potential to occur
Cephalophyllum fulleri	Rare	Occurs in the Pofadder area in quartz pebble fields overlaying sandstone or dolerite. Known from less than 5 records. *Highly likely to occur in the quartz patches along all three corridors*.
Conophytum vanheerdei	Rare	Exposed quartzite formations in Bushmanland Inselburg Shrubland. *Suitable habitat on inselbergs within the study area. However, only route alternative 3 will traverse such habitat directly.*
Crassula sericea var. *velutina*	Rare	Rock crevices on quartzite outcrops mainly on the south or south-western aspect. Restricted to high peaks of the western mountains on both sides of the Orange river in high altitude rock crevices so unlikely to be threatened. *Suitable habitat is present on mountainous areas between Pofadder and Paulputs substation and therefore a likelihood of occurrence.*
Crassula thunbergiana subsp. *minutiflora*	Rare	Sandy soils between Aus in Namibia and Springbok in the Northern Cape. *Suitable habitat is present within all three corridors, and therefore a likelihood of occurrence.*
Eriospermum ernstii	Rare	Bushmanland: Dabenoras and Pellaberg.Lower south facing mountain slopes, amongst hard quartzite rocks. *Suitable habitat is present within all three corridors, although the known localities are not traversed.*
Eriospermum pusillum	Rare	Springbok to Aggeneys. Steep shaded areas amongst rocks. This species is very small it is likely to be overlooked *Suitable habitat is present within all three corridors, and therefore a likelihood of occurrence.*
Lachenalia polypodantha	Rare	Sandy areas in Namaqualand Broken Veld. A naturally rare dwarf species known for a long time from only two collections made near Springbok in Namaqualand. The species was later also discovered near Vioolsdrif further to the north. *Suitable habitat is present within all three corridors, and therefore a likelihood of occurrence.*
Monechma saxatile	Rare	South facing slopes of rocky gneiss hills in the Pofadder area. Range restricted endemic. *Suitable habitat is present within all three corridors, and therefore a likelihood of occurrence.*
Schwantesia pillansii	Rare	Bushmanland, Namies Mountain. Bushmanland Inselberg Shrubland, well-drained, sandy soil, mostly in crevices of quartzite, steep slope 1000m. A range restricted endemic. *Suitable habitat on inselbergs within the study area. However, only route alternative 3 will traverse such habitat directly.*
Tylecodon sulphureus var. *armianus*	Rare	Orange River Valley in Northern Bushmanland, Dabenorisberg to Pellaberg. Steep, often sheer, north-facing quartz cliffs, shaded for most of the day. 700-1100 m. A range restricted

Specie	Conservation status	Suitable habitat on site / potential to occur
		endemic. *Unlikely to occur as the known locality is not traversed by either of the corridors, however, similar habitat is present in the corridors north of Pofadder*
Vachelia (Acacia) erioloba	**Declining (recently reclassified to Least Concern, nationally)**	**Widespread in the drier areas of the northern provinces of South Africa, deep sandy soils and drainage lines** ***Confirmed to occur within deep sand along drainage areas – mostly recorded within route alternative 3.***
Dinteranthus vanzylii	Data deficient (Taxonomic problems)	*Endemic to the study area and highly likely to occur in gravel and quartz patches.*
Drosanthemum godmaniae	Data deficient (Taxonomic problems)	Inselberg vegetation and quartz patches. *Suitable habitat on inselbergs within the study area and therefore a likelihood to occur.*
Trichodiadema obliquum	Data deficient (Taxonomic problems)	Bushmanland Inselberg vegetation. *Suitable habitat on inselbergs within the study area. However, only route alternative 3 will traverse such habitat directly.*
Wahlenbergia divergens	Data deficient (Taxonomic problems)	Unknown
Hoodia gordonii	**Data deficient (insufficient information)**	**Occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds.** ***Was recorded in sandy and gravelly grassland south of the Paulputs substation as well as within a quartz patch investigated.***
Avonia recurvata subsp. *minuta*	Data deficient (Taxonomic problems)	Bushmanland arid grassland. Known only from the type collection at one site in Bushmanland. Not enough is known about the distribution, specific habitat or population status of this subspecies to assess it. *Suitable habitat is present within all three corridors, and therefore a likelihood of occurrence.*
Phyllopodium maxii	Data deficient (Taxonomic problems)	*Suitable habitat on inselbergs within the study area. However, only route alternative 3 will traverse such habitat directly.*
Ruschia aggregata	Data deficient (Taxonomic problems)	Unknown

Protected trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. Two species are likely to occur namely *Boscia albitrunca* (Witgat / Sheppard's tree) and *Senegalia (Acacia) erioloba* (Camel Thorn). *Boscia albitrunca* occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. *Senegalia erioloba* usually occurs in deep sandy soils or along watercourses in arid areas.

6.2.2 Fauna

The broader study area is likely to support a reasonable and near-natural diversity of terrestrial fauna. This includes moderately rich reptile and mammal faunas, and both of these faunal groups include a small number of species falling within Threatened and Near Threatened categories, according to respective Red Data publications. Furthermore, there are a number of reptiles and, to a lesser degree, amphibians that have fairly localised distributions, and / or specialised habitat requirements. Many of these are restricted to, or occur in close proximity to mountainous areas and rocky / broken land, and these areas are therefore likely to be of greater sensitivity. Based on this initial assessment, a preliminary analysis suggests that all alternatives may be approximately similar, but the portions of Routes 1 and 2, and stretches that follow existing road networks, may be preferable options. The field study that was conducted has helped in assessing the faunal community composition and distribution in greater detail, evaluating the effect of the proposed development on terrestrial faunal communities (especially sensitive species) and provides recommendations, including mitigation measures, where necessary. The Faunal report is provided in **Annexure M**.

6.2.3 Avifauna

Bird species in the study area explained in terms of the broad vegetation description

It is widely accepted that vegetation structure is more important in determining bird habitat than the actual plant species composition (Harrison *et al.* 1997). From an avifaunal perspective, the vegetation types are all low grassy or shrubby vegetation, with flat landscape interspersed with occasional rocky outcrops. This low vegetation is suited to species which favour open landscapes, such as bustards, korhaans, Secretarybirds and a host of smaller species such as larks – for which Bushmanland is well known. Raptors also flourish in these areas provided that suitable perches exist.

Bird micro-habitats

Whilst much of the distribution and density of bird species in the study area can be explained in terms of the above broad vegetation description, there are differences that correspond to variations in habitat at the micro level. These "bird micro-habitats" are evident at a much smaller spatial scale than the broader vegetation types or biomes, and can generally only be identified

through a combination of field investigation and experience. No field work has been done as yet to investigate bird micro habitats. It is anticipated that the following bird micro-habitats being present in the study area: flat plains; rocky outcrops; drainage lines; and possibly pans.

Bird Species present in the study area

The first Southern African Bird Atlas Project (SABAP 1 – Harrison *et al*. 1997) and the second atlas project (SABAP 2 – www.sabap2.adu.org.za) recorded a combined total of approximately 221 bird species across the broad study area. This does not mean that all of these species do occur on the alignments of the proposed powerline, but it does give an indication of what could occur in the area. Table 9 is an extract of the Red-listed species. For each species the preferred micro-habitat, likelihood of occurring on site and relative importance of site have been assessed at a desktop level, and will be added to in the EIA Phase. An indication of the ways in which the species could interact with the proposed powerline and substation extensions has also been supplied. These species are discussed in more detail below Table 9. These species cannot afford to face additional collision threats due to new powerlines, making it essential that impacts on them are carefully managed for this project.

Table 9: Summary of Red-listed bird species associated with the proposed Aggeneis – Paulputs 400 kV powerline

Common name	Taxonomic name	SABAP1	SABAP2	Taylor *et al* 2015	TOPS list	IUCN 2013	Likelihood of occurring on site	Importance of site for species	Possible interactions with project
Harrier, Black	*Circus maurus*	✓		EN		VU	Possible	Moderate	Collision with overhead cables Habitat destruction Disturbance
Vulture, White-backed	*Gyps africanus*	✓		EN	E	EN	Possible	Moderate	Collision with overhead cables Habitat destruction Disturbance
Bustard, Ludwig's	*Neotis ludwigii*	✓	✓	EN	VU	EN	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Eagle, Martial	*Polemaetus bellicosus*	✓	✓	EN	VU	VU	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Eagle, Verreaux's	*Aquila verreauxii*	✓	✓	VU		LC	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Lark, Red	*Calendulauda burra*	✓	✓	VU		VU	Probable	High	Habitat destruction Disturbance
Stork, Black	*Ciconia nigra*	✓	✓	VU	VU	LC	Possible	Moderate	Collision with overhead cables Habitat destruction Disturbance
Courser, Burchell's	*Cursorius rufus*	✓	✓	VU		LC	Possible	Moderate	Habitat destruction Disturbance
Falcon, Lanner	*Falco biarmicus*	✓	✓	VU		LC	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Secretarybird	*Sagittarius serpentarius*	✓		VU		VU	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Pipit, African Rock	*Anthus crenatus*	✓		NT		LC	Possible	Moderate	Habitat destruction Disturbance
Bustard, Kori	*Ardeotis kori*	✓	✓	NT	VU	NT	Probable	Moderate	Collision with overhead cables

								Habitat destruction Disturbance
Korhaan, Karoo	*Eupodotis vigorsii*	✓	✓	NT	LC	Probable	Moderate	Collision with overhead cables Habitat destruction Disturbance
Flamingo, Greater	*Phoenicopterus ruber*	✓		NT	LC	Possible	Low	Collision with overhead cables Habitat destruction Disturbance
Lark, Sclater's	*Spizocorys sclateri*	✓	✓	NT	NT	Possible	High	Habitat destruction Disturbance

EN = Endangered; VU = Vulnerable; NT = Near-threatened

Important Bird & Biodiversity Areas (IBBAs)

Important Bird & Biodiversity Areas are classified on the basis of the following criteria:

- The site regularly holds significant numbers of a globally threatened species;
- The site is thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area; and
- The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.

Two such IBA's are relevant to this study: the Haramoep and Black Mountain Mine IBA, which encompasses the Aggeneis substation in the west; and the Mattheus-Gat Conservation Area IBA which encompasses the Paulputs area. In both cases, these IBA's are unavoidable by the proposed powerline, since it must connect the two existing substations, which lie in the IBA's.

The Mattheus-Gat Conservation Area IBA is important for globally threatened species such as Red Lark, Sclater's Lark, Kori and Ludwig's Bustards, and Black Harrier (Marnewick *et al,* 2015). Karoo Korhaan is regionally threatened. A large number of other lark, sparrow-lark, chat and other Namib Biome restricted bird species occur here. Renewable energy developments (some of which are already operational) are the newest threat to the habitat in this IBA. New powerlines are also listed a threat to the birds in this IBA (Marnewick *et al,* 2015).

The Haramoep and Black Mountain Mine IBA have a very similar avifaunal community to that described above. Several additional species occur here which are relevant to this study, including Secretarybird and Verreaux's Eagle. The threats facing this IBA are similar to those mentioned above. The figure below shows the layout of these IBA's relative to the proposed powerline.

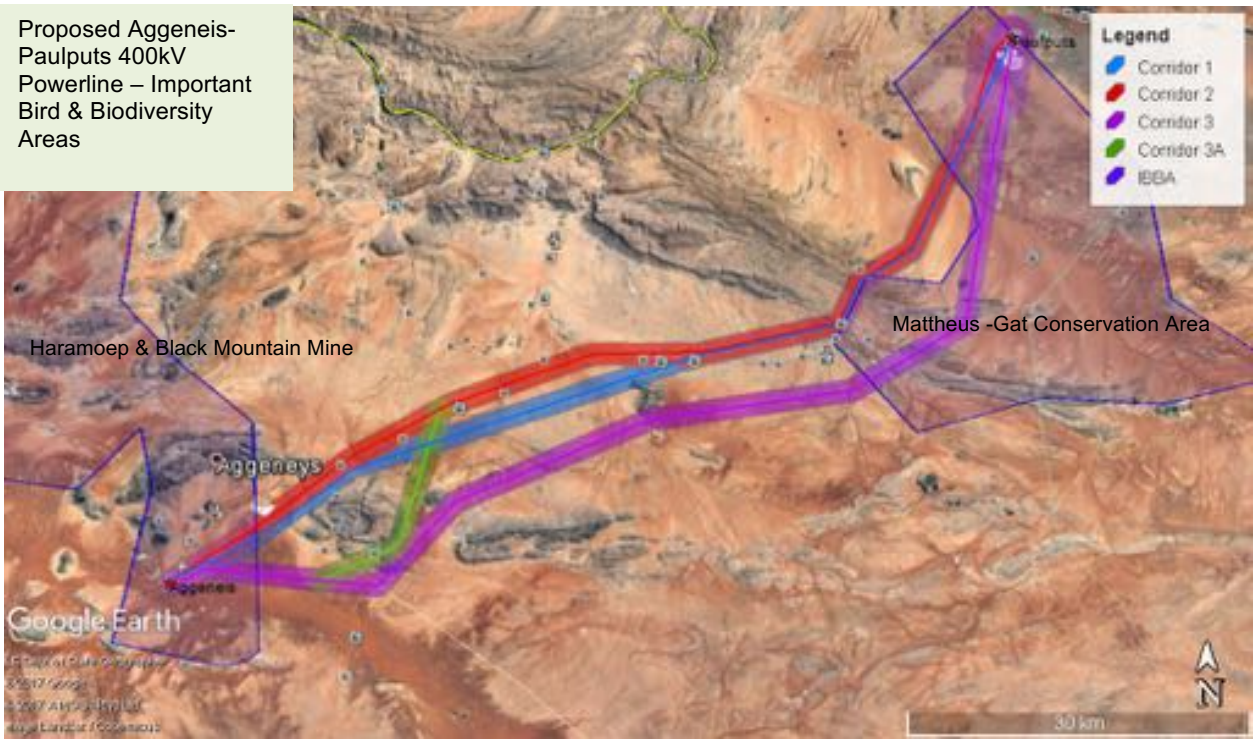


Figure 20: Important Bird & Biodiversity Areas position relative to the proposed powerline

6.3 CULTURAL HERITAGE RESOURCES

COLONIAL FRONTIER

The eighteenth and nineteenth century records for this region (Penn 2005) include the travelogues of George Thompson (1827) and E.J. Dunn (1931, Robinson 1978), who visited the area in 1824 and 1872 respectively. Place names were becoming fixed in this colonial frontier period (in a cadastral sense, on maps and in farm names), many such names having Khoe-San origins encapsulating vestiges of precolonial / indigenous social geography. A much more prominent appreciation is now emerging concerning the history of genocide against the Bushmen in this area (Anthing 1863), with certain mountainous areas (like Gamsberg near Aggeneys) being likely massacre sites, referred to by Dunn in 1872 (Robinson 1978) and, more obliquely, by Anthing (1863; Jose Manuel de Prada-Samper pers. comm. 2009).

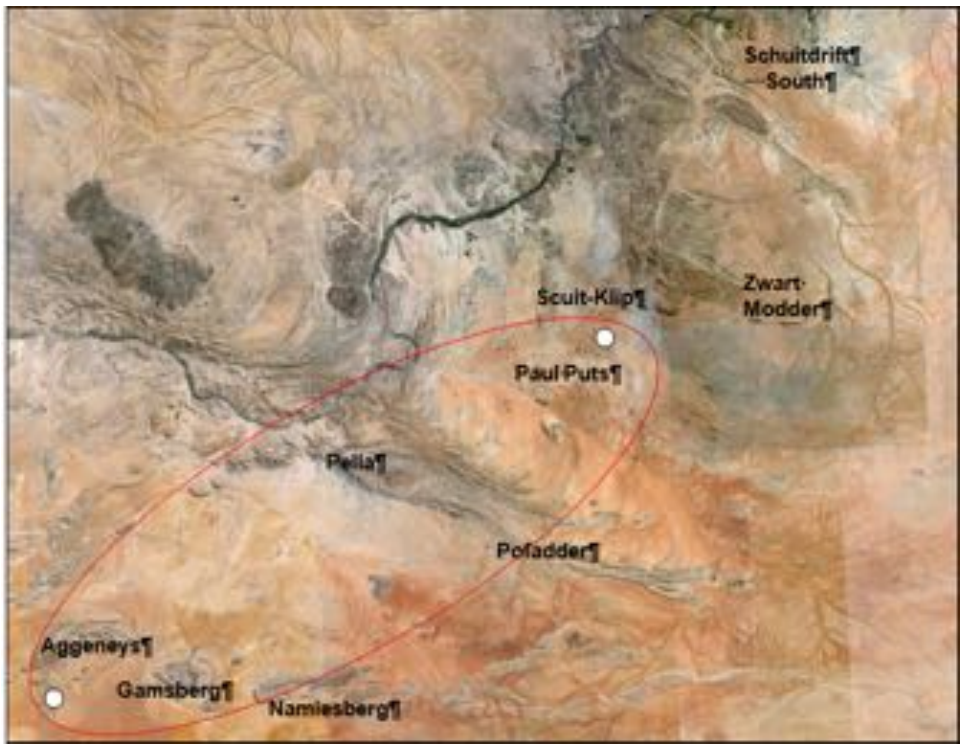


Figure 21: Regional focus: the study area relative to Aggeneis and Paulputs and some other places mentioned

LATER STONE AGE

Late Holocene Later Stone Age (LSA) sites are the predominant archaeological trace noted in surveys in the Aggeneys-Pofadder region (Morris 1999a-b, 2000a-c, 2001, 2009). Beaumont *et al*. (1995) have shown, with reference to the LSA, that "virtually all the Bushmanland sites so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river" (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1990), which reflected the "much higher productivity and carrying capacity of these bottom lands." "Given choice, the optimal exploitation zone for foragers would have been the Orange River." The appearance of herders in the Orange River Basin, Beaumont *et al*. argue, led to competition over resources and ultimately to marginalisation of hunter-gatherers, some of whom then occupied Bushmanland, probably mainly in the last millennium, and focused their hunting and gathering activities around the limited number of water sources in the region. Surveys have located signs of human occupation mainly in the shelter of granite inselbergs, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *el al*. 1995:264). Possibly following good rains, herders moved into the Orange River hinterland, as attested archaeologically at sites with ample pottery near Aggeneys and, east of Pofadder, at Schuitdrift South – Morris 1999a). However, Thompson (1824) refers to herder groups settled at the stronger springs such as Pella dispersing during periods of drought to smaller springs in the region, which could equally well account for the traces referred to here. At such times competition between groups over resources and stress within an already marginalised hunter-gatherer society, must have intensified.

PLEISTOCENE: MIDDLE AND EARLIER STONE AGE

Beaumont *et al*. (1995:240-1) note a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka till. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and Maans Pannen, and east of Gamoep, could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA).

Beaumont *et al*. have shown that "substantial MSA sites are uncommon in Bushmanland" (1995:241): and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Smith 1995).

The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

No substantial sites have been found previously in the survey area. Only very sparse localized scatters of stone tools have been seen in places, with limited traces in the hills or at the bases of hills.

PREDICTIONS: POTENTIAL AREAS OF SENSITIVITY

Based on previous experience in the area, it is estimated that the terrain close to hills or rocky features, particularly sandy spots near sheltering rocks, may tend to have traces of precolonial Stone Age occupation/activity. The range of hills north east of Pofadder may tend to have more sites than other places in this landscape.

While places in the open plains have been found to have (usually very) sparsely scattered artefacts (such as on the dunes east of the Paulputs Substation site – Morris 1999a), these areas are expected to be less significant. An exception to this is where rocky outcrops at the surface on the plains provide places where water pools exist after rains. Such places often attracted people in the past with traces of this including artificial grinding grooves in the bedrock and ample evidence of stone artefacts and pottery. An example near the proposed routes of the powerline is to the north of the national road near Gamsberg (Morris 2001; 2009).

The belt of sand dunes between Paulputs and Pofadder may also have been a focus for past human occupation.

Colonial era sites or features within the study area include stone walled farming infrastructure, homesteads and graves.

6.4 VISUAL AND AESTHETICS

AFFECTED RECEPTORS

The topographical features that may be affected are the plains, rocky outcrops, mountains and sand dunes. On the surface, grassland vegetation and succulent plants will be affected where the towers are constructed. They should be seen as a unit that collectively contribute towards a visual resource. These features are important as it contributes to the identity of the region and adds a value to the visual resource.

An alternation to any of the individual components could affect the character of the landscape and the value of the visual resource. Therefore, the character of the study area, and its comprising components, are considered receptors that may be influenced by the proposed project.

The above-mentioned are tangible receptors and are easily recognised by visual inspection. An intangible receptor is the sense of place, or the identity of the study area. This is considered a sensory experience that translates to a more emotional understanding of a place.

The affected observers are expected to be the farmers, scattered across the region and especially those that reside within the Zone of Maximum Visual Exposure (ZMVE). The two towns, Aggeneis and Pofadder are areas where local residents are concentrated. Tourists travel through this area especially during August and September when the Namaqualand is in flower. Motorists on the N14 and local road network are also considered receptors travelling through the region.

SENSITIVTY OF RECEPTORS

The sensitivity of the visual resource is considered to vary across the study area depending on its degree of intactness or transformation. It is expected that the areas near the two substations have a much lesser sensitivity due to the degree of transformation that exists in this area. A convergence of power infrastructure is noticeable in these areas that establish a baseline that is severely impacted by existing powerlines and substations. The KaXu Solar One power plant is a significant addition to the landscape and contrasts with the desolate and generally undeveloped nature of the study area. The central region between the two substations and especially the region south of the N14, appears less impacted by powerlines, although several traverse the study area. It is also less impacted by other anthropogenic elements. Here the identity of the study area is fairly uninterrupted and intact. The widely distributed farming communities and the endless expanse of desert-like plains, contribute to a sense of place that speaks of a desolate landscape. From a motorist's perspective, especially when travelling at high speed along the N14, the landscape can be experienced as mundane and monotonous with few roadside attractions, but the true identity can only be enjoyed when one spends time in its presence. Due to the low growing vegetation and the open plains, the landscape is considered exposed and distant, panoramic views are possible. Therefore, the visual resource in the central region is considered highly sensitive to changes.

The residents in the study area are classified as visual receptors of high sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest

towards their living environment. Tourists visiting the area, are also regarded as receptors of high sensitivity. Their main reason for visiting is to experience and enjoy the picturesque natural environment and in particular the flowering bursts after rain. They have high expectations in terms of the scenic quality. Motorists passing through the area are expected to have low sensitivity. Their attention is generally focussed on the road and their exposure to roadside objects is brief due to the speed they travel.

DISTANCE FROM SOURCE OF IMPACT

The three alternative alignments are positioned to avoid the most prominent topographical features in the study area. From a technical perspective, it is much easier and cost effective to construct a powerline over even terrain than to cross over irregular terrain. The mountainous terrain north of Pofadder fades out in the region where the alternatives pass around a few low lying ridges. The Gamsberg, east of Aggeneis, appears to be an important topographical feature from a biological perspective as well as being a lookout point. Alternatives 1 and 2 pass 2.5 km north of the Inselberg, and Alternative 3 passes 2 km east. Its importance as a tourist attraction will be verified during the site investigation as very little online information exists.

The towns of Aggeneys and Pofadder both fall out of the ZMVE of the alternatives. Pofadder is the closest to Alternatives 1 and 2 which pass 1.2 km north of the town. Alternative 3 passes 2.1km south. Aggeneys is 2.3 km from Alternative 1 and 2 and 3.4 km from Alternative 3. A couple of farm residents appear to be within the ZMVE and are mostly concentrated around the N14. There are only 2 major transport routes in the study area that are crossed by the proposed alternatives, namely the N14 and the R358. Sparse networks of dirt roads are also noticeable in the study area but are presumably farm roads.

POSSIBLE SOURCES THAT MAY CAUSE VISUAL AND LANDSCAPE IMPACTS

The following are typical negative impacts that may be expected as a result of the construction and operation of the proposed project:

- The project activities or components are visually intrusive and noticeably change the existing features and the qualities of the visual resource, thereby impacting on observers' views;
- The project introduces new features which are uncharacteristic, incompatible or in contrast with the existing character of the landscape; and/or
- The project removes or blocks aesthetic features in the landscape, which subsequently affect the aesthetic value and scenic quality of the visual resource, and intrude on observers' views.

CONSTRUCTION PHASE

The construction of the transmission line will cause a change to the condition of the existing baseline environment. Landscape and visual impacts will result from the temporary presence of construction camps and material stockyards as well as activities and disturbances within the transmission line servitude. Typical visual impacts often relate to the unsightly character of such

construction sites brought about by the untidy and disorderly placement of ancillary elements and the associated surface disturbances. Construction vehicles will travel up and down the servitude as foundations are prepared and the building materials are conveyed. Vegetation around the tower bases will be removed or trampled which will expose the underlying soil. The physical damage to the existing vegetation impacts on the visual resource and its visual value. It may also cause intrusive views from sensitive viewpoints.

The construction of towers is often regarded as a low-intensity construction activity due to the localised damage to vegetation (i.e. around the tower base). The damage to the vegetation is contained within the servitude and easily rehabilitated. A practice that causes severe physical damage over a large area is the clearing of high growing vegetation in the servitude. This often results in a very distinct linear corridor that is devoid of trees or large shrubs. Such clearing is only necessary where safety standards are bridged. Through the assessment of large-scale maps, it appears that most of the vegetation in the study area is low growing scrub or grasslands. The need for clearing in the servitude is regarded highly unlikely, but will be confirmed after the site investigation.

The impacts during the construction phase will be temporary and are normally contained in the corridor, over the length of the alignment. For the duration of the construction phase, equipment, construction camps and workforce will be uncharacteristic to the visual environment. It will contrast with the normal farming activities in the study area and is considered incompatible with the prevailing character.

OPERATIONAL PHASE

Once the project is completed, the most visually prominent elements will be the transmission towers, which will be spaced rhythmically inside the proposed servitude and the conductors between the towers. Landscape and visual impacts will result from the addition of new elements in the environment that will alter the existing character of the landscape and intrude on the views of observers.

It has been established that the study area already features a number of powerlines and that the baseline environment has been impacted by electrical infrastructure. High probabilities for cumulative impacts occur. An increased visual dominance of electrical infrastructure can be expected which contrasts with the desolate character of the study area, thereby causing a loss in visual value.

Observers within the ZMVE are limited to individual farm residents and motorists on the major transport routes. Generally, the viewer incidence is regarded low / medium within this zone. The town of Pofadder falls just outside the ZMVE but the residents' exposure is considered high due to the lack of screening in the study area. Tourists travelling through the area and visiting some of the prominent topographical features such as Gamsberg will also be affected and may experience an impact on the picturesque views from the viewpoints.

The extent of the visual impact is at its most severe within 1 km from the alignment. It is expected that the powerline will be visible at greater distances but 5 km is considered the furthest a powerline will still have an impact.

NO-GO AREAS

There are no formally classified scenic areas or routes in the study area and the scenes are considered common within the larger region. Also, the corridors do not cross any protected areas or conservation sites that are of national importance. Limited information about the region has been assimilated during the desktop study and it appears that significantly important tourist attractions are unlikely in the study area. Further investigation is required into the Gamsberg and what significance it has from a scenic viewpoint. Other landscape features that are locally considered as important, may also occur and could count as sensitive viewpoints or features of a specific scenic quality. A couple of highly sensitive viewers are identified in the study area. The towns, farmsteads and tourist attractions are all considered highly sensitive and may be classified as no-go areas after the site investigation.

6.5 AGRICULTURE POTENTIAL

As indicated in Table 10 below, Khai Ma basically consists of two land capability categories namely, non-arable, low potential grazing land occupying ±75% and wilderness areas constituting approximately 25%. The wilderness category includes the mountainous areas along the Orange River, north-west of Pofadder, north of Aggeneis and the mountains of Gamsberg and Namiesberg. Diep-in-Dier-Kloof behind Pella Mountain and along the banks of the Orange River is a spectacular wilderness area that can only be accessed by foot.

Table 10: Agricultural land capability categories (Source: Enpat 2001)

Category	Area (ha)	%
Non-arable, low potential grazing land	646 877	75.17
Non-arable, low to moderate potential grazing land	0	0
Non-arable, moderate potential grazing land	0	0
Wilderness	213 702	24.83
TOTAL	**860 579**	**100%**

Accordingly, 0% of the municipal area is regarded as high potential agricultural soils. The banks of the Orange River, presumed to have high agricultural potential, consist of soils not suitable for agriculture or commercial forestry, however, suitable for conservation, recreation or water catchments.

An Agricultural Research Council report (2010) notes that in a dry, hot part of South Africa like Khai Ma, the limiting factor to agriculture is climate and not soil. The report says that unless there is a source of water for irrigation, it will not make a significant difference which soils are occurring within a specific area. It goes further to claim that the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image (Figure 22 below) of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

Figure 22: Agriculture Infrastructure in Khai Ma

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit (ARC-ISCW, 2004). However, the agricultural potential of land in Khai Ma allows for:

- livestock (80%) and game farming; and
- irrigation farming on the banks of the Orange River, including dates, export grapes, mangoes, cotton, hoodia and geranium and other crops

Despite the largely semi-arid environment of Khai Ma, the land that lies along the banks of the Orange River supports the production of some quality agricultural products, i.e., export table grapes, dates (Klein Pella and Pella), hoodia, geranium and other crops at Onseepkans and Pella. Sheep farming contributes to 80% of Khai Ma's farming activities, with some limited cattle and game farming. Two abattoirs are located in Pofadder. The area is renowned for its quality meat that is marketed locally and in the larger metropoles of Cape Town, Johannesburg and Pretoria. Beneficiation of agricultural products could provide opportunities to emerging farmers and create more job opportunities that could reduce the high unemployment rate in the area. Stakeholders representing the community feel that agriculture is not practiced to the maximum potential that the area offers. Karsten farm is a typical example of how agriculture could flourish in the Khai Ma Municipality (Khai Ma IDP, 2012-2017).

As concluded by the ARC (2010) report, the major impact on the natural resources of the study area would be the loss of arable land due to the construction of the towers for the transmission line and the upgrade of the two substations. However, this impact would in all probability be of

limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

6.6 SOCIAL ENVIRONMENT

6.6.1 LAND USE AND SETTLEMENT PATTERNS

Khai Ma Municipality is mainly covered by shrubland/fynbos, followed by grassland. The "built up land: residential" only constitutes 0.06% of the Municipality. A brief settlement analysis shows the following about the two towns closest to the proposed transmission line.

Pofadder- Pofadder, the main town of Khai Ma, was developed around the N14 main road and its intersection with the R358 road to Onseepkans. The town is traversed by the N14 alignment separating it in a northern and southern part as dictated by apartheid planning of the past. The southern part accommodates larger residential plots and the central business functions of Pofadder i.e. commercial, institutional uses and sports stadiums. The cemetery is located to the east of Pofadder. The north-western part, known as Blyvooruitsig, accommodates smaller erf sizes, a school, limited business uses (café's, filling station etc.) and a sports stadium (soccer, rugby, cricket). Informal settlement occurs around Blyvooruitsig. Pofadder is surrounded by extensive municipal town lands mainly used for commonage farming.

Aggeneys - Aggeneys (place of water) is a mining town providing residence to mainly the mine workers. Aggeneys accommodates a primary and secondary school, police station, clinic, golf course and tarred airstrip. Aggeneis is divided by a road into a northern and southern section, clustered around mixed land uses, i.e., business, clinic, police station, sports grounds and offices, etc.

Pella - originally functioned as a mission station providing a sanctuary for Khoisan driven out of Namibia. Pella has limited infrastructure consisting of a primary school, police station, library, clinic, restaurants/taverns and the old cathedral, which is quite an important tourist attraction.

Other notable land-use trends in Khai Ma are:

- More farm land is being purchased by government and allocated to emerging farmers, resulting in unsustainable, marginalised agri-villages with little or no improvement in livelihoods.
- This trend is also problematic to Khai Ma as no maintenance is done by emerging farmers and no rent is paid to the Municipality.
- Financially stronger farmers tend to purchase the farms from those who are struggling.
- Currently, Pofadder is experiencing a declining economy, resulting in the closing down of businesses
- There is uncertainty about Aggeneis mine as there are talks that it is in process of closing down. No subsidies are being made available to residents to purchase houses elsewhere.
- Informal settlement is taking place in Pella and Pofadder.

MINING

The Vedanta Group, through its Black Mountain Mine is the largest employer in Khai Ma apart from farming.

Figure 23: Black Mountain Mine

The Gamsberg project is one of the most strategic projects of Zinc International business of Vedanta Resource Plc in the area. The project consists of an open pit zinc mine (with a defined ore resource of 186 Million Tons and >250 Million Tone of potential ore resources) hydrometallurgical processing (concentrator) and associated infrastructure. The proposed Gamsberg mine is located in the Northern Cape Province of South Africa, just south of the N14 National Road linking Upington to Springbok, and 20 km east of the existing Black Mountain Mine and the town of Aggeneys.

The following associated infrastructures will be put in place along with mine and concentrator:

- Tailings dam, waste rock dump, stockpiles and a landfill site;
- Evaporation dams;
- Offices, workshops and construction workers contractor's camp;
- Powerlines from the Aggeneis substation to Gamsberg, approximately 15 km;
- Pipelines from the Pella pump station to Gamsberg, approximately 60 km;
- Access Roads from the N14 to Gamsberg, approximately 10 km of road network; and
- Sewage treatment facilities.

The opening of the Gamsberg mine holds promising economic prospects, creating an estimated 5000 new jobs, a smelter on-site and the provision of housing in Pofadder. Increased access to minerals by small-scale mining companies, affected by new minerals legislation, holds further prospects to the mining industry. Increased levels of local minerals processing remains an ongoing challenge.

TOURISM

The Khai Ma environment is characterised by vast open land, unique topographical features (i.e., mountain ranges, Bushmanland, Inselberg, wilderness areas along the Orange River, etc.) and rich heritage of the Khoi San/Nama people as well as the cathedral at Pella. These provide the area with ample opportunity for eco-tourism, adventure tourism and cultural tourism. The municipality is characterised by vast tracts of land, pristine natural environment, unique "koppies" and its bad cell phone reception provides a unique attraction to urban dwellers that need to escape the rat race. This inherent potential for eco-tourism needs to be exploited and managed in a sustainable manner in order to retain this unique setting. In addition, the Orange River and flowering season in Namaqualand attract tourists from across the country and abroad. Khai Ma offers numerous tourism attractions i.e. 4x4 trails, walking routes, mountain climbing, canoeing, the cathedral at Pella, a "Quiver" forest at Onseepkans and cultural heritage. The unique landscape of Khai Ma lends itself to filmmaking (i.e. Desert Star Studio's is already active in Namibia) (Source: Municipal Officials).

Figure 24: Scenic Views near Pella (Source: Khai Ma Spatial Development Framework, 2012-2020)

Feedback from the IDP Public Participation Initiative suggests that the tourism sector could have an immediate effect on alleviating unemployment, however funds from National Government need to be made available for the initiative/project. Possibilities include: Guided 4X4 routes; Upgrading of caravan parks and camping facilities; and Guest Farms.

6.6.2 DEMOGRAPHIC AND SOCIO-ECONOMIC PROFILE OF THE PROJECT AFFECTED AREA

In this study, the project social description is characterized from several perspectives mainly: socio-geographical; social administrative; socio-cultural; and economic perspectives. Socio-geographical description defines the geographical attributes of the project area and how those attributes define the social character of the population. The administrative set up of the people and how the community relates with formal and informal administrative structures.

POPULATION SIZE

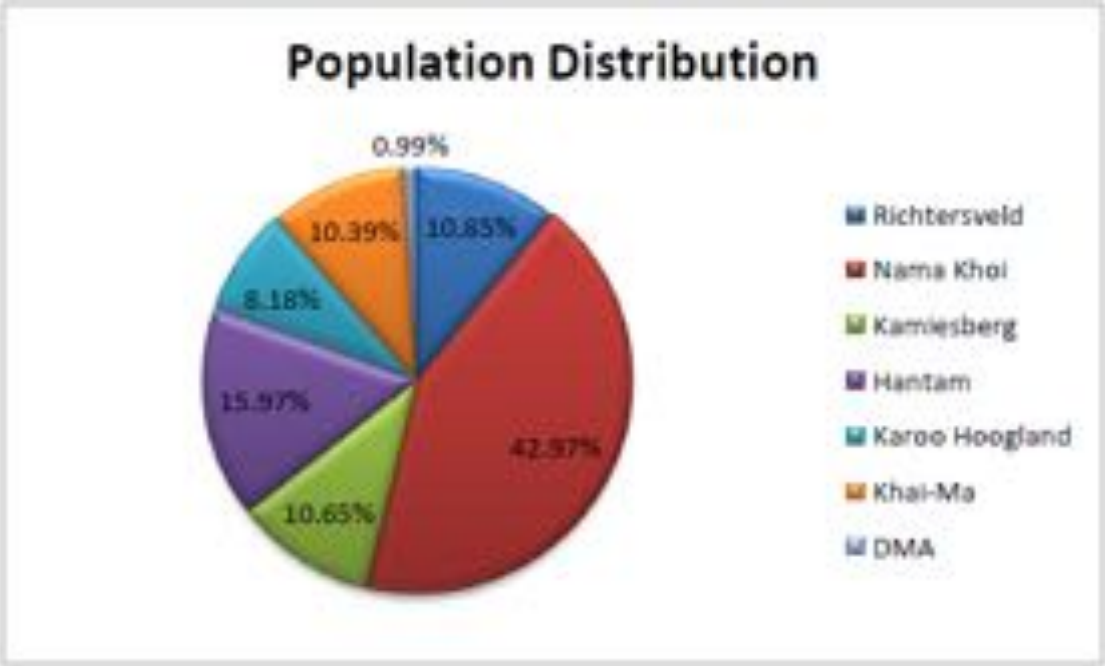


Figure 25: Namakwa District Population distribution by municipality (Source: Khai Ma IDP 2012-2017)

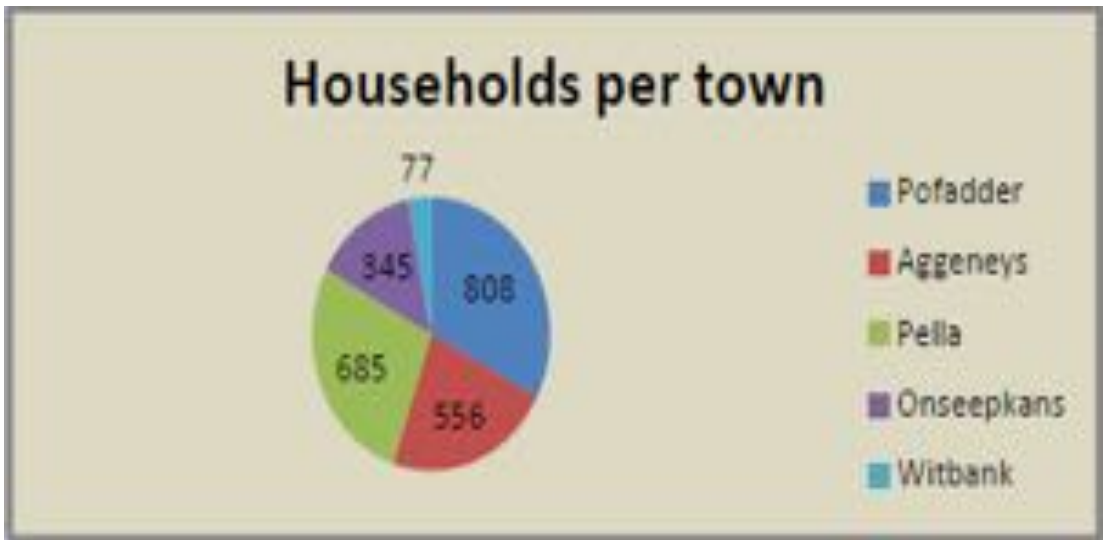


Figure 26: Households per town (Source: Khai Ma IDP 2012-2017)

Total number of households in Namakwa District Municipality is 36 437:

- 10.4% of the Namakwa households are located in Khai Ma Local Municipality.
- Households are mainly located in the towns of Pofadder, Aggeneis, Onseepkans, Pella, and Witbank.

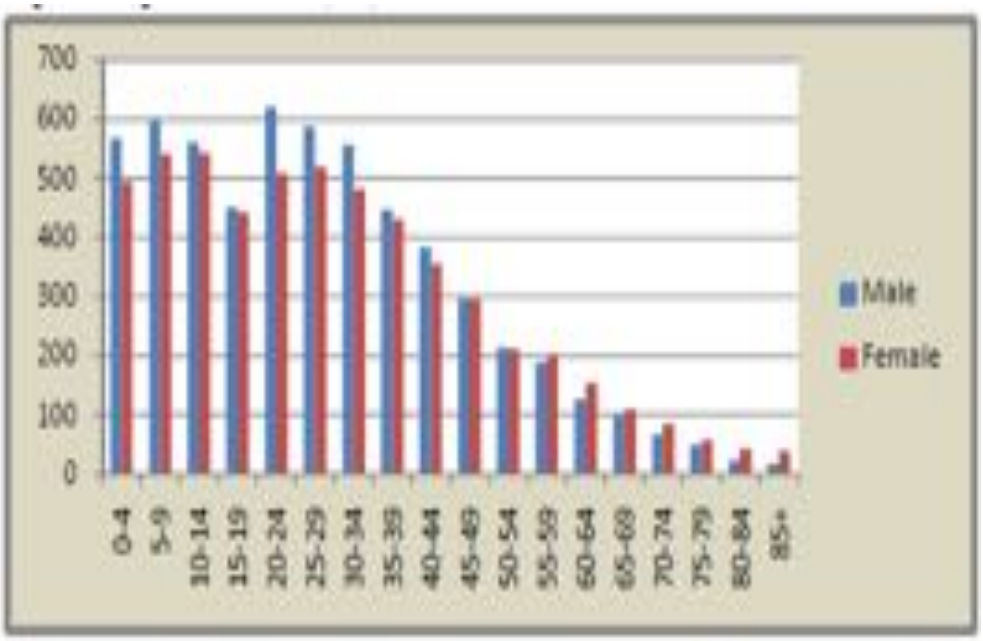


Figure 27: Population by age and gender: Khai Ma IDP 2012-2017

- The gender ratios are almost equal, at 51% males and 49% females.

- The younger age structure implies a population explosion resulting in additional strain on social and engineering infrastructure (i.e. health care facilities, schools, water, sanitation, electricity etc.).
- A fairly young population requires skills development programmes matched with appropriate jobs to ensure that this group do not immigrate to other parts of the country in search of a) tertiary education and employment or b) rely on grants to survive.

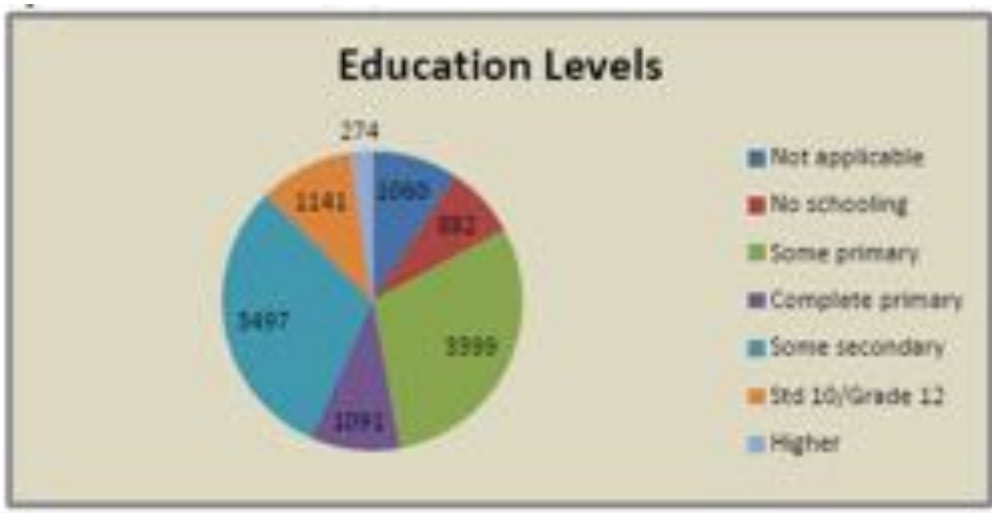


Figure 28: Population by educational level (Source: Khai Ma IDP 2012-2017)

- 30.8% of the population has some secondary education, while 10% have a Grade 12 certificate.
- Only 2.4% of the Khai Ma population has received tertiary education, this can be ascribed to the fact that Namakwa District and the Province as a whole has no university and students who move to attend universities around the country tend not return to Namakwa after gaining their qualification.

EMPLOYMENT

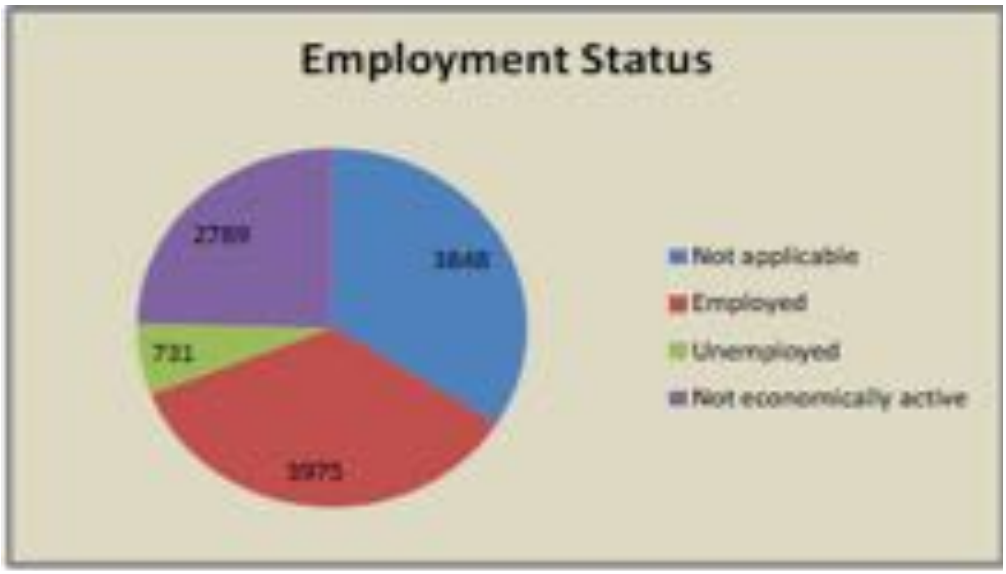


Figure 29: Employment(Source: Khai Ma IDP 2012-2017)

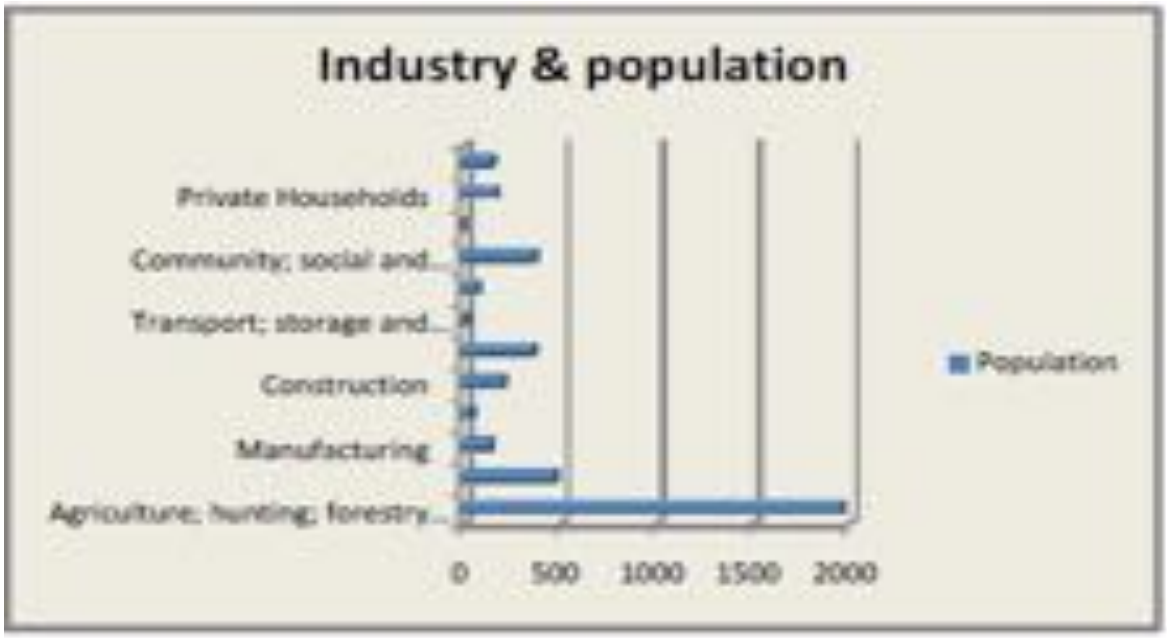


Figure 30: Employment distribution per sector (Source: Khai Ma IDP 2012-2017)

The majority of people in Khai Ma are involved in the agricultural sector, followed by mining and quarrying, wholesale and retail trade and then social and personal services. However, over the last two decades, there has been a significant decrease in the agricultural employment sector which has been absorbed, to a large degree, by an increase in mining, manufacturing and the community, social and personal service sectors. The municipality has therefore been seeking a strategy that that will further diversify the economy, reducing dependence on the agricultural and mining sectors.

As stated in the Khai Ma IDP (2012-2017) document, the high unemployment and low income levels frustrate the service delivery programme of the Municipality in that the Municipality does not generate sufficient funds for the provision and maintenance of these services. This implies that the planning for the provision of services should be cost-effective and based on optimal usage of these services Economic opportunities need to be identified in close proximity to disadvantaged areas, alternatively, effective public transport systems need to be implemented to reduce travel time between work and home. Community upliftment and skills development programmes, social support structures, food security (soup kitchens) and proper health care facilities need to be prioritized in disadvantaged areas by clustering it in Multi -Purpose Community Centres. The Khai Ma municipal IDP says that there is a need for educational facilities, particularly post-matric training as well as accredited tertiary institutions that offer affordable and appropriate qualifications. There is also a need to attract and retain qualified professionals in Khai Ma.

HOUSEHOLD INCOME

Table 11: Household income (Source: Khai Ma IDP (2012-2017)

Income Level (monthly)	Population Number
No income	99
R 1 - R 400	747
R 401 - R 800	1567
R 801 - R 1600	480
R 1601 - R 3200	440
R 3201 - R 6400	393
R 6401 - R 12800	201
R 12801 - R 25600	43
R 25601 - R 51200	12
R 51201 - R 102400	0
R 102401 - R 204800	0
R 204801 or more	9

- Currently 77% of households are considered indigent and received subsidies for basic services.
- The high poverty level directly affects the Municipality's financial ability to provide and maintain services.
- The main sources of income are the Black Mountain Mine at Aggeneis, government departments (i.e. Department of Education, Health, Safety and Communication) and the local Municipality.
- Commercial farmers depend on income generated from their farms, whilst others make a living by rendering services to the agricultural sector.

- Many residents depend on government grants, whilst others earn a living by providing housekeeping or gardening services.

HEALTH

The total population of Namakwa District is estimated at ±125 000 people, 5% of the total population has HIV/AIDS, growing rapidly - in 2007 5.1% of the population was infected, which is an 8.68% increase from 2006. Khai Ma Municipality has to make provision for the effects of HIV/Aids with regard to lowered productivity, increased need for health services, increasing number of orphans, cemetery sites etc. Other challenging health issues include tuberculosis and substance abuse. Statistics on mining related illnesses, i.e. asbestos poisoning, exposure to radio activity from nuclear waste deposits etc. are not readably available, but investigations are currently being done.

WATER SERVICES

According to the Khai Ma IDP (2012-2017) all communities rely on the Orange River for water. Water is purified near Pella and then pumped to Pella, Pofadder and Aggeneis whilst Solar energy is used to abstract water for households in Witbank. However, only Pofadder and Aggeneys have internal water reticulation networks.

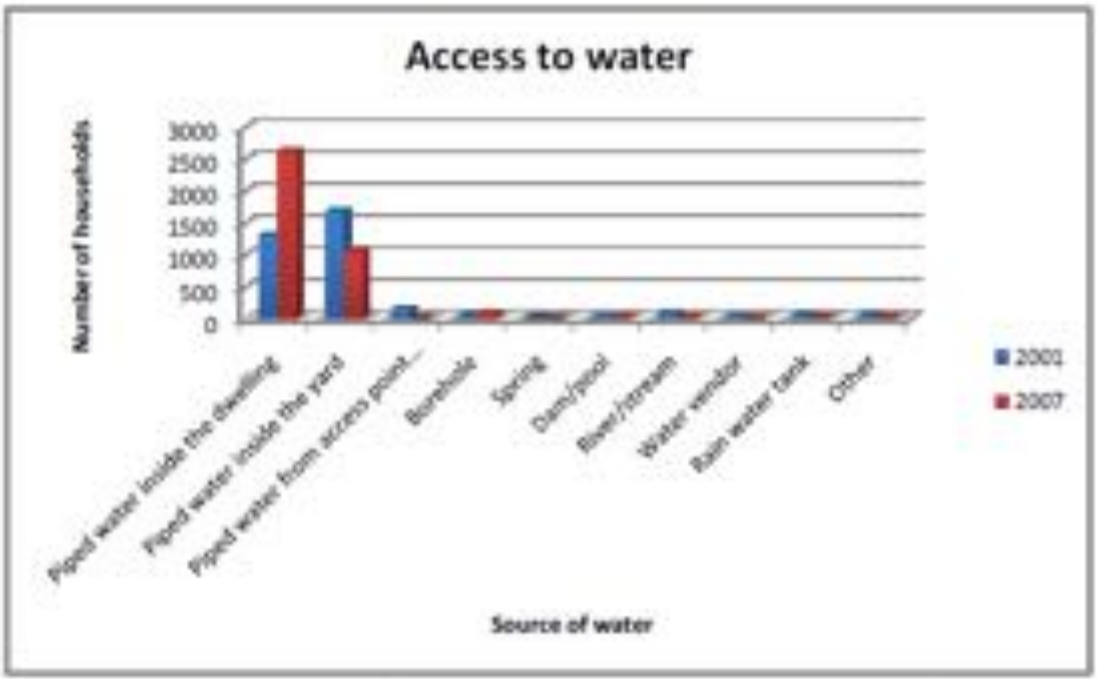


Figure 31: Water success per household (Source: StatsSA 2001 and Community Household Survey 2007)

SANITATION

Statistics SA 2001, confirms the following figures on access to sanitation that:

- 3.5% households have access to VIP toilets and 4894 households (85%) have access above VIP standards.
- 11% of households have access below VIP standards.
- 259 households use the bucket system and 362 households have no access to sanitation facilities.

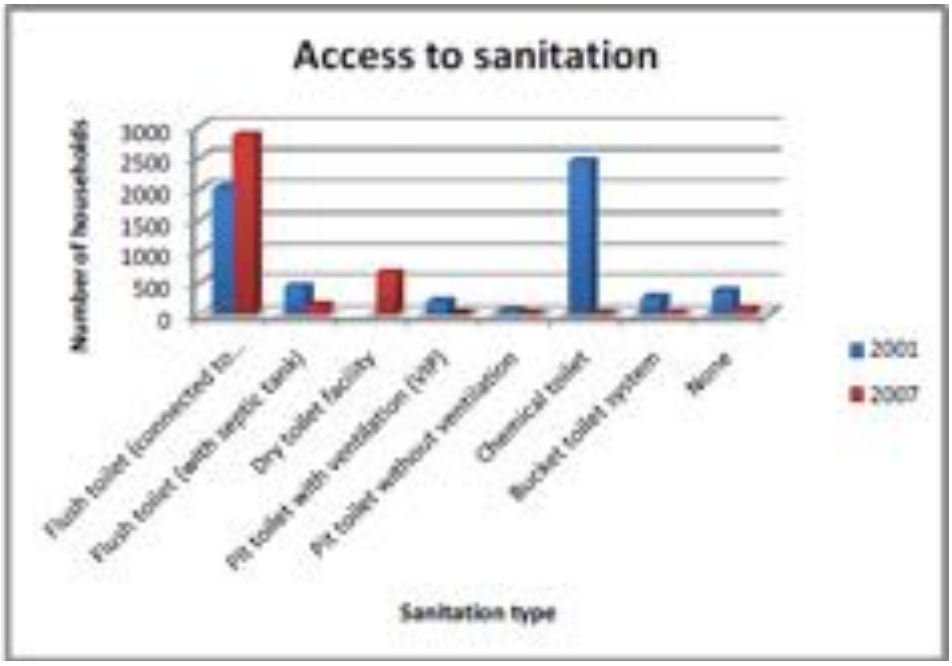


Figure 32: Sanitation access per household (StatsSA Census 2001 and StatsSA Household Survey)

ELECTRICITY

Electricity is provided by Eskom (Pella & Onseepkans), Khai Municipality (Pofadder) and Black Mountain Mine (Aggeneys) and 75% of households have electricity.

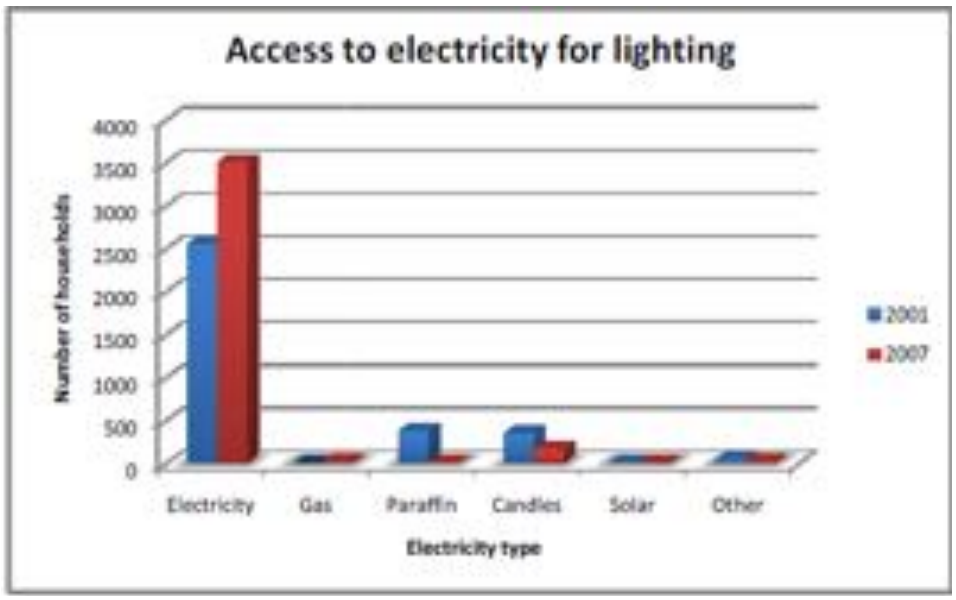


Figure 33: Access to electricity (Source: StatsSA Census 2001 and Household Survey 2007)

7. SCOPING AND EIA PROCESS

7.1. SCOPING PROCESS

The following objectives were met during the Scoping process:

- To identify and evaluate potential environmental impacts that could emanate from activities at different stages of the implementation of the proposed development. These could either be positive and or negative impacts. This was done through a desktop review of existing data.

- To provide the competent authorising body with sufficient information to identify the issues that require assessment as well as the nature and extent of specialist studies required during the EIA process.

- To clarify scope and nature of activities and reasonable and feasible alternatives to be considered during the EIA process.

- To ensure considerable evaluation of all alternatives including the “do nothing option”.

- To identify key environmental, socio-economic and biophysical issues associated with the proposed development.

- To conduct an open participatory and transparent process and facilitate the inclusion of Interested and Affected Parties and stakeholders’ concerns of the proposed project in the decision making process.

Figure 34 below provides a summary illustration of the Initiation and Scoping phase process.

The EIA process followed the framework outlined in Figure 35 as far as the finalisation of the EIAR.

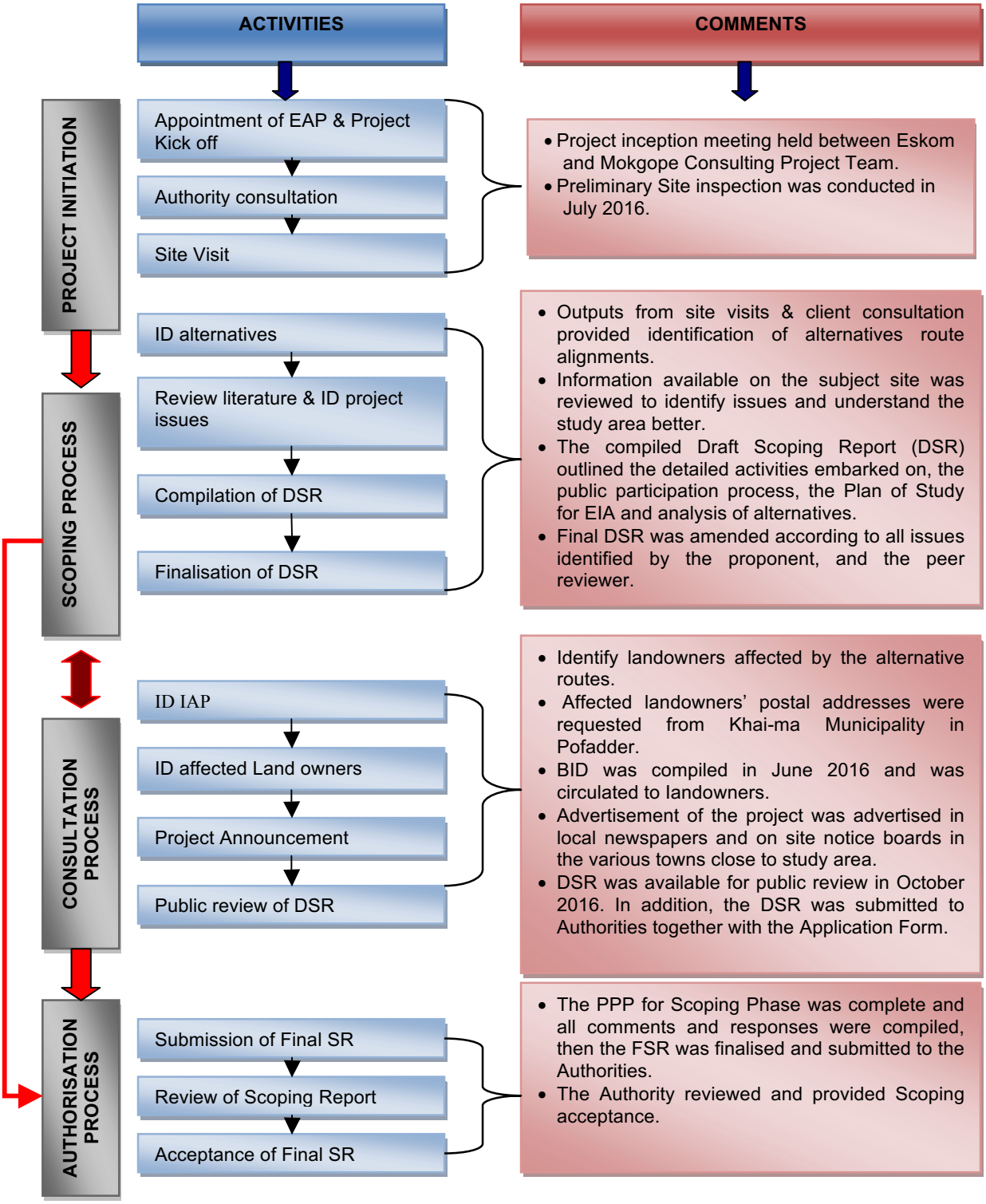


Figure 34: Initiation and Scoping Phase Flow Chart

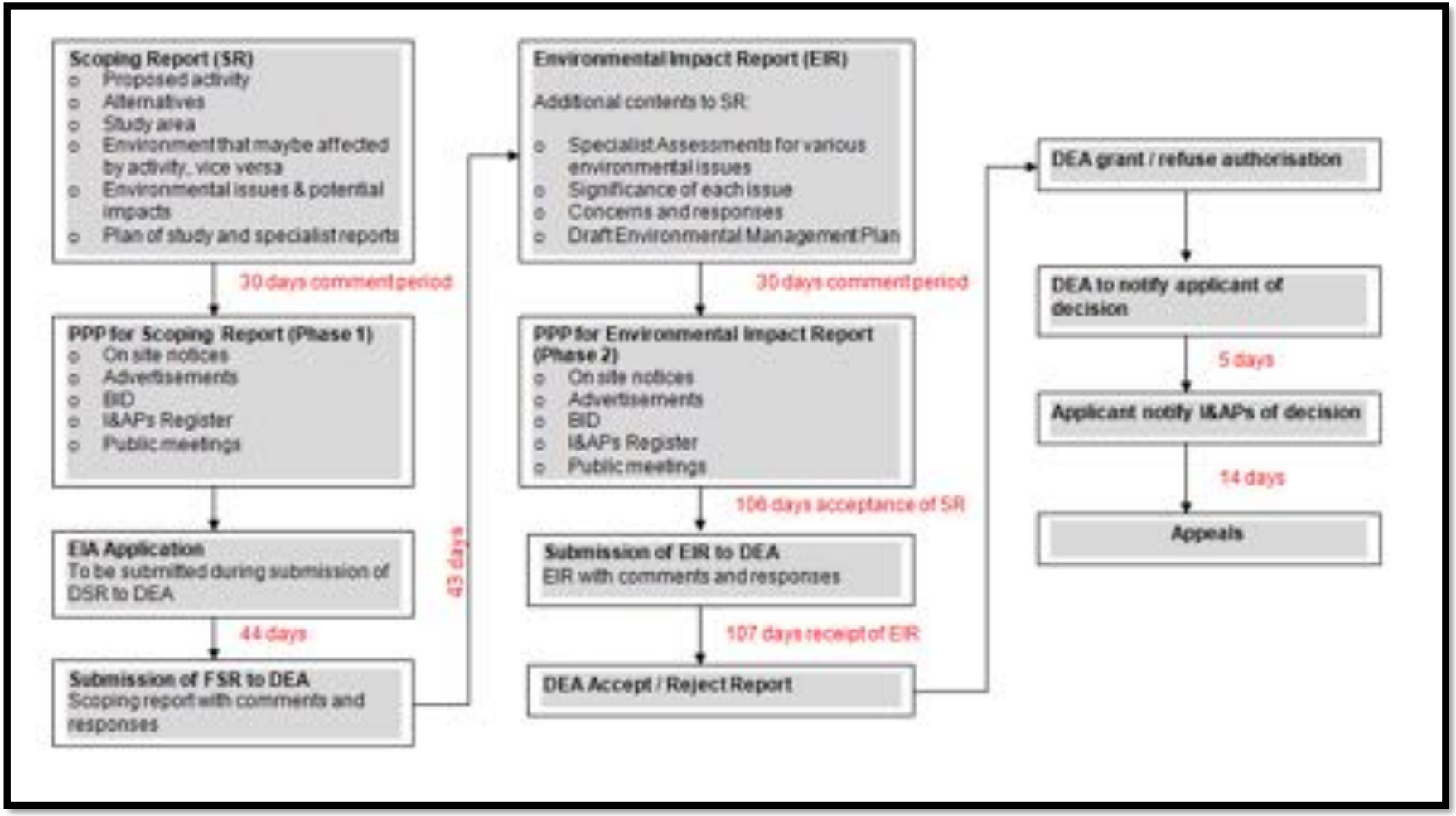


Figure 35: Outline of the EIA Process Flow

7.2 TECHNICAL PROCESS

For the Scoping phase of this EIA process, the following technical process was followed:

7.2.1 Kick-off Meeting with Client

On notification and receipt of the appointment letter from Eskom, a project inception meeting was held in April 2016 between Eskom and Mokgope Consulting. During this project kick-off meeting the following was discussed:

- Project Scope and requirements (confirmation of scope of work);
- Project Schedule;
- Identification of key stakeholders and role players; and
- Preliminary analysis options for powerline route alignments and substations upgrades.

7.2.2. Application for Environmental Authorisation in terms of GNR 982 of 2014, as amended as GNR326 on 7 April 2017

An application for Environmental Authorisation (EA) together with the DSR was re-submitted to the national and provincial authorities in June 2017. The Department of Environmental Affairs (DEA) acknowledged receipt by providing the project reference numbers. DEA Ref: 14/12/16/3/3/2/1012.

The Provincial Department of Environment and Nature Conservation and Development in the Northern Cape; the Namakwa District Municipality and the Khai Ma Local Municipality are regarded as the commenting authorities for the Scoping & Environmental Impact Report (S&EIAR) of this project and they have been included on the list of Key stakeholders.

To secure approval for Scoping Report from the authorities, the following activities were embarked on:

- Compilation of the Draft Scoping Report (DSR);
- Circulation of the DSR to I&APs and Stakeholders for comments;
- Finalisation of the Final Scoping Report (FSR) incorporating comments from I&APs and Stakeholders; and
- Submission of the FSR to the Authorities.

7.2.3 Site Inspection

Mokgope Consulting and Eskom undertook a preliminary site inspection between the 13 and 15 July 2016. Site inspection photographs are provided in **Annexure F.**

The site inspection was conducted with the intention to:

- Gather information about the study area;
- Identify properties which may be crossed by the proposed transmission line;
- Identify alternatives for the powerline construction and substations upgrade;
- Provide a visual understanding of the study area. This would also offer an opportunity to conduct a precursory assessment of impacts of the proposed development on the biophysical and social environment; and
- Provide an opportunity to introduce the proposed project to the affected communities.

7.2.4 Identification of issues

In order to compile the Scoping Report, issues identified by the I&APs, the local municipality, other stakeholders such as the mining sector and solar energy developers amongst others, were considered. The issues and concerns from the I&APs made it possible to identify additional potential impacts that were not initially envisaged for the proposed development. Furthermore, it was necessary to conduct specialist assessment studies to determine more potential impacts that would need to be avoided or minimised by the development. The specialist assessment findings and recommendations are discussed in Chapter 9 in this report.

7.2.5 Collection of Information

Mokgope Consulting gathered information on the potential impacts of the project from various stakeholders, registered Interested and Affected Parties (I&APs), authorities and Eskom. Basic information was gathered from existing literature on the study area with inputs from various specialists.

7.2 6 Review of Scoping Report

The Scoping Report was prepared on the basis of information and issues identified during the Public Participation Process. The final Scoping Report included comments obtained from I&APs and Stakeholders. Thereafter the Final Scoping Report was submitted to the DEA for final review and acceptance.

7.3 PUBLIC AND STAKEHOLDER PARTICIPATION DURING SCOPING

7.3.1 Background Information Document

A Background Information Document (BID) was drafted, ratified and approved by the client before it was circulated to all identified I&APs. The BID encouraged all individuals to contact Mokgope Consulting should they wish to be registered on the I&AP database and / or make a comment regarding the proposed project. The BID is provided in **Annexure G.**

7.3.2 Registration as Interested and Affected Parties (I&APs)

All I&APs were notified of the project through:

- site notice posters;
- telephone;
- registered mails;
- e-mails, and
- advertising in Namakwalander and Gemsbok newspapers.

The following methodology was utilised to identify all major stakeholders and landowners affected by the alternative corridors:

- GIS data available;
- Landowners address records from Khai Ma Municipality;
- Researching relevant local, provincial and / or national stakeholders; and
- Information from the mining sector in Aggeneys.

The criteria used to identify the affected landowners and stakeholders were as follows:

- Landowners within the 2km alternative corridors of the proposed transmission powerline;
- Landowners and occupiers of land in close proximity to the proposed alternative route alignments and substations;
- Industries and other projects in the vicinity of the proposed development; and
- Government Departments in the Northern Cape Province.

Names and contact details of the affected landowners are recorded on the I&AP Register. The first contact particularly with landowners was in the form of Background Information Document (BID). Proof of registered mails is provided in **Annexure H**.

The I&APs Register / database has been provided in **Annexure I**. The I&APs register will be updated continuously at each stage of the EIA process.

7.3.3 Newspaper Adverts

Adverts were published in the following newspapers in Afrikaans: Gemsbok and Namakwalanders. These two newspapers are widely read in the towns (Aggeneys; Pofadder and Pella) close to the study area of the proposed Aggeneis-Paulputs Project.

The advertisements were calling for registration of I&APs on the project register and announcing the availability of the DSR as well as the public meetings which were held in October 2016. The proof of newspaper adverts are provided in **Annexure H.**

7.3.4 Site Notices

Site notices were posted in October 2016 at various focal points in the towns that are in close proximity to the proposed development. The site notice photographs are provided in **Annexure J.**

7.3.5 Involvement of Key Stakeholders

The affected local authorities and organisations were contacted to introduce the project and identify relevant people to engage with during the project execution process. Names of representatives from these authorities and organisations are included in the I&APs database **(Annexure I)**. The stakeholders received project correspondence via e-mail. The proof is provided in **Annexure H**.

7.3.6 Public Meetings

Public meetings were held in the areas close to the proposed development in October 2016. Venues, dates and times for the public meetings are detailed in the newspaper adverts and site notices. During the public participation meetings, presentations were presented by Eskom and Mokgope Consulting.

The purpose of the meetings was to:

- introduce the project to the local I&APs;
- identify issues pertinent to the project;
- invite people to register as I&APs;
- link Eskom, the consultant and local communities; and
- provide I&APs with an opportunity to participate in the identification of feasible alternatives.

The minutes and attendance registers are provided in **Annexure K.**

7.3.7 Public review of Scoping Report

All I&APs and stakeholders were given the opportunity to review and comment on the Draft Scoping Report for a minimum of 30 days. The report was placed at: Aggeneys Recreational Club; Pella library and Pofadder library. To inform landowners of the availability of the report, written notices were sent to them (proof of registered mails and e-mails are provided in **Annexure H**). In addition, advertisements in English and Afrikaans were published in the relevant newspapers to inform the public. Electronic copies of the report were e-mailed to individuals upon request.

All I&APs and stakeholders were given an opportunity to forward their written comments, objections, inputs and queries within the commenting period. All comments received from stakeholders and I&APs were acknowledged and contained in the "Comments and Response Report", which is provided in **Annexure L.**

The Final Scoping Report included all issues and concerns raised by I&APs and stakeholders. The report was submitted to the National and Provincial Environmental Departments for final review and comments.

The acceptance of the Scoping phase formed the basis for further studies to be conducted during the EIAR phase.

7.3.8 Summary of I&AP Issues during the Scoping Phase

Departments

DAFF is concerned about the clearance of vegetation within the powerline servitude. In particular, protected trees and sensitive vegetation areas are to be avoided as far as possible. A site sensitivity map is to be provided to DAFF. The Fauna and flora reports are also to be provided to DAFF. The EAP has brought these comments to the attention of the vegetation specialist. Furthermore, the vegetation specialist mentioned that the DAFF concerns have been addressed in the vegetation report which will be provided to DAFF for commenting in the EIAR Phase.

SANRAL is concerned about the impacts that the proposed powerline may have on the N14 National Road. SANRAL is to be notified of any alterations or upgrading measures that are required at any intersection with the N14 National Road. Furthermore, if abnormal loads have to be transported by road to the proposed site, a permit has to be obtained from SANRAL. Eskom acknowledges the comments by SANRAL and states that it will abide with any SANRAL requirements prior to the construction phase of the project. An application form provided by SANRAL for the proposed encroachment was forwarded to Eskom.

The DSR was received by DEA and DENC. However, no comments have been provided. Furthermore, email notifications of the proposed project were sent to:

mdibane@ncbg.co.za; chrisf@namakwa.co.za; simon.gear@birdlife.org.za;
Dwerth@ncpg.gov.za; wnodoba@ncpg.gov.za; jpetersen@ncpg.gov.za;
aahmed@ncpg.gov.za; crobertson@ncpg.gov.za.

See I&APs Register provided in **Annexure I** for more details.

Interested & Affected Parties

The I&APs' concerns were mostly addressed during the public meetings in October 2016. See minutes provided in Annexure J. Landowners were mostly concerned about the proposed powerline traversing their properties. The corridor along the existing powerline was preferred. One landowner stated that the existing powerline runs through his property and would like the proposed powerline to be closely adjacent to the existing line. The other corridors cut his property in different sections within his farm. A number of landowners were not in favour of Corridor 3. Hence they suggested for a deviation route (Deviation 3A) following the road on the west of Gamsberg (see locality map in **Annexure B**). Furthermore, an I&AP requested that when heritage artefacts are found in their area, the artefacts should not be kept at McGregor Museum in Kimberley. They request that the artefacts should be kept in Khai Ma region. The EAP has requested the Heritage Specialist to respond to the I&AP's concern with regards to Heritage artefacts.

Other concerned parties were the Independent Power Producers (IPPs) and the landowners of the solar farm properties. The concern was that the proposed powerline should not clash with the solar farm developments. In particular, Eskom engaged with Biotherm Energy to agree on the appropriate route alignment. The corridors closer towards Paulputs substation will be 4km wide. This is to allow sufficient space within the corridors to locate the powerline and to avoid clashes with the IPPs in proximity to Paulputs substation. The Solar Farms are indicated on the locality map.

Black Mountain Mine was concerned about all three corridors traversing the quartz fields and the sensitive succulent plants. This issue was brought to the vegetation specialist's attention to identify the sensitive areas. In particular, Corridor 3 runs through the mine's property in the dunes. Hence, no construction of the powerline would be allowed to take place on the mine's property.

The community members in Pella were mainly concerned about job creations during the construction phase. The Eskom project manager explained to them that the construction of the powerline is highly technical. Hence the construction companies already have a team that would undertake the technical parts of the job. However, should there be a need for extra labour, the community leaders would be requested to assist with the labour required from the community.

8. ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) PHASE

This section gives a brief outline of the process followed when conducting the EIAr phase for the proposed powerline. During this phase, specialist studies were undertaken to assess significant potential impacts of the proposed development. This process is also in line with the approved plan of study for the EIA.

8.1 PURPOSE OF THE EIAR

The EIAr phase provides stakeholders and I&APs the opportunity to ascertain that their issues and concerns raised during the Scoping phase have been adequately considered, and to capture further public comments. In addition, the specialist studies that were identified in the Scoping phase have been undertaken in the EIAR phase. The specialist studies assessed impacts on the biophysical, biodiversity, social, aesthetic and the cultural environment and identified ways that could mitigate the anticipated impacts.

The purpose of this EIAR is therefore, to:

- Outline the manner in which the biophysical, biodiversity, social, aesthetic and the cultural aspects of the environment may be affected by the proposed development;
- Appraise the I&APs and stakeholders of the information collated during the investigation of impacts by the project specialists and team members;
- Outline methods used for analysing and interpreting the information;
- Provide an assessment of any positive and negative implications of the proposed project and identified alternatives;
- Recommend the least impacting alternative route corridor to the authorities for final authorisation regarding the proposed project;
- Provide mitigation measures for all identified impacts on the feasible option; and
- Provide the I&APs and stakeholders with an opportunity to comment on the information provided in the report prior to final submission to the authorities.

8.2 SPECIALIST STUDIES

The specialist studies were conducted focusing on a 2km corridor from the Aggeneis to Paulputs substations along the alternative corridors. The following specialist studies were conducted by highly experienced team experts. The various specialists have been discussed in Table 6 in this report. The table below outlines the requirements of each study.

Table 12: Specialist Studies and Requirements

Specialist Studies	Requirements
Flora and Fauna	• Provide status of habitat and identification of all ecologically sensitive areas. • Identification of endangered species and their locations. • Identify conservation worthy areas and how the proposed development can avoid them. • Identify potential impacts of the fauna and flora, if any, on the proposed infrastructure per alternative route to be assessed and substations to be upgraded. • Identify potential impacts and mitigation measures of the proposed infrastructure on the fauna and flora per alternative route to be assessed and the substations to be upgraded. • Provide recommendations for clearing of plants and acceptable heights. • Recommendation of the best alternative route and technology to be used.
Avifauna	• Provide status of bird habitats in the area and any endangered species including their migration patterns. • Identification of areas where bird interactions may play a major role. • Classification of potential bird impact, if any, on the proposed infrastructure and infrastructures impact on the bird species in the area. • Recommendations regarding how to mitigate any potential impacts on both birds and the proposed infrastructure. • Recommendation of the best alternative route and technology to be used.
Wetland	• Identification of wetlands and river crossings. • Mapping of information digitally on all alternatives being assessed. • Analyses of both negative and positive impacts on the proposed infrastructure, if any, and on the natural environment by the proposed development. • Recommendations for mitigation measures for each potential impact identified. • Recommendation of the best alternative route and technology.
Agricultural potential	• Identification of agricultural activities taking place in the area and the significance to the local economy and livelihoods. • Identification of stakeholders in this sector to be engaged on the proposed development, • Analyses of both negative and positive impacts on the agriculture by the proposed development. • Recommendations for mitigation measures for each potential impact identified. • Identification of potential impacts of the proposed powerline on the agricultural sector in the area. • Recommendation of the best alternative route and technology.

Specialist Studies	Requirements
Visual	• Identification and location of visual impact that may affect no-go areas. • Development of mitigation measures. • Recommendation of the best alternative routes and technology.
Heritage	• Identification & location of archaeologically, historically important areas, heritage declared sites, paleontology sites. • Mapping of all areas to be affected and the identification of mitigation measures. • Recommendation of the best alternate route.
Social	• Social and economic impact assessment of the proposed development. • Identify service crossings, electrified railways, roads, airfields, and local settlements with people who will be affected by the proposed development. • Provide a brief background of the area (i.e. language, population composition etc). • Identify socio-economic factors of locally affected communities and how they will be impacted by the proposed development. • Identification of various land uses *e.g.* agricultural areas, mining, game lodges, nature reserves, zonings and future land use to be considered during corridor selection. • Identification of proposed townships lodged with local municipalities within the study area, if any. • Identify potential impacts of the proposed development on those settlements and land-uses or economy. • Identify areas of tourism potential in the study area that may be affected by the proposed development. • Recommendation of the best alternative route and technology.
Geographical Information Systems	• All maps to be produced in a format which will enable the process of corridor and route selection and assessment of issues for inclusion in the Scoping report and EIAR. The maps will include information like land use, access routes, conservation areas and locality. The locality maps must be printed on A3 size to ensure clear illustrations.

Terms of Reference of Specialist Studies

All specialists were required to provide their independent professional assessment and opinion on the impacts and recommended mitigations measures to be applied. The Terms of Reference (ToR) for each specialist is summarised below. Specialists were requested to use the evaluation criteria similar to the one provided under Section 8.6 in this report.

ToR: Vegetation

A vegetation impact assessment was conducted with the following aims:

- Review existing literature and identification of red data species;

- Conduct a site visit to assess the site and identify potential impacts;
- Identification of potential direct, indirect and cumulative impacts, alternatives and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

ToR: Fauna

A faunal assessment was conducted with the following aims:

- Review existing information;
- Conduct a site visit to assess the state of the site and determine potential impacts, with special emphasis on threatened and/or endangered species;
- Identify mitigation measures for potential direct, indirect and cumulative impacts and feasible alternatives for the proposed development;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

ToR: Avifauna

The Avifauna study was conducted with the following aims:

- Review of existing literature;
- Conduct site visit to assess the site and identify potential impacts;
- Identification of potential direct, indirect and cumulative impacts, alternatives and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

ToR: Wetland

A wetland impact assessment was conducted with the following aims:

- Review existing literature;
- Conduct a site visit to assess the site for any affected wetlands;
- Identification of potential direct, indirect and cumulative impacts, alternatives and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

ToR: Agriculture

An agriculture impact assessment was conducted with the following aims:

- Review existing literature on the study area;
- Conduct a desktop study to assess the site and identify potential agricultural soils that occur within the study area
- Identification of alternative activities, their impacts and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compiling a report indicating all findings, fatal flaws, and maps indicating the potential agricultural soils within the study area.

ToR: Visual

The Visual study was done with the following aims:

- Conduct site visit to visually assess the site and identify potential impacts on the aesthetics of the receiving landscape;
- Identification of potential direct, indirect and cumulative impacts, alternatives and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

ToR: Heritage and Archaeological

A historical and archaeological impact assessment was conducted with the following aims:

- Review existing literature on the study area;
- Conduct a site visit to assess the site and identify potential impacts and develop mitigation measures;
- Identification of alternatives , their impacts and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives;
- Obtaining comments from the heritage agency in the Northern Cape on the compiled specialist report; and
- Compiling a report indicating all findings, fatal flaws, recommendations and maps indicating no-go areas.

ToR: Social Impacts

A social impact assessment was conducted with the following aims:

- Review existing literature on the study area;
- Conduct a site visit to assess potential social impacts on the communities areas within the study area;

- Identification of alternative activities, their impacts and mitigation measures;
- Provide a ranking assessment of the suitability of the proposed alternatives; and
- Compiling a report indicating all findings, fatal flaws and recommendations for environmental management programme.

ToR: GIS

The GIS specialist will compile maps required by the project team during the assessment process. This should include providing all relevant and updated metadata. Furthermore, when new information/features are identified, the maps are to be amended to include the additional information.

8.3 PUBLIC PARTICIPATION

All registered I&APs and stakeholders have been given the opportunity to review the draft EIAR in accordance with the Environmental Regulation R982, as amended (GN R326). The report was available for public review at Aggeneys Mining Offices; at Pella and Pofadder libraries. Advertising in English and Afrikaans on the availability of the report and public meetings was undertaken to inform stakeholders and I&APs. In addition, stakeholders and I&APs were also informed of the availability of the report through notification letters site notices posted at various focal points in Aggeneys, Pella and Pofadder.

All stakeholders and I&APs were given an opportunity to forward their comments, objections, inputs and queries within a minimum of 30 days comment period. This was done in order to assess and provide I&APs an opportunity to comment on: the specialist assessments; the ranking of corridor alternatives; as well as recommendations by the specialists.

All issues identified during this public review period will be documented and compiled into a Comments and Response Report. The Environmental Assessment Practitioner (EAP) undertaking the public participation process will communicate with the stakeholders and I&APs throughout the duration of the project.

8.3.1 Public Meetings

Public meetings were held during the EIAR phase in October 2017. Similar to the Scoping phase meetings, the EIA public meetings were conducted in English and Afrikaans where necessary. Public participation meeting venues and dates were scheduled to suit the I&APs. These meetings provided the I&APs with an opportunity to engage with the consultants on the outcome of the studies and proposed recommendations. Minutes of the meetings will be compiled and circulated to all I&APs after the public meetings.

The public participation meetings were advertised in Gemsbok and Namakwalanders newspapers in English and Afrikaans to ensure that local stakeholders and I&APs were informed beforehand. Other forms of notification of the public meetings were through site

notices, which were posted at public focal points in Aggeneys, Pella and Pofadder, and through electronic notification to the registered I&APs who preferred to communicate by e-mail.

8.4 AUTHORITY REVIEW OF THE ENVIRONMENTAL IMPACT REPORT

The I&APs and stakeholders would be afforded, a minimum of 30 days to comment on the Final Environmental Impact Assessment Report (EIAR), should there be additional information that was not included in the Draft EIAr. Subsequently, the I&APs comments will be incorporated into the final EIAR, which will be submitted to the authorities for consideration.

8.5 EIA TIMEFRAMES

The following work programme will be followed during the EIA process.

Please note: the timeframes are either stated in terms of Mokgope Consulting's planning or the applicable legislative requirements and outcomes of the various public participation stages. This would mean that the future tentative dates in this report could change and should only be considered as a guideline.

Table 13: Proposed Project Schedule

ACTIVITY	TIME FRAME	STATUS
Preliminary Site Visit	July 2016	**Complete**
Circulation of BID to Landowners	August 2016	**Complete**
PPP for Scoping phase	October 2016	**Complete**
Circulation of Draft Scoping Report	October 2016	**Complete**
SUBMISSION OF DSR TO DEA AND APLICATION FORM	May 2017	**Complete**
SUBMISSION OF FSR TO DEA	July 2017	**Complete**
Approval of FSR	August 2017	**Complete**
PPP for EIAR phase	Sept/Oct 2017	In progress
Draft EIAR 30 days comment period	Sept/Oct 2017	In progress
SUBMISSION OF FEIR TO DEA	November 2017	Pending
Anticipated Environmental Authorisation	Jan/Feb 2018	Pending

8.6 METHODOLOGY FOR THE ASSESSMENT OF POTENTIAL IMPACTS

All impacts identified during S&EIAR phases are classified in terms of their significance. The broad significance categories are as follows:

- The **Nature** of the impact: This will describe the cause and the effect, what will be affected and how it will be affected.

- **Mitigation level:** The degree at which the impact can be mitigated.

- The **Extent** of the impact: This will be categorised as either local, regional or national.

- The **Magnitude** of the impact: This will be quantified as either:
    - Low: Will cause a low impact on the environment;
    - Moderate: Will result in the process continuing but in a controllable manner;
    - High: Will alter processes to the extent that they temporarily cease; and
    - Very High: Will result in complete destruction and permanent cessation of processes.

- The **Probability:** which shall describe the likelihood of impact occurring and will be rated as follows:
    - Extremely remote: Which indicates that the impact will probably not happen;
    - Unusual but Possible: Distinct possibility of occurrence;
    - Can Occur: there is a possibility of occurrence;
    - Almost Certain: Most likely to occur; and
    - Certain/ Inevitable: Impact will occur despite any preventative measures put in place.

- **The duration (Exposure)**: wherein it will be indicated whether:

    - The impact will be of a immediate;
    - The impact will be of a short tem (Between 0-5 years);
    - The impact will be of medium term (between 5-15 years);
    - The impact will be long term (15 and more years); and
    - The impact will be permanent.

- **Reversibility/ Replaceability:** The degree at which the impact can be **reversible or the lost resource can be replaced.**

To determine the significance ranking, the following ranking (or similar) was applied to each specialist's impact identified. Furthermore, the summary of the all the specialists' impact assessment is provided in **Annexure C.** It outlines the significance of the potential impacts that the proposed powerline may impose on the biophysical, biodiversity, social, visual and cultural aspects of the environment.

Table 14: Significance ranking

RANKING	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact ceases after operational life of asset)	Almost certain
3	Moderate	Reversibility with human intervention	Provincial	Medium term	Can occur
2	Low		Local	Short term	Unusual but possible
1	Minor	Completely reversible	Site bound	Immediate	Extremely remote
0	None		None		None

Significance = Consequence (Magnitude+ Duration+ Extent + Reversibility) X Probability

9. SUMMARY OF THE SPECIALISTS IMPACT ASSESSMENTS

The information provided in this section summarises findings and recommendations of specialist reports. The detailed Specialist Reports are provided in **Annexure M.**

9.1 VEGETATION ASSESSMENT

9.1.1 Vegetation Findings

Vegetation Types Traversed by the Proposed Aggeneis-Paulputs 400kV Powerline

The proposed powerline corridors could impact on six vegetation types as geographically presented in Figure 36 (Mucina & Rutherford, 2006 in Eyssell, A. 2017). One of these vegetation types, Bushmanland Inselberg Shrubland are only directly traversed by Route 3, but occurs within the corridors of all three routes. The inselbergs support a high number of local endemics, especially succulents of the families Aizoaceae, Apocynaceae, Crassulaceae, Portulacaceae (Avonia, Anacampseros) and closely related Didiereaceae (Ceraria) (Mucina & Rutherford, 2006). Mining around the town of Aggeneys and on top of Gamsberg poses a potential threat to this vegetation type. The remainder of the vegetation types along the proposed powerline route corridors are not considered to be threatened. Although classified as Least Threatened, very little or none of these vegetation types are formally protected e.g. in reserves or other protected areas.

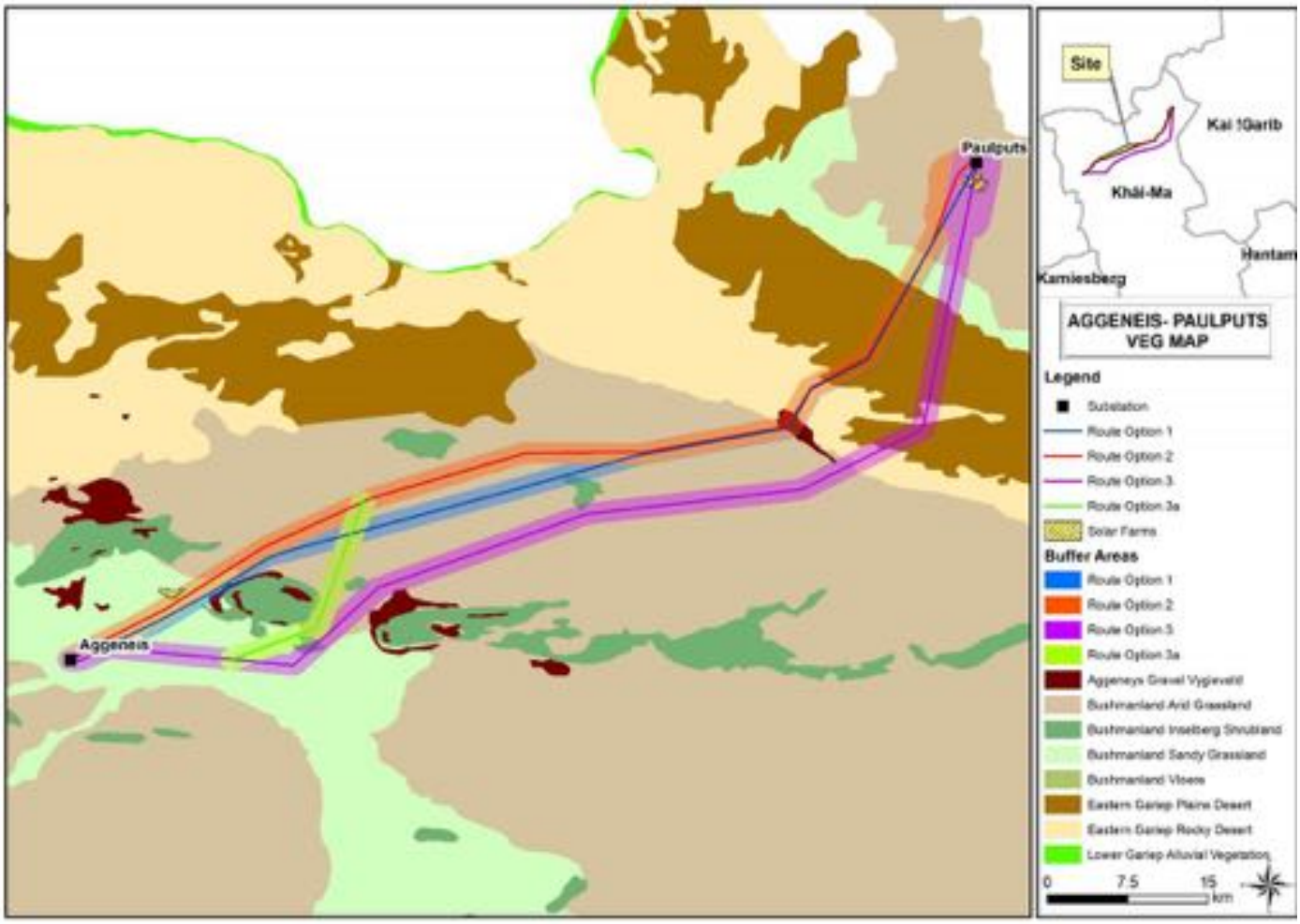


Figure 36: Vegetation types occurring within and in proximity to the proposed Aggeneis-Paulputs route alternative corridors

CBAs and ESAs Traversed by the Proposed Aggeneis-Paulputs 400kV Powerline

The proposed 400kV powerline is situated within the Namakwa District and are included in the Namakwa Biodiversity Sector Plan. This Biodiversity Sector Plan maps areas of biodiversity concern to ensure that biodiversity information can be accessed and utilized by local municipalities to inform land use planning and development as well as decision making processes within the NDM (Namakwa District, 2008 in Eyssell, A. 2017). The Namakwa Districts biodiversity map indicates where Critical Biodiversity Areas (CBAs), as well as Ecological Support Areas (ESAs) occur along the proposed route alternatives[4] (Figure 37).

[4] CBAs and ESAs are explained in section 6.2.1 in this report.

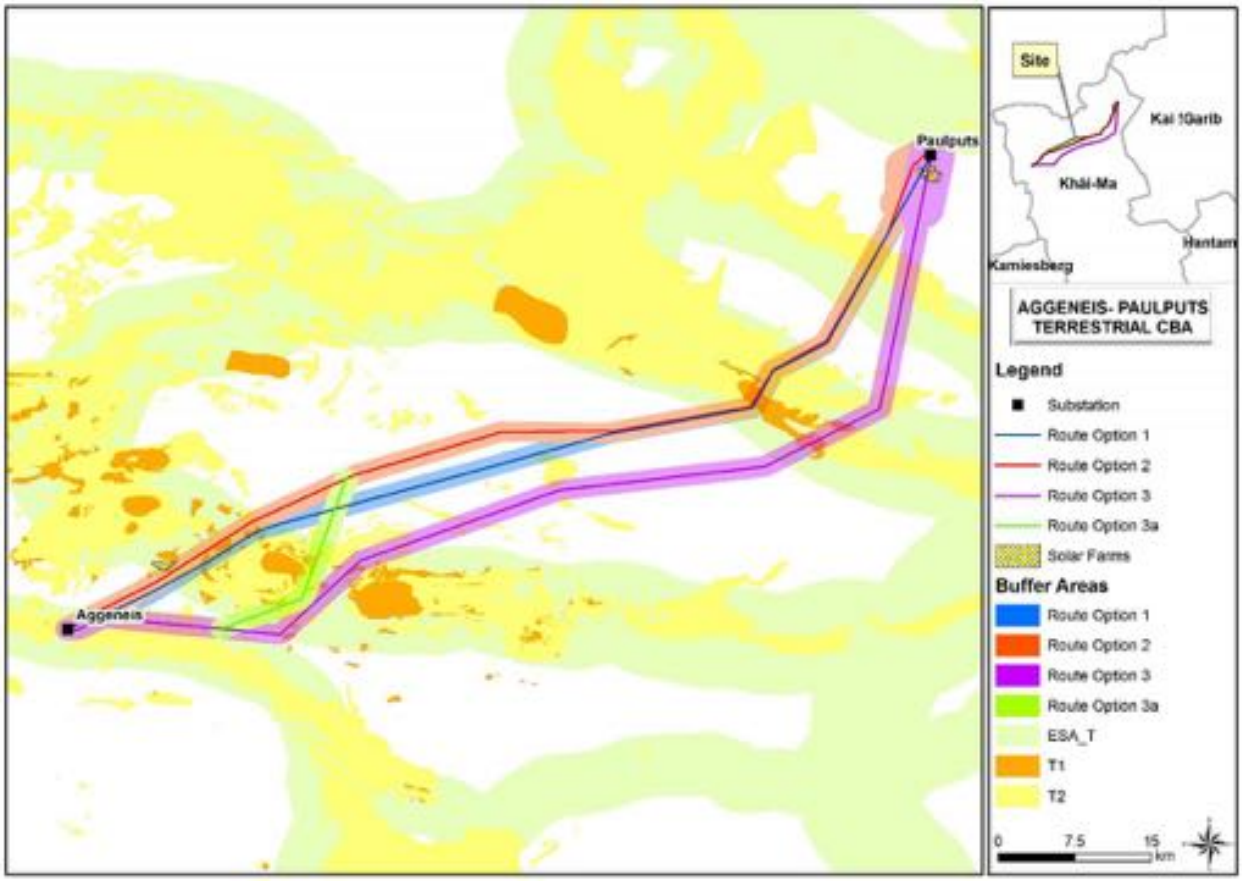


Figure 37: Critical Biodiversity Areas (T2 and T2) as well as ESA's along all three proposed route alternative corridors

The above figure illustrates that the powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out their extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats. The ESA's comprise biodiversity corridors aimed at retaining connectivity between all geographic areas in the district and nationally.

Succulent Karoo Ecosystem Programme (SKEP) Priority Areas

One of the SKEP[5] priority areas, the Bushmanland Inselbergs, occurs west of Pofadder and can be impacted on by the proposed powerline route (Figure 38). The area is dominated by a plain of desert grasslands and dotted by inselbergs that are important refugia for plants and animals and act as stepping-stones for rock-loving species migrating east west across the sand-covered plains of Bushmanland. These inselbergs support a highly diverse dwarf succulent shrubland and some has been impacted on by mining and overgrazing.

[5] The Succulent Karoo Ecosystem Programme (SKEP) is a long term, multi-stakeholder bioregional conservation and development programme with the aim of defining a way to conserve this Succulent Karoo ecosystem, and to develop conservation as land-use.

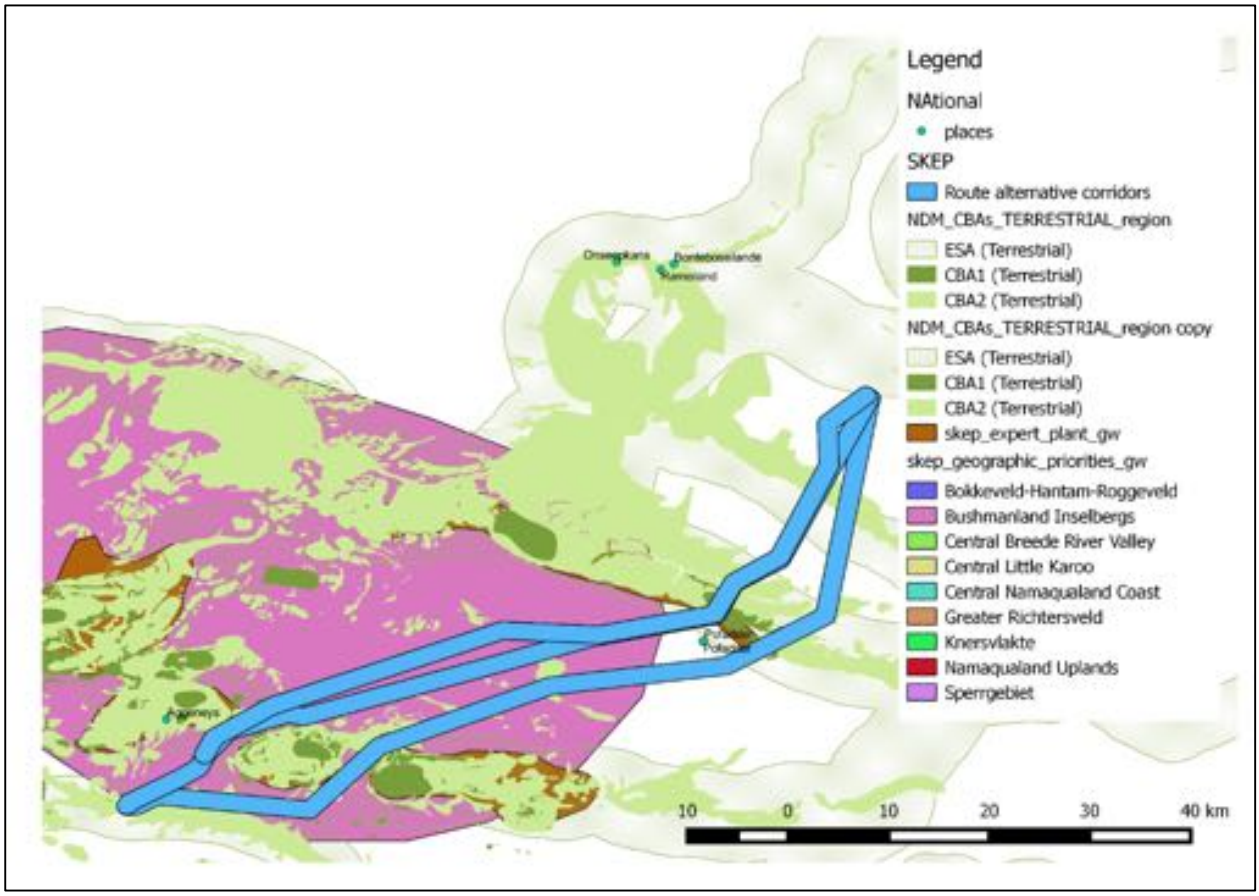


Figure 38: The Bushmanland Inselberg Priority area (SKEP), important plant habitats (skep_expert_plan_gw), as well as the Namakwa CBAs and ESAs

Gariep Centre of Endemism

Endemic plants are species that are naturally only found in a particular and usually restricted geographic area or region. These plants are therefore restricted in their distribution and vulnerable to habitat loss. The Gariep Centre of Plant Endemism includes about 2 700 species of plants of which 560 are endemic or near-endemic. Over 400 of these are succulent plant species and some are known to occur in the study area. In addition areas associated with calcareous or quartzitic soils (e.g. the Aggeneys Gravel Vygieveld that occur mainly in Corridors 1 and 2) are likely to have high number of species limited to this habitat. The Gamsberg, situated about 12km north-east of the town of Aggeneys, is the largest inselberg located in the centre this Centre of Endemism. The inselbergs and associated rocky plains have very high levels of species diversity of which many are range restricted being associated with specific regionally rare habitats such as types of gravel patches (quartz, calcrete and feldspar).

Kamiesberg Bushmanland Augrabies Focus Area

The majority of the southern extent of all three proposed powerline corridors will traverse the Kamiesberg Bushmanland Augrabies Focus Area (Figure 39). This focus area represents the largest remaining natural area for the expansion of the protected area network and forms part of the planned Lower Orange River Trans-frontier conservation area. It provides an opportunity to protect twenty-two desert and succulent karoo vegetation types, mostly completely unprotected, several river types that are still intact but not protected, and important ecological gradients and centres of endemism.

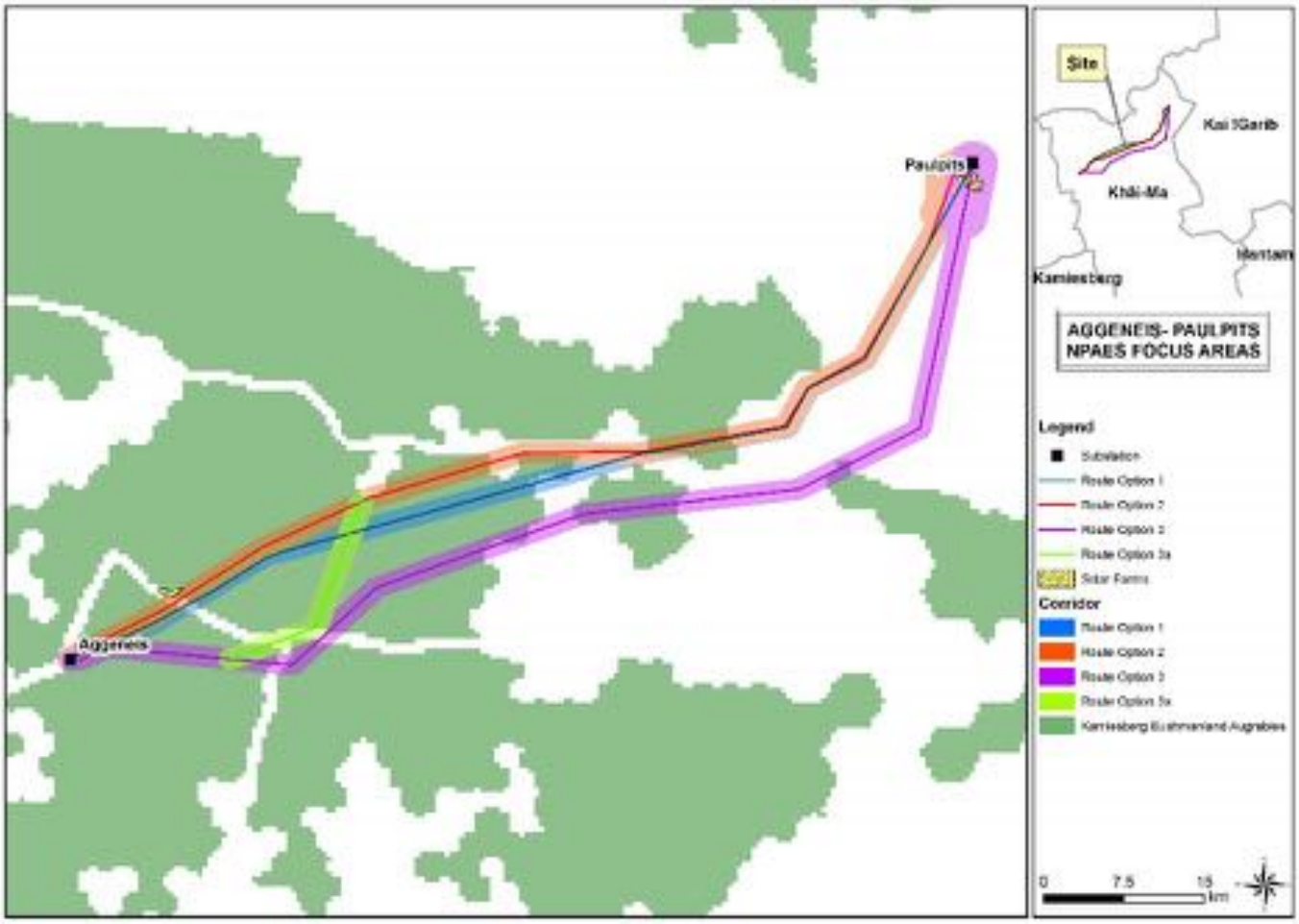


Figure 39: Much of the eastern section of the proposed powerline alternative corridors occurs within the Kamiesberg Bushmanland Augrabies Focus Area

Vegetation Site Characteristics

The vegetation observed along the proposed alternative corridors was found to be representative of the biomes and the broad scale vegetation types.

Six vegetation associations were grouped as follows (Figure 40) and Photographs taken during the field surveys are also depicted below.

1. Sandy grassland and desert plains
2. Arid gravelly grassland
3. Gravel and quartz veld
4. Rocky desert and outcrop vegetation
5. Inselberg vegetation
6. Drainage lines and riparian

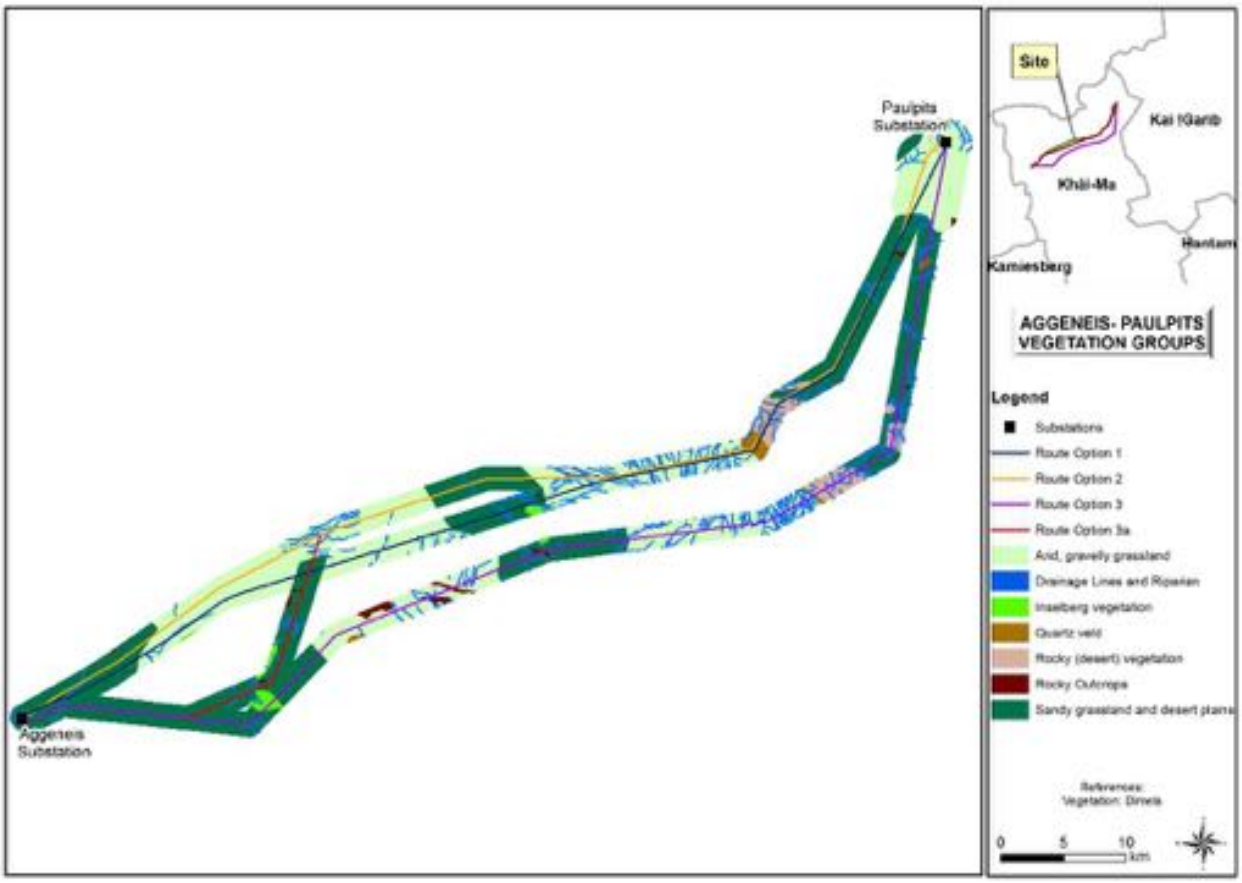


Figure 40: Broad vegetation associations within the route alternative corridors

1. Sandy grassland and desert plains

This vegetation association includes the Bushmanland Sandy Grassland and Eastern Gariep Plains Desert as described in Mucina and Rutherford (2006). The vegetation comprises grassland on sandy soils and in sandy plains, dominated by white grasses (*Stipagrostis* & *Schmidtia* species) and karroid shrubs. Annual herbaceous species were largely absent due to the drought, but would be more noticeable after good rains.

Photograph 1: Grassland on red sands north east of Aggeneis substation (left), with high grazing pressure recorded where cattle graze (right). The Vulnerable Aloidendron dichotomum in sandy grassland (right)

Photograph 2: Sandy grassland north of Aggeneis substation (left) and grazed sandy grassland 20km south of Paulputs substation (right)

In between rocky and mountainous areas, additional shrubs and herbs were noted in the drainage lines or on more gravelly or loamy soil next to the mountains(Mucina & Rutherford, 2006) (Photograph 3). Where grazing pressure was high, the shrub *Rhigozum trichotomum* (driedoring) was particularly prominent in the sandy drainage lines (Photograph 4).

Photograph 3: Sandy grassland along drainage lines

Photograph 4: Rhigozum trichotomum in the drainage lines (left) with gravelly bed of the drainage lines within parts of the sandy grassland (right)

Plants of conservation concern:

The Vulnerable *Aloidendron dichotomum (*was *Aloe dichotoma* (quiver tree / tree aloe) occurred scattered throughout the grasslands. Two protected tree species were noted. *Vachellia erioloba* (camelthorn) was recorded within the desert plains east of Pofadder, within the route alternative 3 corridor. This tree was most prominent in the deep sandy soils along the drainage lines or 'washes' between the mountainous rocky desert (Photograph 6).*Boscia albitrunca* subsp.*albitrunca*(witgat) grew scattered within the sandy grassland (Photograph 7). *Hoodia gordonii* (ghaap) was recorded in sandy grassland south of Paulputs substation.

Photograph 5: Vachelia erioloba within sandy grassland in route alternative corridor 3

Photograph 6: Boscia albitrunca in sandy grasslands

2. Arid gravelly grassland

This vegetation association occurred through most of the powerline route corridors and includes the Bushmanland Arid Grassland and calcrete gravel patches as well as elements of the Aggeneys Gravel Vygieveld. The vegetation comprises sparsely vegetated grassland dominated by white grass / bushman grass (*Stipagrostis* species) with open low shrubs. The sands are more gravelly than the sandy grassland with scattered gravel patches (Photograph 7). The sand is underlain by calcrete (also called hardpan) and where the sand eroded away, the white calcrete is exposed (Desmet, 2013 in Eyssell, A. 2017) (Photograph 8).

Photograph 7: Gravelly grassland with gravel patches north of Gamsberg (visible in the background) (right)

Photograph 8: Calcrete areas embedded in the arid grassland

Photograph 9: Disturbed and grazed areas within the alternative 1 and 2 corridors

Plants of conservation concern and endemic plants:

The Vulnerable and provincially protected *Aloidendron dichotomum*(quiver tree) occurred scattered throughout the grasslands as well as the protected tree *Boscia albitrunca* subsp. *Albitrunca* (Photograph 6). A number of endemic species could be present, particularly in calcrete gravel patches.

The area is home to a number of endemics such as *Tridentea dwequensis, Dinteranthus pole-evansii, Larryleachia dinteri, L. marlothii, Ruschia kenhardtensis, Lotononis oligocephala* and *Nemesia maxii*. None of these were recorded within the sampling areas, but are likely present within the corridors.

3. Gravel and quartz veld

Gravel, calcrete and quartz veld include the Aggeneys Gravel Vygieveld. This quartz veld is similar to that of the calcrete patches but has a high occurrence of white quartz on the surface, limited grass species and a higher abundance of small succulent plants. The quartz mostly occurs on undulating landscapes and foot slopes and is known to provide habitat to unique dwarf succulents. The white quartz gravel reflects the sunlight, and is not as hot as the darker rocks and could support unique species not found in the surrounding sandy or gravelly grassland (Photograph 10). The quartz occurs on small patches or interspersed with larger gravel patches (Photograph 11). North of Pofadder, strips of quartz patches can be seen embedded in the rocky desert (Photograph 12).

Photograph 10: A quartz patch next to the N14. Despite past disturbances small succulents were observed such as Dinteranthus microspermus,Anacampseros filamentosa, Avonia (Anacampseros) papyracea subsp.namaensis, Crassula columnaris and Crassula muscosa


Photograph 11: Gravel with some quartz

Photograph 12: White quartz visible between rocky desert vegetation

Most of the vegetation is used for grazing although the quartz areas investigated seem to be more impacted on by existing servitude road and powerline (Photograph 13). The invasive *Prosopis glandulosa* was recorded in previously disturbed areas.

Photograph 13: Towers and tracks within the gravel and quartz veld

Plants of conservation concern:

Hoodia gordonii was recorded in a quartz patch. A high number of endemic and protected species may occur such as *Adromischus nanus,* species, *Dinteranthus microspermus* subsp. *puberulus, Dinteranthus vanzylii, Lapidaria margaretae, Anacampseros bayeriana* and *Lithops julii* subsp *fuller.*

4. Rocky desert and outcrop vegetation

Rocky outcrops and rocky mountainous areas are present between Pofadder and the Paulputs substation. This vegetation association includes the Eastern Gariep Rocky Desert (Mucina and Rutherford, 2006 in Eyssell, A. 2017). Some rocky outcrops and ridges are also scattered eastward towards the town of Aggeneys and may be outliers of the Bushmanland Inselberg Shrubland. These rocky areas are sparsely vegetated or bare and are separated by the sandy plains or sheet-wash plains (Photograph 14).

Photograph 14: Rocky outcrops and rocky desert

Plants of conservation concern:

The Vulnerable and provincially protected *Aloidendron dichotomum* (quiver tree) and protected tree *Boscia albitrunca* were recorded on or in close proximity to the rocky areas. The endemic species *Ozoroa namaquensis* and *Tylecodon sulphurous*could occur within the corridors.

5. Inselberg vegetation

The inselbergs comprise a group of prominent solitary mountains (inselbergs) and smaller koppies towering over surrounding flat plains (Mucina & Rutherford, 2006 in Eyssell, A. 2017). The vegetation is not as sparse as that of the rocky desert vegetation association discussed above. Vegetation on inselbergs is described as the Bushmanland Inselberg Shrubland by Mucina and Rutherford (2006). Only route alternative 3 traverses an inselberg, south-east of Gamsberg (Photograph 15), whereas the corridor of deviation 3A passes through and over a number of inselbergs. Tree-like succulents such as *Ceraria namaquensis*; *Aloe gariepensis* and *Euphoria avis-montana* has been recorded on slopes, while the plateau of some inselbergs such as the Gamsberg is similar to the Aggeneys Gravel Vygieveld (Desmet, 2013). Similar vegetation as to that of the Gamsberg can be expected where route alternative 3 traverses the

inselberg, with Bushmanland Inselberg shrubland on the slopes and the Bushmanland Inselberg Succulent Shrubland on the south facing slope (Desmet, 2013 in Eyssell, A. 2017).

Photograph 15: South-east of Gamsberg, an inselberg where the route alternative 3 is proposed to cross (top left) and typical vegetation on the slopes (remainder of images)

Plants of conservation concern:

Of the vegetation associations delineated, inselbergs are of the most concern as it provide habitat to a number of species of conservation concern, including endemic species and protected trees. It is highly likely that the area traversed by the proposed route 3 alternative could impact on range restricted species.

6. Drainage lines and riparian

Numerous drainage lines cut through the sandy plains and arid grassland. These drainage lines are ephemeral and many originate in the rocky hills and inselbergs. The substrate varies from deep sandy areas such as at T'Goob-se-loopto gravelly, rocky and coarse sand (Photograph 16). Due to the arid climate, no definite riparian vegetation are present, however, the tree layer are more prominent than in any other vegetation association observed and include species found only along the drainage lines.

Photograph 16: The drainage lines varied from small, narrow channels in gravelly grassland (top left), to wide and flat in sandy grassland soils e.g. T'Goop se Loop (bottom right)

Plants of conservation concern:

The protected trees *Vachelia erioloba* (camel thorn) and *Boscia albitrunca* were recorded in or proximate to drainage lines.

More plants of conservation concern that occur in the study area are listed in Table 8 in this report.

Protected Trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. Two of these species were confirmed to occur namely *Boscia albitrunca* (witgat / sheppard's tree) and *Vachellia(Acacia) erioloba* (camel thorn). *Boscia albitrunca* occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. This species was recorded mainly in the arid, gravelly grassland. *Vachelliaerioloba* usually occurs in deep sandy soils or along watercourses in arid areas and was recorded in route alternative 3 corridor east of Pofadder.

Provincially Protected Plants

Provincially, a number of plants are protected by the Northern Cape Nature Conservation Act No.9 of 2009. The removal or pruning of these plants will require a permit from the Northern Cape Department of Environment and Nature Conservation. The list below outlines the provincially protected species that were confirmed to occur in the study area. However, it is thought that during favourable conditions, more protected plant species may be identified to occur along the powerline route alternatives.

Some provincially protected species confirmed to occur:

Species	Protection
Aloidendron dichotomum (quiver tree)	specially protected, schedule 1
Anacampseros filamentosa	All *Anacampseros* species, schedule 2
Boscia albitrunca and *B foetida*	All *Boscia* species, schedule 2
Crassula columnaris and *C.muscosa*	The whole Crassulaceae family, schedule 2
Euphorbia gariepina subsp *gariepina, E. gregaria, E. mauritanica* and *E.spinea*	The whole Euphorbiaceae family, schedule 2

Alien Invasive Plant Species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001 in Eyssell, 2017).

Alien invasive plant species identified within the corridors[6]

Species	Common name	Category
Atriplex lindleyi subsp *inflata (A. inflata)*	Australian Saltbush	Category 1b
Atriplex nummularia	Old Man Salt Bush	Category 2 (NEMBA). Can replace indigenous vegetation
Prosopis glandulosa	Honey Mesquite	Category 3 in Northern Cape
Tamarix chinensis	Tamarisk	Category 1 and 1b invader of riparian areas, especially in dry Northern Cape

[6] The Three Alien Invasive Species Categories are briefly explained in the Vegetation Specialist Report.

9.1.2 VEGETATION VULNERABILITY AND IMPORTANCE

Vegetation of high importance and vulnerability[7]

Inselberg vegetation as well as those inhabiting gravel and quartz patches are regarded as vulnerable to any impacts and are also classified as CBA 1's in the Namakwa Biodiversity Sector Plan. These habitats provide suitable habitat for threatened, protected species and habitat restricted species. These plants could be very cryptic and small and can usually only be positively identified in the growing season. These plants are also restricted in their distribution (endemic). Inselbergs and quartz patches are important topographical features that usually support higher species diversity and are considered valuable features in the natural landscape that have the potential to support a large number of protected plant species. In addition, the vegetation observed here were in a natural state with disturbances noted only where the existing 220kV line traverse quartz veld (Figure 41). Quartz patches in particular does not recover after disturbances and are difficult if not impossible to rehabilitate. It is thus recommended that these areas be avoided or spanned.

Only alternative Corridor 3 traverses inselberg vegetation and are therefore not a preferred route alternative. Alternative 1 and 2 runs parallel to an existing powerline through the quartz veld and if the existing disturbed footprint can be utilised for much of the construction, these routes are preferable.

Vegetation of medium-high importance and vulnerability

Rocky outcrops and mountainous areas are also important topographical features that could support higher species diversity due to the different aspects. In addition, the vegetation observed here were in a natural state with limited disturbances and falls within CBA 2's of the Namakwa Biodiversity Sector Plan. Although the potential occurrence of threatened species is low, the vegetation is unique and not easily rehabilitated.

All three corridors will traverse these habitats, however, route alternative 3 Corridor include more free standing outcrops, whereas the existing powerline through the mountains north of Pofadder disturbance footprint could be utilised for the construction of the line if route alternative 1 or 2 is selected.

Vegetation of medium importance and vulnerability

The majority of the vegetation along the route falls within the sandy and arid, gravelly grassland. The grasslands have intermediate to high levels of species diversity and likely include potential habitat for limited number of threatened species. The grasslands occur over a vast area and are not considered vulnerable to impacts from the powerline. However, cumulative impacts such as the increase in solar plants in the area, could pose a threat to these habitats in the long term.

[7] In order to determine the vegetation condition and importance along the proposed route alternatives, weighting scores as listed in Table 6 in the Vegetation Specialist Report, were applied. This is geographically represented in Figure 41 in this section of the report.

Within the grasslands, particularly the gravelly grassland, calcrete and quartz patches are found and are localised sensitivities that must be investigated during a walk-down.

Drainage lines are protected environments as all watercourses are protected by legislation and impacts on these areas as well as a regulated buffer zone should be avoided. Activities within and in proximity to watercourses (Regulation 1199 of the National Water Act, 1998 (Act 36 of 1998) are subjected to strict mitigation measures and authorisation from the competent authority in order to protect and sustainably utilise South Africa's water resources. Seasonal drainage lines should be valued as potential recharge zones or as discharge zones that sustain vegetation in a more lush state during dry seasons and extended dry periods (Esler *et al,* 2006 in Eyssell, 2017). Any activities that lead to increased erosion and deterioration of the riparian areas can reduce the riparian areas potential to recharge groundwater (Esler *et al,* 2006 in Eyssell, 2017).

All three proposed corridors will traverse vegetation of medium importance to a more-or-less equal extent.

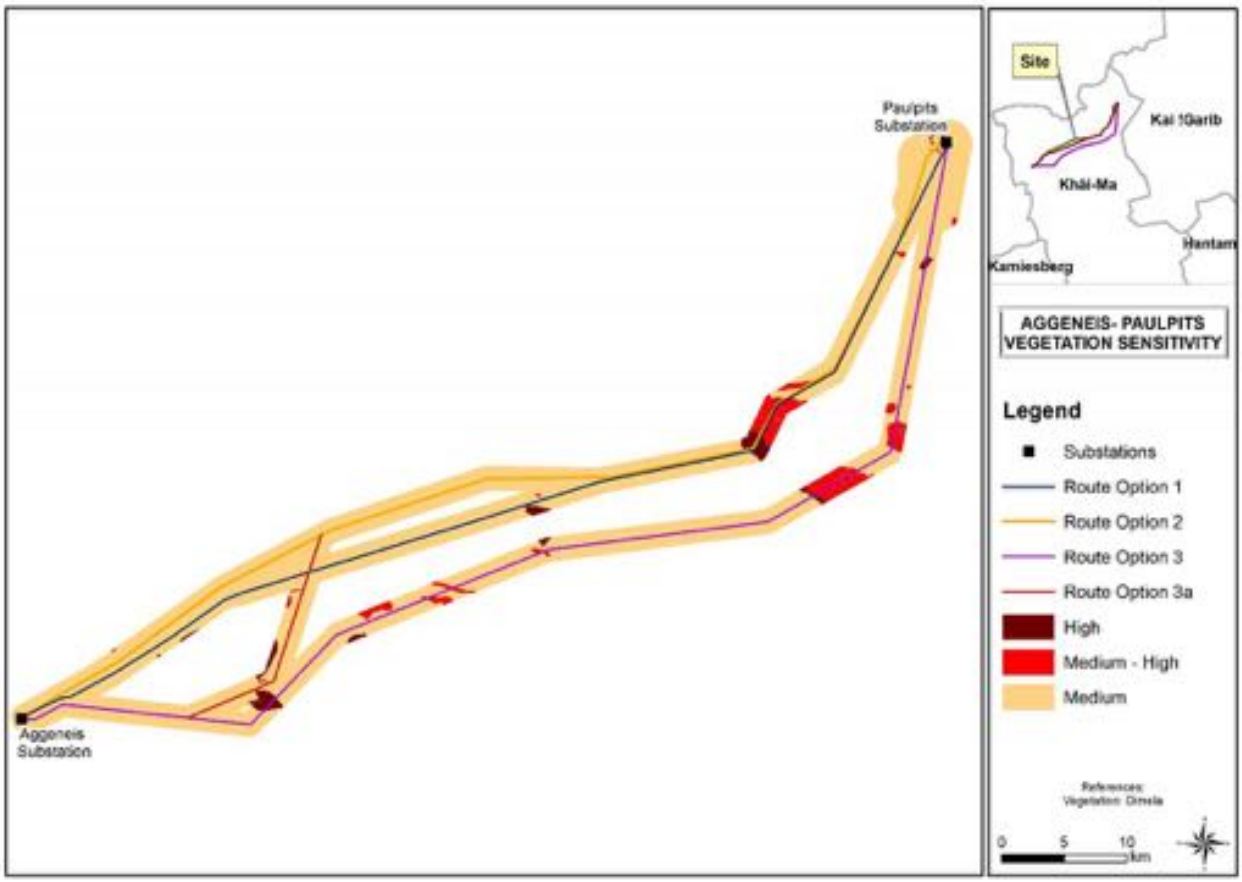


Figure 41: Vegetation sensitivity map

The CBAs of the Namakwa Biodiversity Sector Plan was merged with the high vulnerability and importance vegetation of the vegetation assessment (Figure 42).

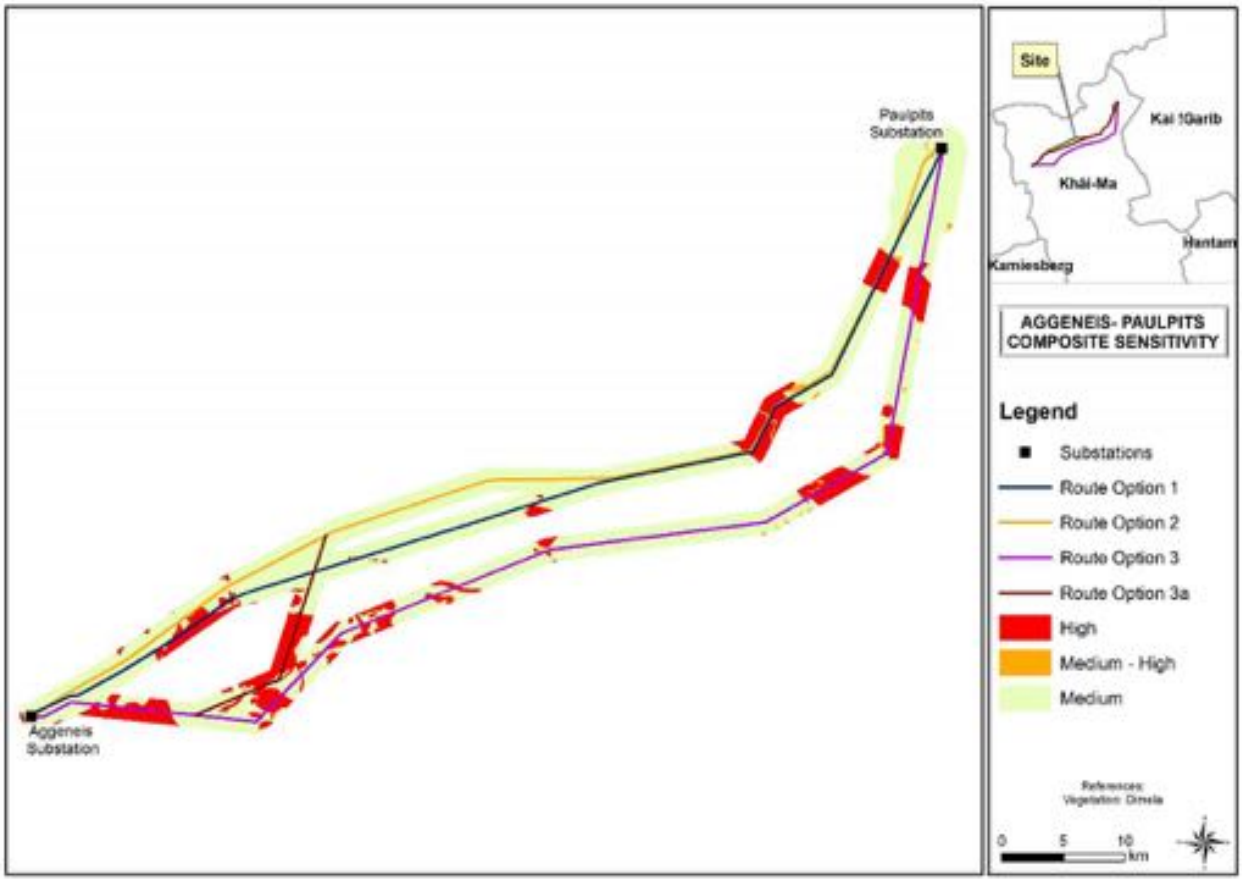


Figure 42: Composite vegetation map, including T1 and T2 CBA's classified as high sensitivity

9.1.3 Vegetation Impacts and Mitigations

The most significant impacts of electrical powerlines are expected to occur during the construction phase. Once in use, the powerlines have relatively contained impacts on the vegetation and can successfully be mitigated to limit or even negate the negative impacts.

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
1. Destruction of natural vegetation The construction of the powerline would inevitably require the removal / destruction of vegetation for the purpose of access, and the tower footprint. This is of particular importance in the vegetation classified as being of medium to high and high vulnerability and importance.	• Corridor 2, which will impact on a smaller area of vulnerable and important vegetation, must be constructed. This route can also utilise existing access roads and servitudes, thereby limiting fragmentation. Corridor 1 could also be considered due to the presence of existing servitudes and

Areas where pylon components and equipment are stored could flatten vegetation that could be detrimental to the persistence of the vegetation.

The illegal disposal of construction material such as oil, cement, amongst others, could destroy natural vegetation. Heavy vehicles and machinery will crush succulents, as well as trampling by workers.

access roads, **if the section west of the Gamsberg could move further west or align within alternative corridor 2.**

- A walk down should be undertaken within the growing period of plant species in the area and after good rains, prior to commencement of construction. The walk down should focus on identifying localised sensitivities and protected plant species that must be avoided (in situ conservation is preferred) or relocated. The walk down should also identify sensitive habitats such as quartz patches with a high diversity and threatened, endemic or protected species that should be circumvented.
- The final route alignment should thus be flexible within the corridor to avoid sensitivities as identified during the walk-down.
- An independent Ecological Control Officer (ECO) should be appointed to oversee construction.
- A protective 200m buffer from any vulnerable and important vegetation should be respected, and include features such as quartz patches and rocky outcrops.
- Limit clearing of indigenous vegetation to pylon positions only.
- Aim to minimise the destruction of indigenous large trees.
- Wood may not be sold as firewood.
- During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
- Restrict the impact on vegetation: a temporary fence or demarcation must be erected around the construction area (include the servitude, construction camps, areas where material is stored and the actual footprint of the development) to prevent access to sensitive and adjacent environs.

- Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Maintain as much vegetation cover as possible.
- A vegetation rehabilitation plan should be implemented. Due to the dry climate, natural colonisation will take a long time, in which vegetation may degrade further. In addition, relying on the seed bank in the soil will be bias towards short lived annuals instead of long-lived, succulent perennials. Therefore, these species should be included in rehabilitation, preferably collected from the site prior to disturbances (note that the removal of plants will require authorisation (permit) from the provincial conservation authorities). A diversity of plant species, resembling the composition prior to disturbance should be attained during rehabilitation. Timeous rehabilitation is imperative. Even in the event of good rains, annual pioneer plants are short-lived and therefore an effort must be made to keep as many shrubs in place as possible or to replace these as part of rehabilitation. As a start, runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler, *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006). Locally collected seeds of *Stipagrostis* grass

	and *Salsola* species could be used to hasten establishment. • Construction workers may not remove flora and neither may anyone collect seed from the plants without permission from the local authority. • No activities should take place during rainy events and at least 2 days afterwards. • Ideally, an on-site ecologist should be present when excavation takes place to ensure that any uncovered species are protected from destruction. Note that threatened, endemic and some protected species are cryptic and could be dormant until favourable climatic conditions arise. • It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.
Significance Without Mitigation:	High
Significance With Mitigation:	Moderate to Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
2. Exposure to Erosion Much of the soils comprise sand and are prone to erosion. The removal or destruction of surface vegetation will expose the soils, which in the event of rain could cause erosion. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully.	• Do not allow erosion to develop before taking action. • Make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Retain vegetation and soil in position for as long as possible, removing it (preferably with intact plants) immediately ahead of construction / earthworks in that area (DWAF, 2005). Rehabilitation should take place continuously, as a section of line is completed. Rehabilitation should be undertaken in accordance to an approved rehabilitation plan, specific to the area. • Runoff from roads must be managed to avoid erosion and pollution problems. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining

natural vegetation cover.

- Runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006). Locally collected seeds of *Stipagrostis* grass and *Salsola* species could be used to hasten establishment.
- Mulch and brush also reduces the force of raindrops, limiting the dispersion of clay and the extent of mineral crusting (Esler *et al,* 2006). It also traps dust, sand and seeds to ensure plant establishment (Esler *et al,* 2006).
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- Shred all woody material cleared and use the chips as mulch for dust and erosion control.
- Where topsoils need to be removed, store such in a separate area where such soils can be protected until they can be re-used for post-construction rehabilitation (never mix topsoils with subsoils or other spoil materials).

Significance Without Mitigation:	High
Significance With Mitigation:	Moderate

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
3. Removal / Destruction of protected plants and plants of conservation concern The construction could result in the removal or	• A suitably qualified person (botanist) must survey the final route during a walk down and specifically the proposed tower positions. The walk down must be undertaken during the

irreversible deterioration of plant species of conservation concern, impact on their habitat, pollinators and inevitably the persistence of these. This could put further strain on the already declining or scare and range restricted populations.

growing season of the plants in order to identify endemic, threatened and protected plants that will be impacted on by the proposed construction. This must take place prior to the finalisation of tower positions and the commencement of construction.

- Where possible, construction activities must be restricted to previously disturbed areas.
- Slight deviations of access tower positions must be permitted, so as to avoid plant populations of conservation concern (DWAF, 2005).
- Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activity and the impact cannot be avoided, the plants should be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). These plants could also be relocated to other suitable and conserved habitats.
- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any species not identified during the EIA phase, or the final walk down are protected from destruction. Note that the species could be dormant for some time until favourable conditions arise.
- The Eskom staff, contractor and construction crew must be educated about the sensitivities involved along the route as well as the potential sensitive species they could encounter.
- Construction workers may not tamper or remove these plants and neither may anyone collect seed from the plants without permission from the local authority.
- Cordon off the sensitive vegetation (e.g. quartz patches) that house the protected plant species and the plants

	of conservation concern and protect from construction activities and vehicles. • Protected tree species should rather be pruned instead of removed. For removal or pruning, a permit must be obtained from the North West Department of Agriculture, Forestry and Fisheries (DAFF). • A permit for the removal or relocation of plant species of conservation concern must be obtained from the Northern Cape
Significance Without Mitigation:	Very High
Significance With Mitigation:	Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
4. Potential increase in invasive vegetation Limited alien invasive plant species were observed at the time of the field survey. However, some annuals may be present, but were dormant at the time. The seed of alien invasive plant species could spread into the disturbed soils. Also, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site.	• All alien seedlings and saplings must be removed as they become evident for the duration of construction. • Manual / mechanical removal is preferred to chemical control. • All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO.
Significance Without Mitigation:	Moderate
Significance With Mitigation:	Moderate to Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
5. Disturbance to drainage lines Removal of vegetation surrounding, drainage lines could affect soil conditions. In addition, all watercourses (including non-perennial rivers and pans) in South Africa are protected by legislation and must be classified as no-go areas along with protective buffer zones. Note that any activities within the watercourses are subject to authorisation by the Department of Water Affairs (DWA) by means of a Water Use	• Avoid placing pylons within 32 m of active riverbank or riparian area where feasible • The powerlines should span the drainage lines and rivers. Where it is unavoidable to place the tower footprint within recommended minimum protective buffer zones, the construction activities must be restricted to as small a footprint possible and rehabilitation undertaken as soon as construction is complete. • No construction / activities can be

License.	undertaken within the riparian area unless a Water Use License was granted by the Department of Water Affairs. • Where access through drainage lines and rivers is unavoidable, only one road is permitted, constructed perpendicular to the drainage line. Avoid roads that follow drainage lines within the floodplain. • Roads should be elevated above the non-perennial rivers so as to minimise the destruction of the drainage bed. • Roads and tracks should not cause erosion within these systems. • After construction, compacted soil access roads should be rip, mechanically break the surface to increase water infiltration. • Construction should take place outside of the rainy season when the flow of the non-perennial rivers is at a minimum. • Do not permit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.
Significance Without Mitigation: Significance With Mitigation:	Moderate Moderate to Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
6. Soil compaction, disruption of quartz fields / gravel / calcrete areas The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation, sterilise quartz and inhibit re-vegetation. Soil compaction as a result of construction vehicles and traffic, could lead to a decrease of water infiltration and an increase of water runoff.	• Construction and stringing (and maintenance) vehicles may not veer from the dedicated roads. • Sensitive ecological features such as the quartz and gravel patches, rocky areas and drainage lines should be cordoned off and no activities be allowed to impact on these. • Once construction is complete, obsolete roads should be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, while vegetation should be re-established. This should be done in accordance with a vegetation rehabilitation plan written by an expert on rehabilitation in these areas.

Significance Without Mitigation:	High
Significance With Mitigation:	Moderate

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
7. Erosion and bare soils Lack of rehabilitation or failed rehabilitation after construction, can result in erosion after construction was completed. The vegetation occurring along the bypass route could degrade over time if suitable rehabilitation of the disturbed soils did not take place. In addition, maintenance vehicles could disturb rehabilitated areas which could lead to soil erosion, habitat modification, trampling of vegetation as well as the destruction of protected plants and plants of conservation concern.	• Leave as much natural vegetation as intact as possible during construction. • Do not disturbed soil unnecessary during maintenance. • After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction. • Ensure that maintenance work does not take place haphazardly, but according to a fixed plan. • Monitor rehabilitation and ensure that alien invasive species are dealt with in accordance to the EMP. • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Monitor rehabilitation and delay the re-introduction of livestock (where applicable) to all rehabilitated areas until an acceptable level of re-vegetation has been reached. • Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.

Significance Without Mitigation:	High
Significance With Mitigation:	Moderate to Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
8. Destruction of natural vegetation During the operational phase, maintenance vehicles could impact on rehabilitated and	• Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation

natural vegetation e.g. maintenance vehicles driving within natural vegetation / quartz fields.	measures as set out for the construction phase should be adhered to. • Maintenance vehicles must not veer from dedicated access roads and activities should be restricted to the previously disturbed footprint. • To prevent the necessity for random vehicle deviations from existing tracks into surrounding veld, ensure that all maintenance tracks are routinely cleared of shrubs and alien invasive species and ensure that maintenance tracks are in good condition. • It is advised that environmental audits be undertaken by an independent party during the operational period, especially in sensitive areas.
Significance Without Mitigation:	High
Significance With Mitigation:	Moderate to Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
9. Possible increase in exotic vegetation If rehabilitation of the indigenous vegetation along the bypass route is unsuccessful or is not enforced, exotic and invasive vegetation may invade the area.	• Implement an alien invasive plant monitoring and management plan whereby the spread of alien and invasive plant species into the areas disturbed by the construction are regularly removed and re-infestation monitored.
Significance Without Mitigation:	High
Significance With Mitigation:	Moderate to Low

9.1.4 Cumulative Impacts

The majority of the study area comprise natural vegetation with minimum transformation and land uses along the powerline routes. Route Corridors 1 and 2 follow existing powerlines, servitudes and access roads for most of its extent and will therefore likely result in the least increase in transformed areas.

The large solar plant at Paulputs substation, the proposed wind farms around Aggeneys and the proposed 400kV powerline between Paulputs and Aggeneys will disturbed and modify vegetation and habitat. In addition, these developments will also cause edge effects into adjacent natural vegetation, which cumulatively will increase the transformed or impacted areas and increase fragmentation.

The amount of servitudes should thus be kept to a minimum, with lines rather running parallel in a wider servitude where feasible, with only one maintenance track necessary in such servitude, rather than each project having a distinct servitude for most of the line route.

NATURE OF CUMULATIVE IMPACT (Corridors 1,2 & 3)	MITIGATION MEASURE
Increase in transformed areas	• Avoid the powerline alternatives (Corridor 3 and 3A) that will not follow existing powerline, servitudes and access roads. • Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Thus new powerlines should follow routes of existing servitudes if such exist, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape or built adjacent to more sensitive habitats. • Prevent the spread of alien and invasive plant species
Erosion of soils and water pollution from access roads or construction camps	• Make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Retain vegetation and soil in position for as long as possible, removing it (preferably with intact plants) immediately ahead of construction / earthworks in that area (DWAF, 2005). Rehabilitation should take place continuously, as a section of line is completed. Rehabilitation should be undertaken in accordance to an approved rehabilitation plan, specific to the area. • Runoff from roads must be managed to avoid erosion and pollution problems.

	• Remove only the vegetation where essential for construction / roads or construction camps and do not allow any disturbance to the adjoining natural vegetation cover. • Construction and stringing (and maintenance) vehicles may not veer from the dedicated roads. • Once construction is complete, obsolete roads and construction camps should be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, while vegetation should be re-established. This should be done in accordance with a vegetation rehabilitation plan written by an expert on rehabilitation in these areas. • No vehicles may be washed on the property, except in suitably designed and protected areas • No vehicles may be serviced or repaired on the property, unless it is an emergency situation in which case adequate spillage containment must be implemented • Stay within demarcated temporary construction areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas • Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering according to the relevant EMPr
Significance Without Mitigation:	• High to Medium
Significance With Mitigation:	• Low

9.1.5 Vegetation Conclusion and Recommendations

Corridors 1 and 2 runs parallel to an existing powerline through the important quartz veld and if the existing disturbed footprint can be utilised for much of the construction, these routes are preferable.

Corridors route 1 and 2 are similar in route alignment and vegetation associations traversed. However, route alternative 1 is situated parallel and within 100m of an existing 220kV powerline for most of its extent, except around the Gamsberg. Existing servitudes and access roads could therefore be used, limiting the clearing of natural vegetation. In its southern extent, prior to reaching Aggeneis substation, alternative corridor 1 passes closer to the Gamsberg and its associated sensitivities, this increases its potential impact on vegetation of concern. Therefore Corridor 2 is the preferred route, as it traverses fewer areas of sensitivity. Corridor 1 could also be considered if the section west of the Gamsberg is moved further west, or linked with Corridor 2 for that section.

Only alternative Corridor 3 and deviation 3A traverse inselberg vegetation of a high conservation importance and are therefore not preferred route alternatives. Furthermore, Corridor 3 and 3A do not follow existing powerlines, servitudes and access roads for most of its extent and will therefore likely result in a high to moderate cumulative impact on transformed areas.

It is recommended that a pre-construction walkthrough survey should be conducted between March and May, depending on rainfall. This must take place prior to commencement of the activity to ensure that all protected, threatened and endemic species are marked to enable avoidance and/or rescue. The walk down should also identify local sensitivities such as quartz patches that should be spanned in order to conserve the habitat and species *in situ*.

9.2 FAUNA ASSESSMENT

9.2.1 Fauna Findings

Site Characteristics and Habitat Diversity

During the site visit, the following site characteristics were observed:

Much of the study area is under relatively low intensity land use, such as livestock farming and is in natural to semi-natural condition.

In terms of terrestrial fauna, examples of the main habitats within the study area can be described as follows:

- Open sand and gravel plains, sparsely vegetated by grasses and karroid scrub, which covers the vast majority of the study area. See Photographs 17- 19 below.

Photograph 17: Sparsely vegetated, open plains in the east of the study area, 4km south-west of Pofadder on Alternative 3

Photograph 18: Sparsely vegetated, open plains, 13km west of Pofadder, close to Alternatives 1 and 2

Photograph 19: Open plains in the west, south of Gamsberg, where Alternative 3 will pass over or close to this smaller mountain

- Rocky, sparsely vegetated mountainous areas. See Photograph 20, and 21 below:

Photograph 20: Rocky mountainside, with an existing powerline traversing it, 8km north of Pofadder

Photograph 21: Rocky habitat with mountains in background, approximately 7km north of Pofadder (Alternatives 1 and 2)

- Rocky plains, adjacent to mountainous areas, see Photograph 22 below.

Photograph 22: rocky plains, 3km north of Pofadder (Alternatives 1 and 2)

Rare and Threatened Mammals

Eight species of conservation importance are expected to occur within portions of the study area (Table 15). A number of these are rare, low density species and may occur along portions of the route, although at low numbers within their required habitats. Furthermore, some of these have large home ranges (Brown Hyena) (Skinner & Chimimba 2010 in Harvey, 2017) and, if present, any portion of the study area is likely to form a relatively small proportion of the area they routinely utilise.

Table 15: Rare and threatened mammals occurring or likely to occur within the study area
(CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient)

Common Name	Conservation Status	Comment	Occurrence within the study area
Black-footed Cat	RD – LC (likely to be Redlisted in forthcoming assessment)	A rare species, occurring at low densities in semi-arid grassland, karoo and savanna. Threatened by habitat degradation and poisoning	May occur widely but sparsely in open habitats.
Leopard	RD – LC (likely to be Redlisted in forthcoming assessment)	Widely, but sparsely distributed, in western South Africa, largely restricted to mountainous areas. Threatened by habitat loss and human persecution.	May occur rarely in mountainous habitat.
Brown Hyena	RD – NT	Occurs at low densities in semi-arid grassland, karoo and savanna. Primarily threatened through poisoning and predator-control activities.	May occur widely but sparsely in areas of natural vegetation, where some shelter is present. Rare in the region.
Angolan Hairy Bat	RD – VU	Poorly known; occurs in semi desert areas, recorded in riverine habitats, but may forage widely over surrounding habitats. Primarily threatened by	May forage over the study area, but will roost in mountainous/riverine areas within the broader landscape.

		habitat destruction or disturbance of roosting sites.	
Littledales' Whistling Rat	RD – NT	Widely but apparently patchily distributed, and may be threatened by stochastic events e.g. disease	May occur widely in open areas with denser vegetation. Recorded near Gamsberg on open plains (Groundtruth 2013)
Dassie Rat	RD - NT	Restricted to mountainous areas.	Recorded on Gamsberg. Will be confined to mountainous areas, and therefore largely absent from actual footprint
Cape Horseshoe Bat	RD – NT	Requires caves for roosting and occurs widely over surrounding habitats. Primarily threatened by destruction or disturbance of roosting sites.	may forage over the study area but unlikely to roost anywhere in or close to the development footprint.
Honey Badger	RD – NT	Wide habitat use but occurs at low densities. Threatened by human persecution.	May occur widely but sparsely in areas of natural vegetation.

Rare and Threatened Amphibians

No threatened amphibian species are known or expected to occur within the study area. (Measey 2011; IUCN.org 2011 in Harvey, 2017) (Table 16). Three species are fairly localised endemics, with somewhat specialised habitat requirements. However, these three species are expected to be absent from the actual footprint of the development, given that they are restricted to rocky, mountainous areas in the far west of the study area, and the routes examined avoid these specific habitats.

Table 16: Rare and threatened amphibians occurring or likely to occur within the study area
(CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient)

Common Name	Conservation Status	Comment	Occurrence within the study area
Namaqua Caco	Least Concern	A fairly localized endemic, endemic to Namaqualand, and found in rocky areas in karroid vegetation	Recorded from Gamsberg – it is likely to be restricted to this area within the study area. Expected to be absent from actual powerline footprint.
Namaqua Stream Frog	Least Concern	A fairly localized endemic, endemic to Namaqualand, and found in rocky areas in karroid vegetation	Recorded from Aggeneys area – it is likely to be restricted to this mountainous habitat in the extreme west of the study area. Expected to be absent from actual powerline footprint.
Paradise Toad	Least Concern	A fairly localized endemic, endemic to Namaqualand, and found in rocky areas in karroid vegetation	Recorded from Gamsberg – it is likely to be restricted to this area within the study area. Expected to be absent from actual powerline footprint.

Rare and Threatened Reptiles

Two threatened reptiles are known or expected from the study area. In addition, a further three species are considered notable because of their localised distributions and specialised habitat requirements (Bates et al. 2014 in Harvey, 2017) (Table 17). However, all of these species are restricted to rocky, mountainous habitats – the majority of the area covered by all alternative routes consists of unsuitable habitat for these species. Habitat for these species is only present within the corridors immediately south of Gamsberg (near Aggeneys), and in the area north and east of Pofadder.

Table 17: Rare and threatened reptiles occurring or likely to occur within the study area
(CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient)

Common Name	Conservation Status	Comment	Occurrence within the study area
Speckled Padloper	RD - VU	A fairly localized endemic, endemic to Namaqualand, and found in rocky areas in karroid vegetation. Threatened by habitat loss and degradation	A single individual recorded north of Pofadder may represent an isolated population of this species (Branch 2007). Within the study area, likely to be restricted to the mountainous area north of Pofadder
Good's Gecko	RD - VU	A localized endemic, restricted to the mountains associated with the lower Gariep River. Threatened by habitat loss through mining.	Recorded from Aggeneys area – it is likely to be restricted to this mountainous habitat in the extreme west of the study area
Desert Mountain Gecko	Least Concern	A fairly localized habitat specialist, restricted to the mountains associated with the lower Gariep River.	Found in mountainous areas close to Aggeneys and north of Pofadder; absent elsewhere.
Haacke's Gecko	Least Concern	A localized habitat specialist, restricted to the mountains associated with the lower Gariep River.	Found in mountainous areas close to Aggeneys and north of Pofadder; absent elsewhere.
Desert Mountain Adder	Least Concern	A localized habitat specialist, restricted to the mountains associated with the lower Gariep River.	Found in mountainous areas close to Aggeneys and north of Pofadder; absent elsewhere.

9.2.2 Fauna Impacts and Mitigations

Overall, the development is not expected to have significant negative impacts on terrestrial vertebrate fauna. Potential negative impacts relating to these fauna as a result of the development are identified below.

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
1. Disturbance A degree of disturbance will occur to fauna that are present within and immediately adjacent to the footprint area during construction. Animals will likely avoid these areas during this time, but should use such areas post-construction.	Ensure disturbance sources (machinery, personnel movement etc) are kept to a restricted construction area, and that adjacent areas are not disturbed unnecessarily
Significance Without Mitigation:	Moderate
Significance With Mitigation:	Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
2. Habitat loss A small amount of habitat loss will take place within the footprints of the towers. However, within the broader landscape, this will represent a very small area and is unlikely to have a major effect on local terrestrial fauna. The powerlines themselves will be supported by the towers and will have no impact on terrestrial fauna. In general, vegetation clearance is expected to be minimal, given that much of the vegetation is naturally low and sparse.	Disturbance and destruction of habitat must be kept to the most restricted corridor possible. Any disturbance beyond the corridor is prohibited. This should be monitored throughout construction.
Significance Without Mitigation:	Moderate
Significance With Mitigation:	Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
3. Pollution During and Following Construction There is potential for waste products to be dumped into adjacent areas, during and following completion of the construction phase.	All potential pollutants to be safely stored and promptly removed from the construction corridor. No pollutants should be allowed outside of a restricted and defined construction corridor. Any violation of this should be prohibited. This should be monitored during and upon completion of the construction phase.
Significance Without Mitigation:	Low
Significance With Mitigation:	Minor

Please note: There are no cumulative impacts anticipated on terrestrial fauna.

9.2.3 Fauna Conclusion and Recommendations

All three alternatives could be used without any significant effect on terrestrial fauna. However, from a holistic point of view, Corridor 3 is more sensitive, as it traverses a greater extent of both Critically Biodiversity Areas and Important Bird Areas than do the other two routes. In this regard, Corridors 1 and 2 are preferable, and any deviation within those routes that followed existing lines or roads, would be most acceptable.

The following mitigations are recommended:

1. All attempts to minimise unnecessary disturbance and habitat loss during the construction phase should be employed.

2. During construction, all efforts must be made to minimise pollution and disturbance to areas outside the demarcated development footprint - no waste of any kind must be allowed to enter the surrounding areas during construction.

9.3 AVIFAUNA ASSESSMENT

9.3.1 Avifauna Findings

Bird Micro Habitats

Most of the study area is flat arid plains, with either quartz based gravelly plains, or red soils associated with red dunes. There are two areas of rock ridges which the powerline must traverse, just north of Pofadder and in the far south towards Aggeneys.

The open plains will be important for large terrestrial bird species such as bustards and korhaans, and smaller species such as Red Lark (associated with the red dunes and associated plains); Sclater's Lark associated with gravelled plains, Burchell's Courser *Cursoriusrufus*, and others.

The rock ridges will be important for African Rock Pipit *Anthuscrenatus* and various other small species, in addition to Verreaux's Eagle *Aquila verreauxii*, which may breed here if suitable vertical cliffs or other nesting substrate (such as powerlines) exist.

Examples of the various micro habitats can be seen in the Photographs 23 – 24 below.

Photograph 23: Examples of the dominant micro habitat on site – arid plains

Photograph 24: Red dunes on the site

Bird Species Present in the Study Area

A full list of species recorded during field work can be seen in the table blow. A total of 39 species were recorded. This includes 3 Red Listed species; Martial Eagle *Polemaetusbellicosus*; Lanner Falcon *Falco biarmicus* and Karoo Korhaan *Eupodotisvigorsii* (indicated in **bold**).

Table 18: List of species recorded during field work on site

Species primary name	*Species tertiary name*	Latitude	Longitude
Karoo Korhaan	***Eupodotisvigorsii***	**-28.9074**	**19.77457**
Sociable Weaver	*Philetairussocius*	-28.9073	19.77416
Sabota Lark	*Calendulaudasabota*	-28.8982	19.74513
Pied Crow	*Corvusalbus*	-28.8961	19.73853
Rufous-eared Warbler	*Malcorus pectoralis*	-28.8895	19.71731
Ant-eating Chat	*Myrmecocichlaformicivora*	-28.8537	19.59352
Mountain Wheatear	*Myrmecocichlamonticola*	-28.8537	19.59352
Rock Martin	*Ptyonoprognefuligula*	-28.8381	19.58584
Chat Flycatcher	*Bradornisinfuscatus*	-28.9547	19.5324
Cape Turtle Dove	*Streptopeliacapicola*	-28.9985	19.51182
Lanner Falcon	***Falco biarmicus***	**-29.0206**	**19.48708**
Greater Kestrel	*Falco rupicoloides*	-29.0225	19.48498
Spike-heeled Lark	*Chersomanesalbofasciata*	-29.0225	19.48496
Southern Fiscal	*Laniuscollaris*	-29.1184	19.42525
Pale Chanting Goshawk	*Melieraxcanorus*	-29.1075	19.4516
Pygmy Falcon	*Polihieraxsemitorquatus*	-29.075	19.53309
Cape Robin-Chat	*Cossyphacaffra*	-29.129	19.39607
Laughing Dove	*Spilopeliasenegalensis*	-29.1278	19.39583
Bokmakierie	*Telophoruszeylonus*	-29.1321	19.33302
Southern Masked Weaver	*Ploceusvelatus*	-29.1301	19.28843
White-browed Sparrow-Weaver	*Plocepassermahali*	-29.1301	19.28856
Karoo Long-billed Lark	*Certhilaudasubcoronata*	-29.1301	19.28864
Pale-winged Starling	*Onychognathusnabouroup*	-29.1901	19.0071
Rock Martin	*Ptyonoprognefuligula*	-29.1901	19.0071
Familiar Chat	*Oenanthefamiliaris*	-29.1271	19.21552
Rock Kestrel	*Falco rupicolus*	-29.2965	18.81177
Karoo Prinia	*Priniamaculosa*	-29.2558	18.91016
Mountain Wheatear	*Myrmecocichlamonticola*	-29.1901	19.0071
Pygmy Falcon	*Polihieraxsemitorquatus*	-29.1901	19.0071
Karoo Korhaan	*Eupodotisvigorsii*	-29.3147	19.01607
Pale Chanting Goshawk	*Melieraxcanorus*	-29.2948	18.9865
African Red-eyed Bulbul	*Pycnonotusnigricans*	-29.1279	19.39586
Dusky Sunbird	*Cinnyrisfuscus*	-29.129	19.39623
Orange River White-eye	*Zosterops pallidus*	-29.129	19.39623

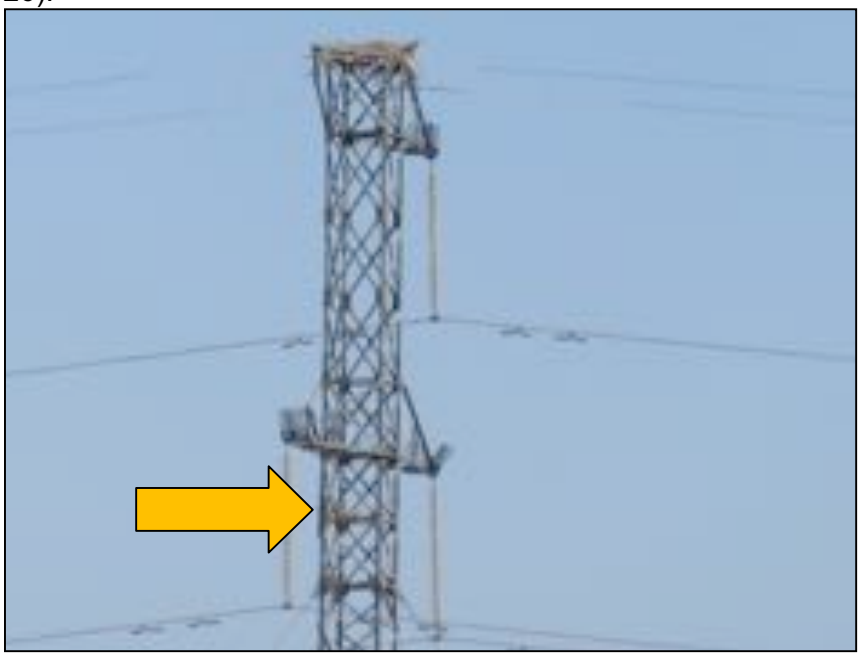
Cape Sparrow	*Passer melanurus*	-29.1254	19.39797
House Sparrow	*Passer domesticus*	-29.1255	19.39799
White-throated Swallow	*Hirundoalbigularis*	-29.1552	19.10527
Red-eyed Dove	*Streptopeliasemitorquata*	-28.8381	19.58584
Cape Bunting	*Emberizacapensis*	-28.8381	19.58584
White-backed Mousebird	*Coliuscolius*	-29.059	19.42618
White-throated Canary	*Crithagraalbogularis*	-29.0591	19.42616
Namaqua Dove	*Oenacapensis*	-28.9184	19.7661
Scaly-feathered Finch	*Sporopipessquamifrons*	-28.8381	19.58584
Martial Eagle	***Polemaetusbellicosus***	**-28.9097**	**19.55209**
Sabota Lark	*Calendulaudasabota*	-28.9097	19.55222

The identification of the species during the field visit was of very low abundances. This is to be expected in this area where many of the large terrestrial species are nomadic, in response to rainfall and food availability. The important factor for this assessment is that these species could occur in much higher abundances on site from time to time in response to rainfall and hence be at temporarily high risk of impact from the proposed powerline.

The most important finding from field work is the presence of an active Martial Eagle nest on the existing 220kV Aggeneis-Paulputs powerline, in the far north of the site near Paulputs substation (see Photograph 25 below). This nest had an immature and an adult eagle on it at the time. **This will be a sensitive feature and will need to be carefully managed during the construction of the proposed powerline to ensure that breeding of these birds is not disturbed.**

Photograph 25: The Martial Eagle Polemaetusbellicosus nest in the Aggeneis-Paulputs study area

Of importance (but less important than the Martial Eagle nest) was the presence of a Greater Kestrel *Falco rupicoloides*nest just below the eagle nest, on the same tower (see Photograph 26).



Photograph 26: The Greater Kestrel Falco rupicoloides nest in the Aggeneis-Paulputs study area

Sensitivity in the Study Area

This is an arid, relatively uniform study area, in which it is challenging to identify areas of higher and lower sensitivity. However, two features do stand out: the red dune areas, which are particularly important for the Red Lark; and the Martial Eagle nests. These have been mapped in the Figure 43 below.

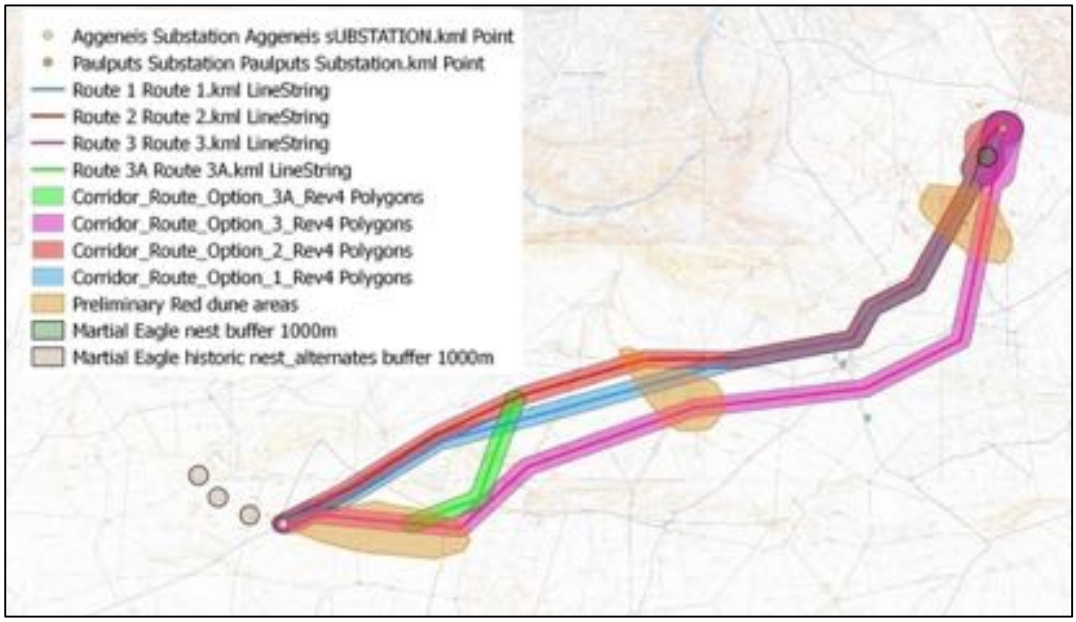


Figure 43: Sensitive avifaunal features in the Aggeneis Paulputs 400kV powerline study area

Important Bird and Biodiversity Areas

Two such Important Bird Areas (IBA's) are relevant to this study: the Haramoep and Black Mountain Mine IBA, which encompasses the Aggeneis Substation in the west; and the Mattheus-Gat Conservation Area IBA which encompasses the Paulputs Substation area. In both cases, these IBA's are unavoidable by the proposed powerline, since it must connect the two existing substations, which lie in the IBA's.

Both these IBA's are important for globally threatened species such as Red Lark, Sclater's Lark, Kori and Ludwig's Bustards, and Black Harrier *Circus maurus* (Marnewick *et al,* 2015). **Karoo Korhaan** is regionally threatened and occurs here. Additional species present in this IBA include: Martial Eagle *Polemaetusbellicosus*; Secretarybird *Saggittarius serpentarius*; Verreaux's Eagle *Aquila verreauxii*; Booted Eagle *Hieraaetuspennatus*; Black-chested Snake Eagle *Circaetus pectoralis*; Cape Eagle Owl *Bubo capensis*; and Spotted Eagle-Owl *Bubo africanus*. Nama Karoo biome specialist species which occur here include: Stark's Lark *Spizocorysstarki*; **Karoo Long-billed Lark *Certhilaudasubcoronata***; Black-eared Sparrow-lark *Eremopterixaustralis*; **Tractrac Chat *Cercomelatractrac***; **Sickle-winged Chat *Cercomela sinuate***; **Karoo Chat *Cercomelaschlegelii***; Layard's Tit-Babbler *Sylvia layardi*; Karoo Eremomela*Eremomelagregalis*; Cinnamon-breasted Warbler *Euryptilasubcinnamomea*; Namaqua Warbler *Phragmaciasubstriata*; **Sociable Weaver *Philetairussocius***; **Pale-winged Starling *Onychognathusnabouroup*** and Black-headed Canary *Serinusalario*.

Species in **bold** above were recorded on site during the field work.

Renewable energy developments (some of which are already operational) are the newest threat to the habitat in these IBA's. New powerlines are also listed a threat to the birds in this IBA (Marnewick*et al,* 2015 in Smallie, 2017).

The figure below shows the layout of these IBA's relative to the proposed powerline.

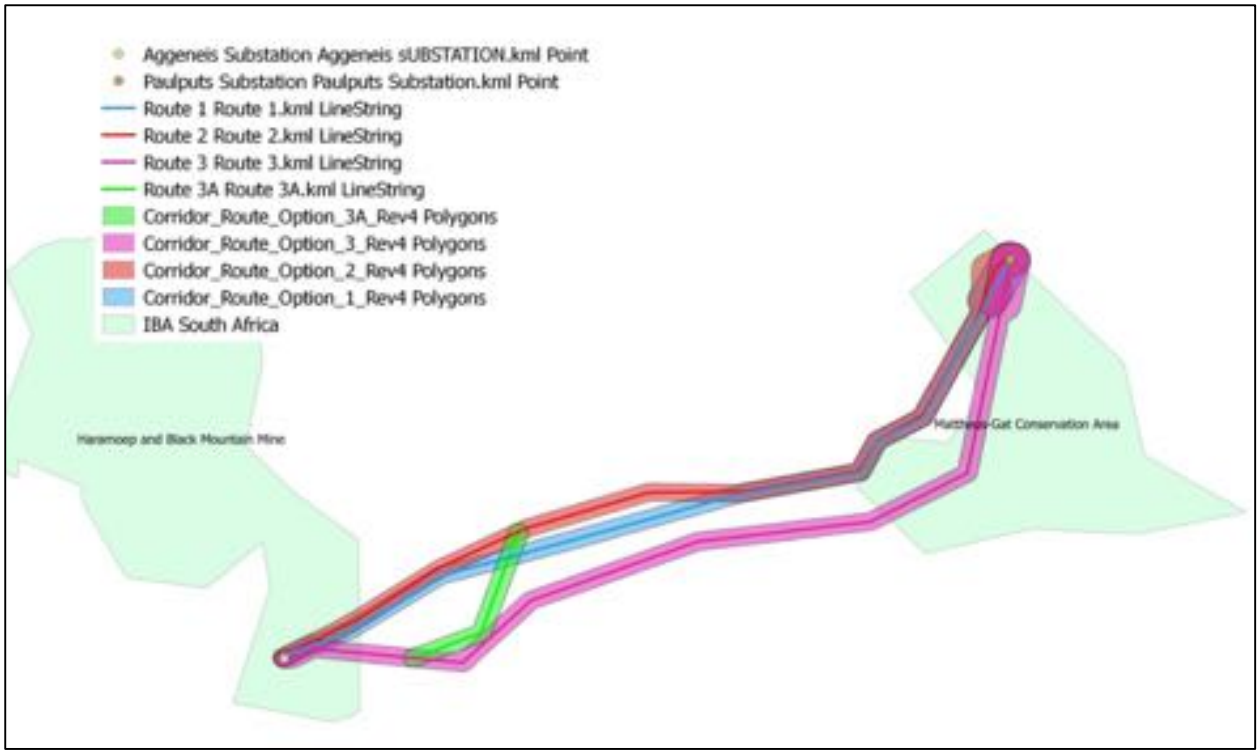


Figure 44: IBA position relative to the proposed Aggeneis-Paulputs 400kV powerline

9.3.2 Avifauna Impacts and Mitigations

The avifaunal impact assessment is primarily aimed at assessing the potential threat to important or Red-listed species that occur or potentially occur along the proposed powerline routes. It is believed that the Red Listed species will also serve as surrogates for other non Red List species in the same ecological groups.

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
1. Collision of birds with earth wires and conductors. Key species being Ludwig's Bustard, Kori Bustard, Secretarybird, Karoo Korhaan, Martial Eagle (particularly fledglings at nest)	It is essential that Option 1 be selected, whereby the new powerline is placed immediately adjacent to (defined as not more than 150 m between outer conductors) the existing 220kV powerline. This will hopefully provide partial mitigation for the impact of collision. In addition, the new powerline must be installed with the very latest and most effective Eskom approved line marking

	devices available at the time of construction. These should be fitted on the earth wires, with 100% of each span marked (not the middle 60% of each span previously stipulated in Eskom Transmission guidelines). This installation must be done according to Eskom best practice at the time, but should include the following at least: markers must alternate between a light and dark colour to provide contrast against a dark and light background respectively. These markers must be no more than 20 m apart on each earth wire and must be placed along the full length of the earth wire (not only the middle two-thirds as done previously). It is Eskom's responsibility to ensure the integrity of these devices for the full lifespan of the powerline. If these devices become damaged or their effectiveness is in any way compromised with time they must be replaced. Likewise if significantly more effective devices become available, these must be installed on the powerline. In addition, a site specific EMP (avifaunal walk through) must be conducted to identify and provide final confirmation of the high risk sections of this powerline. It is also Eskom's responsibility to monitor the impacts of this powerline and the effectiveness of the mitigation measures installed.
Significance Without Mitigation:	High
Significance With Mitigation:	Moderate

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
2. Destruction of bird habitat during construction of the powerline and substation extensions, and to a lesser extent maintenance. Key species are Red & Sclater's Lark, Burchell's Courser and other arid zone small passerines.	A construction EMP (avifaunal walk through) must be conducted to identify any particularly sensitive habitats and environmental best practice must be followed during construction and maintenance activities. An on-site ECO must be responsible for ensuring compliance and minimising habitat destruction during construction. All existing roads and storage sites must be used where possible. No towers should be placed within 100m of red dunes and water sources (drinking troughs, wind mills, reservoirs). No vehicle or human traffic should be allowed through these areas either. Towers should be spaced to avoid these areas and accessed during construction from either

	side, not continuously along the servitude. The red dunes have been digitised as far as possible off Google Earth (See Figure 9), but this aspect, and the surface water sources will require more confirmation during the avifaunal walk through.
Significance Without Mitigation	High
Significance With Mitigation	Moderate

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
3. Disturbance of birds during construction of the powerline and substation extensions, and to a lesser extent maintenance. Key species are Martial Eagle (at the identified nest site), Red &Sclater's Lark, Burchell's Courser and other arid zone small passerines.	A site specific avifaunal walk through for the construction EMP must be conducted and environmental best practice must be followed during construction and maintenance activities. The avifaunal walk through must include an assessment of any nests in the area, particularly on the other powerlines existing in the area. An on-site ECO must be responsible for ensuring compliance and minimising disturbance during construction. No construction activities for the new line should take place within 1km of the Martial Eagle nest (see Photograph 25) on the existing powerline during breeding season. The exact timing of breeding season will need to be confirmed just prior to construction, but is likely to be approximately March to September. If any other breeding raptors or other Red-listed bird species are identified during the site-specific EMP/avifaunal walk through, case-specific management measures must be developed by an avifaunal specialist. No towers should be placed within 100m of red dunes and water sources (drinking troughs, wind mills, reservoirs). No vehicle or human traffic should be allowed through these areas either. Towers should be spaced to avoid these areas and accessed during construction from either side, not continuously along the servitude. The red dunes have been digitised as far as possible off Google Earth (see Figure 43 Sensitivity Map), but this aspect, and the surface water sources will require more confirmation during the avifaunal walk through.
Significance Without Mitigation	High

Significance With Mitigation	Moderate

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
4. Nesting of birds on towers. Key species are Martial &Verreaux's Eagle, Lanner Falcon, Greater Kestrel.	Impacts cannot necessarily be mitigated. However, note that any intervention with nesting once the line is operational must be subject to national and provincial legislation and Eskom nest management guidelines. A suggestion is to use a cross rope suspension configuration to minimise the chances of nests being built.
Significance Without Mitigation Significance With Mitigation	Low Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
5. Electrical faulting on lines, caused by birds. Key species are Martial & Verreaux's Eagle	Electrical faulting is very dependent on the exact tower structure used. The tower structure to be used for the proposed powerline has not yet been confirmed by Eskom. We recommend strongly that a cross rope suspension tower be used, as this presents less suitable perching or nesting substrate for large birds than a guyed-V or self-support tower.
Significance Without Mitigation: Significance With Mitigation:	Low Low

9.3.3 Cumulative Impacts of Multiple Projects on Birds in the Area

In the Aggeneis-Paulputs study area, where multiple facilities impacting on birds in similar ways may be built, it is important to consider the overall or cumulative impact of these facilities on birds. Consideration of each project in isolation may not adequately judge the effect that projects will have on avifauna when combined.

We are aware of the following developments within a 30km radius of the proposed powerline:

- we are aware of two operational renewable energy facilities in the Paulputs area: the large kaxu solar one parabolic trough concentrating solar power facility (approximately 780ha); and the much smaller konkoensies 1 pv facility (approximately 15ha) (see locality map in Annexure B). In addition to those two, we are aware of another proposed solar pv facility just south of Paulputs substation.
- other existing relevant infrastructure includes the existing Paulputs substation, and two overhead power lines: a 33kV line and the existing Aggeneis-Paulputs 220kv line.

- at the Aggeneis substation end of the project, we are aware of one 40 mw solar pv project south west of Aggeneis substation; multiple existing mines; and multiple existing powerlines.

Challenges specific to the Aggeneis Paulputs area and avifauna include:

» The difficulty in defining which projects to include in a CIA. Not all the projects in the area have obtained environmental authorisation, or authorisation from the Department of Energy, so may never materialise. The question is which projects should be considered then, only those authorised, or those successful bidders, or those that have reached financial close.
» The difficulty in defining the spatial extent of a CIA, bearing in mind that some of the relevant bird species move hundreds of kilometres across the landscape and could theoretically be affected by developments within this entire range.

Please note: The mitigations for the cumulative impacts are the same as those detailed in Section 9.3.2 above. The ratings are outlined in the matrix table in Annexure C.

9.3.4 Avifauna Conclusion and Recommendations

It is concluded that Corridor 1 is the preferred route from an avifaunal perspective. This is primarily because the line can be placed adjacent to an existing line for its entire route, an option not possible with the other alternatives. It also passes through Important Bird Areas for the least possible distance.

The following mitigations are recommended:

1. The new powerline should be placed immediately adjacent to (defined as not more than 150 m between outer conductors) the existing 220kV powerline. This will hopefully provide partial mitigation for the impact of collision.

2. The new powerline must be installed with the very latest and most effective Eskom approved line marking devices available at the time of construction. These should be fitted on the earth wires, with 100% of each span marked (not the middle 60% of each span previously stipulated in Eskom Transmission guidelines).

3. This installation must at least include the following:
   Markers must alternate between a light and dark colour to provide contrast against a dark and light background respectively. These markers must be no more than 20 m apart on each earth wire. It is Eskom's responsibility to ensure the integrity of these devices for the full lifespan of the powerline. If these devices become damaged or their effectiveness is in any way compromised with time they must be replaced. Likewise if significantly more effective devices become available, these must be installed on the powerline.

4. No construction activities for the new line should take place within 1km of the Martial Eagle nest (see Photograph 25) on the existing powerline during breeding season if it is active. The coordinated of this particular tower is at: **28 54' 32.30" S 19 32' 53.21" E.** The

exact timing of breeding season will need to be confirmed just prior to construction, but is likely to be approximately March to September.

5. All existing roads and storage sites must be used where possible.

6. No towers should be placed within 100m of red dunes and water sources (drinking troughs, wind mills, reservoirs). No vehicle or human traffic should be allowed through these areas either. Towers should be spaced to avoid these areas and accessed during construction from either side, not continuously along the servitude. The red dunes have been digitised as far as possible off Google Earth (See Figure 43), but this aspect will require more confirmation during the avifaunal walk through.

7. It is recommended strongly that a cross rope suspension tower structure be used, since this will provide less perching and nesting substrate for large birds than a guyed-V or self-support structure.

8. A construction EMPr (avifaunal walk through) must be conducted to:
    a. Determine whether the Martial Eagle nest is occupied and define the breeding season in that year.
    b. Identify any other nests of sensitive species that may require management measures.
    c. identify any particularly sensitive habitats, including red dunes and surface water in the form of windmills/reservoirs/drainage lines.
    d. provide final confirmation of the high risk sections of this powerline.

9. An on-site ECO must be responsible for ensuring compliance with the recommendations and minimising habitat destruction during construction.

10. The ECO must also identify any other breeding raptors or other Red-listed bird species. If any are found case-specific management measures must be developed by an avifaunal specialist.

11. In terms of the cumulative impacts of multiple projects on birds: It is recommended that each project within this broader area ensures that no effort is spared in mitigating impacts on avifauna. It is hoped that if each project provides sufficient mitigation, the overall cumulative impact can be reduced. There are strong grounds for a strategic cumulative avifaunal impact assessment to be conducted for the greater Aggeneis and Paulputs areas respectively. It is recommended that the Department of Environmental Affairs implement such a study.

9.4 WETLAND ASSESSMENT

9.4.1 Wetland Findings

Watercourses identified and delineated within each corridor alternative were classified into three groups and illustrated in Figures 45- 50.

The three classified watercourse groups comprise:

Ephemeral channels and drainage lines: Represent linear and narrow watercourses in the form of headwater drainage lines (second order drainage lines and channels). These features were captured as lines during the delineation process. They can be marginal in nature with discontinuous or poorly developed channels that represent swales due to poor channel development in arid areas with low rainfall, high evapotranspiration and high infiltration in areas with sandy soils. No hydromorphic (wetland soil) or hydrophyte (wetland plant) indicators are expected in these watercourses. Aerial imagery interpretations identified linear features with textural changes that were regarded to be associated with areas of preferential flows during cyclic surface flow events that can occur at frequencies that are several years apart.

Washes and ephemeral rivers: Represent larger and wider watercourses that include NFEPA rivers and broad watercourses that can lack distinct channel development, such as washes (laagtes in Afrikaans). Washes that lack distinct channel features do often display braided channel configuration referred to as bar and swale topography. Discontinuous streams can also display a stream pattern characterized by alternating erosional and depositional reaches (See Appendix A in the Wetland Report for more explanation).

Pan/Depression wetlands: Represent pan or depression wetlands. Pan is a synonym for depression wetlands (Ollis *et al.* 2013 in Grobler, 2016). Depression wetlands, or pan wetlands, represent depressions in a landscape that are inwardly draining (endorheic). In arid to semi-arid environment, such as the study area, these watercourses are not necessarily associated with signs of hydromorphic features or hydrophytes, due to infrequent inundation cycles and shorter periods of saturation. This watercourse type is expected to be under represented within the study area as numerous small pan wetlands the size of a small house and smaller can easily be missed as part of the described approach.

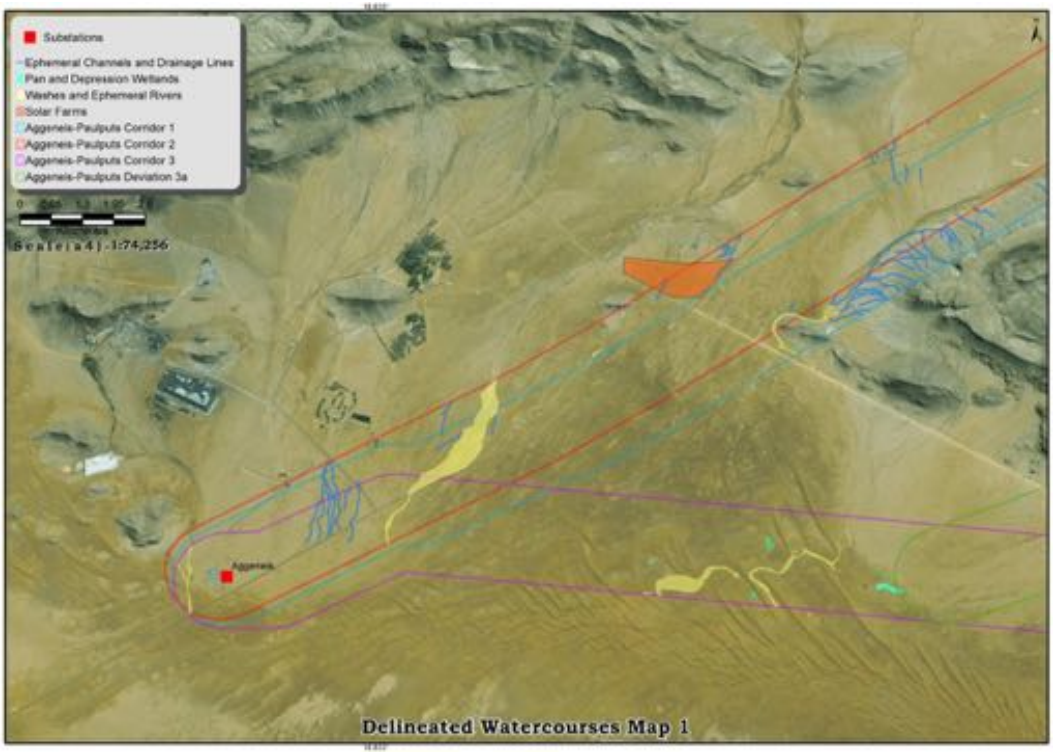


Figure 45: Delineated watercourses in the western-most section of the study area around Aggeneys substation

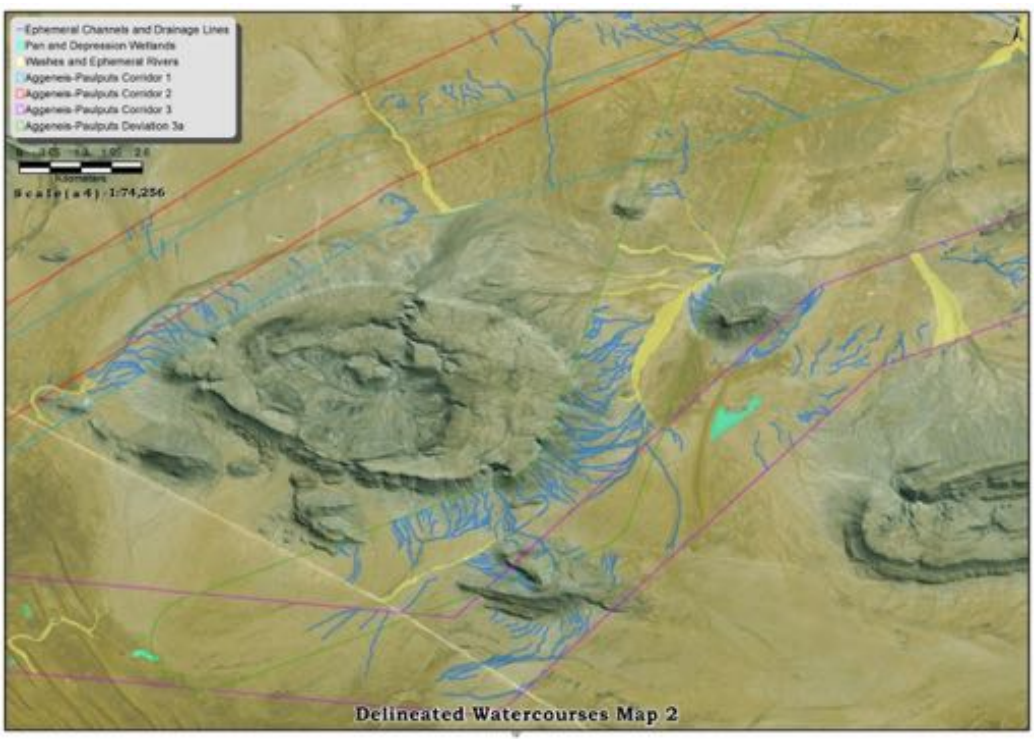


Figure 46: Delineated watercourses in the western portion of the study area around Aggeneys se Berge (west), Ghaamsberg (centre) and Tafelkop (east)

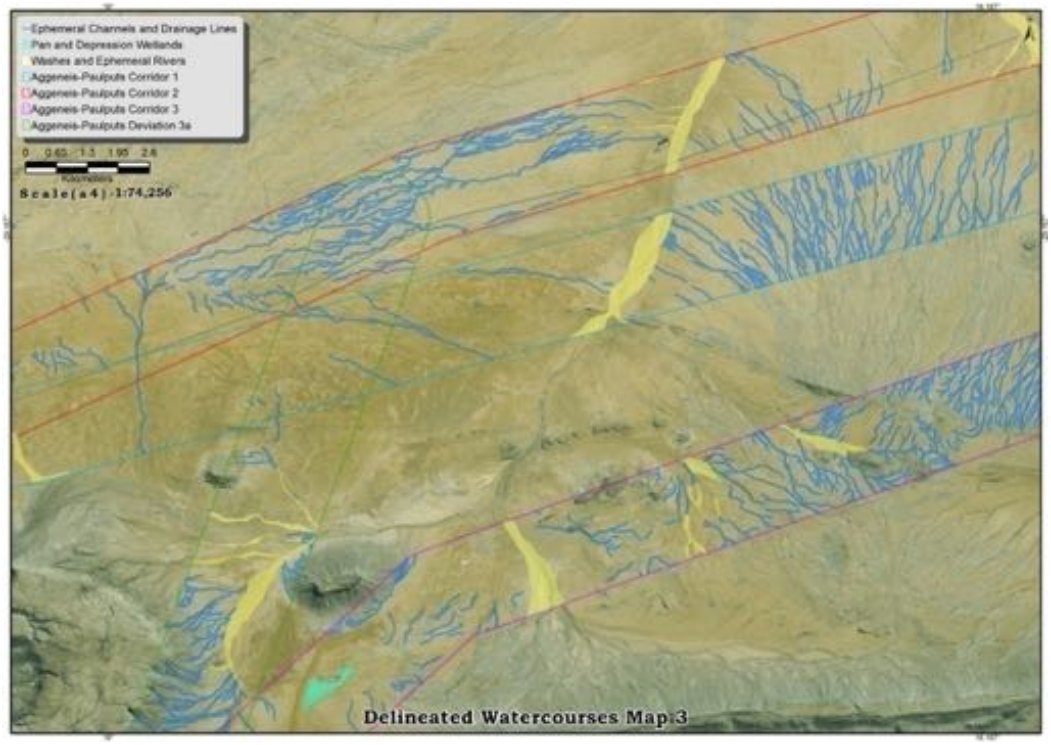


Figure 47: Delineated watercourses in the western-central portion of the study area south of Pella, between Ghaamsberg in the west and T'Goob se Berg in the east

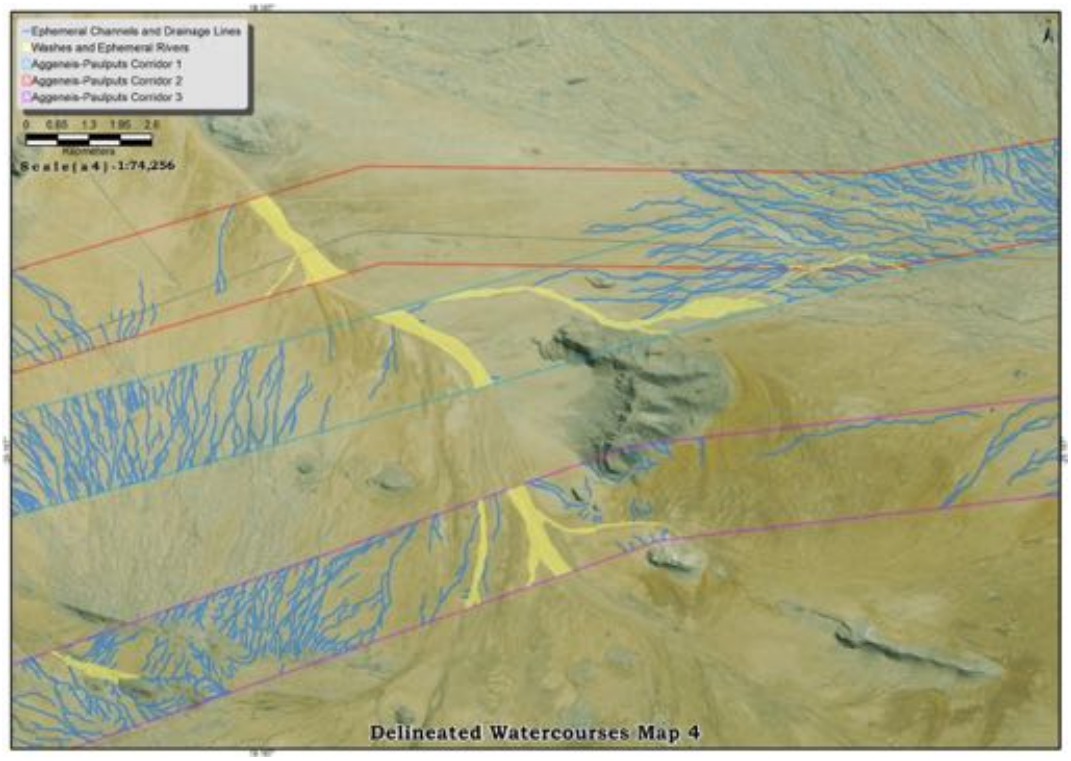


Figure 48: Delineated watercourses in the eastern-central portion of the study area, between T'Goob se Berg in the west and Pofadder in the east

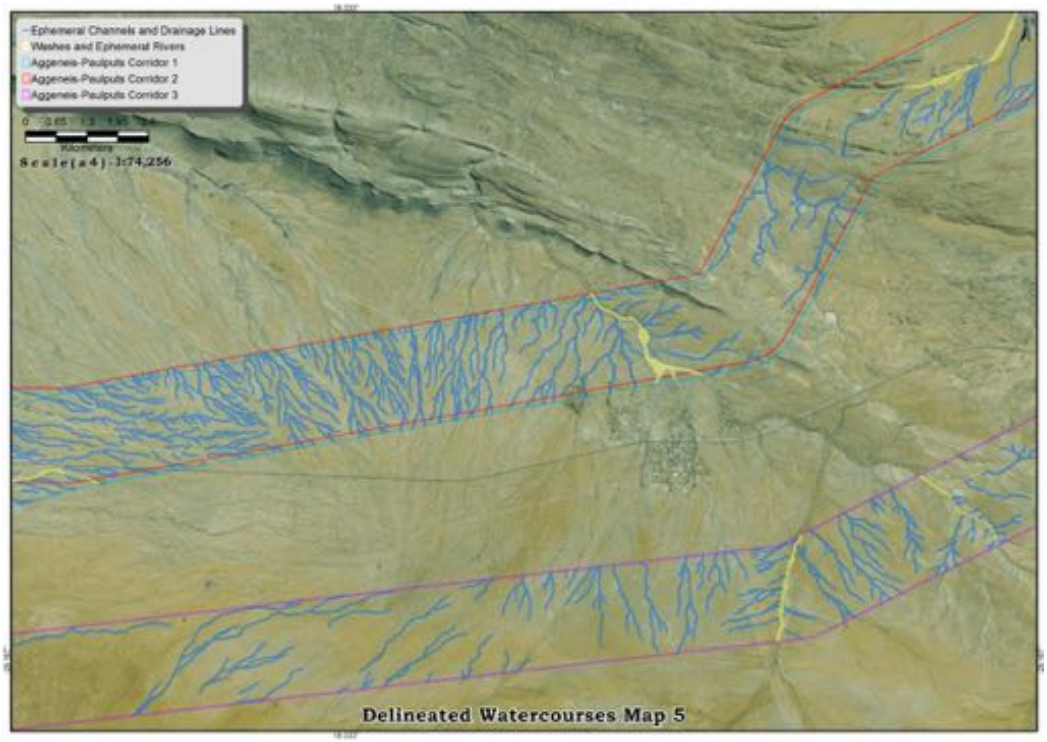


Figure 49: Delineated watercourses in the eastern portion of the study area, northeast of Pofadder towards Paulputs substation (not visible)

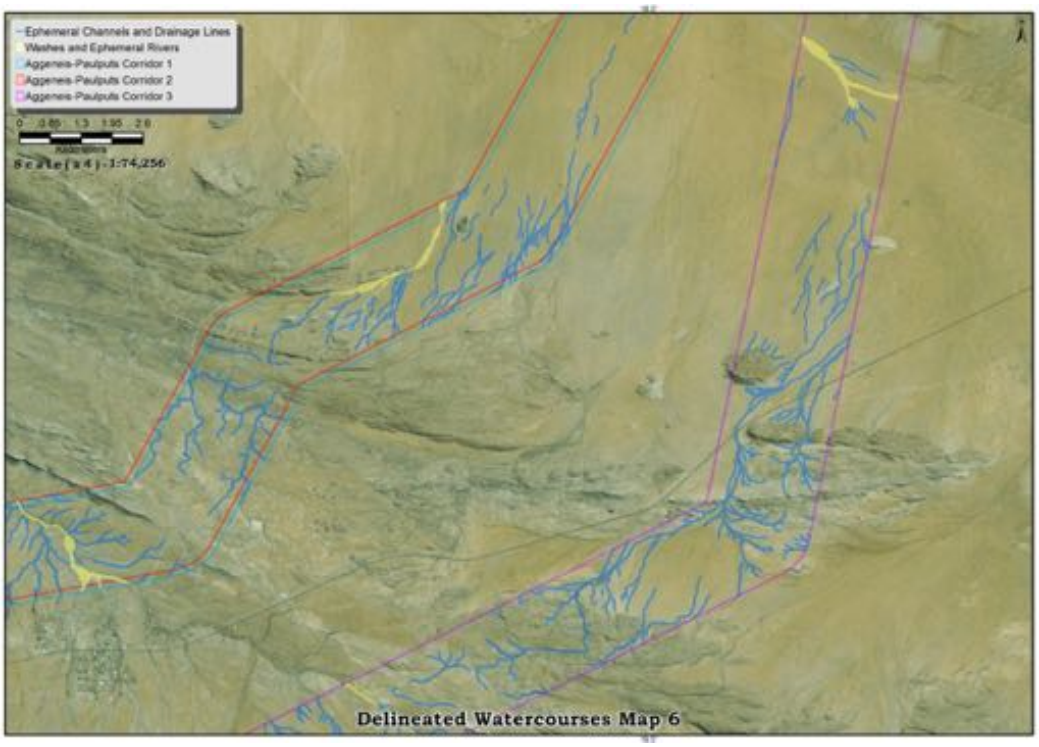


Figure 50: Delineated watercourses in the north-eastern-most portion of the study area, south of Paulputs substation

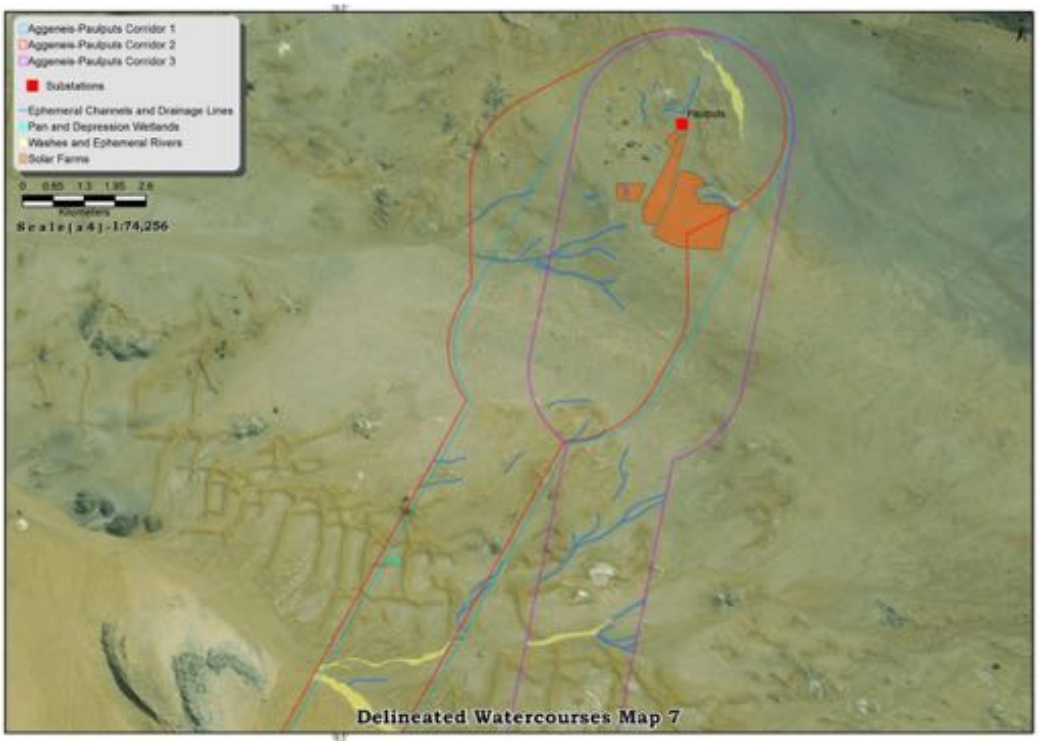


Figure 51: Delineated watercourses in the north-eastern-most portion of the study area, with the end point at Paulputs Substation

Several 1:500000 river crossings are present within the study area (Figure 52). Centre line crossings for Corridor 1 is 8, Corridor 2 has 7, Corridor 3 has 4 and Deviation 3A has only 1. Corridor 3 also has a significantly shorter length of combined river segments compared to Corridors 1 and 2 (Figure 52; Table 19). All of the rivers are ephemeral in nature, have an intact condition, a largely natural Present Ecological State and a mostly endangered conservation status (Table 19).

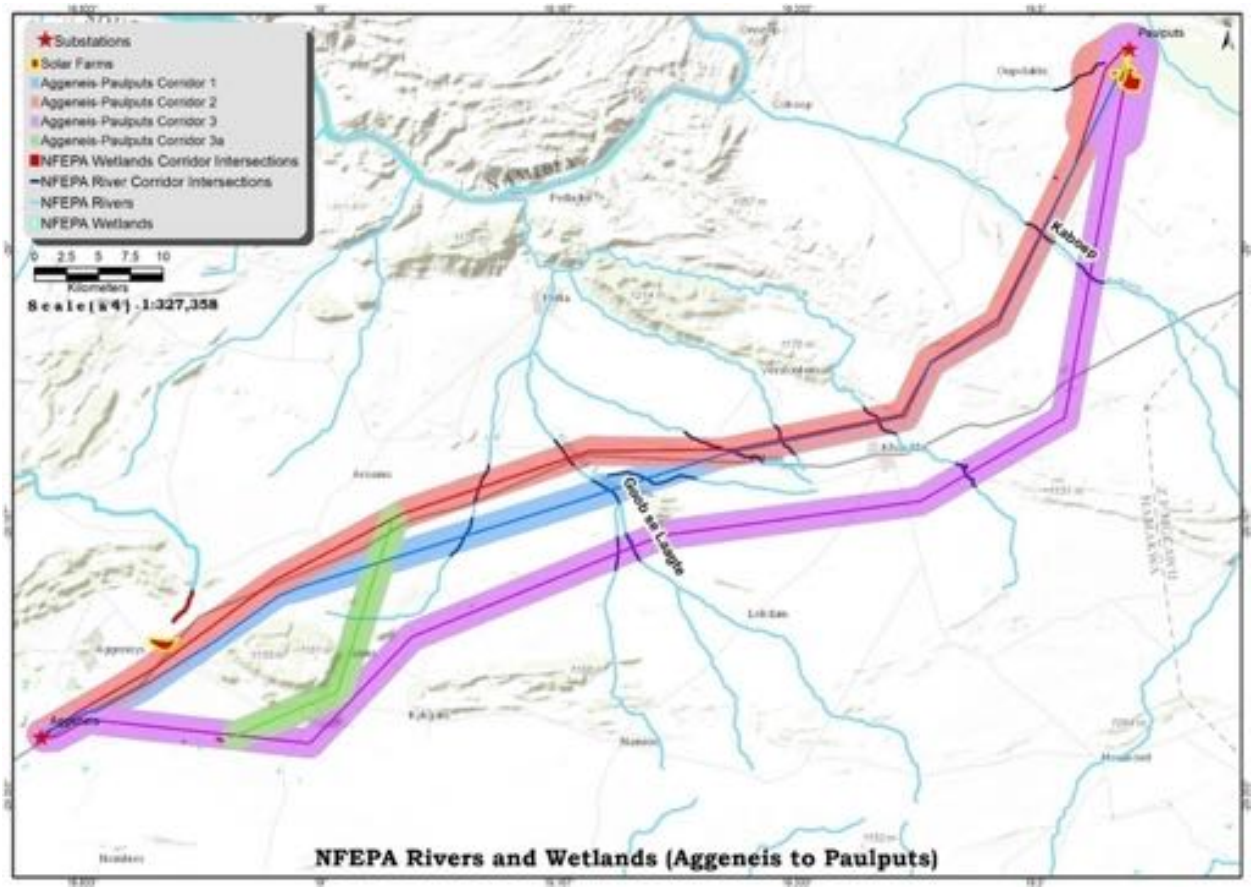


Figure 52: Illustrates rivers and wetlands from the National Freshwater Ecosystem Priority Areas spatial datasets (Nel et al., 2011 in Grobler, 2016) present within the study area and its surroundings

Table 19: Summary of properties for different river datasets (Driver et al., 2004; DWS, 2015; Nelet al., 2011 in Grobler, 2016) in each route corridor. Calculated maximum and minimum values for each of the three corridor routes are indicated in red and green respectively. Deviation 3A does not directly form part of the comparision as it is not a viable alternative on its own.

	Route Corridor 1	Route Corridor 2	Route Corridor 3	Deviation 3A
Ecoregions present	Nama Karoo (majority of rivers) and Orange River Gorge (one river)	Nama Karoo (majority of rivers) and Orange River Gorge (one river)	Nama Karoo (majority of rivers) and Orange River Gorge (one river)	Nama Karoo (majority o rivers) and Orange Rive Gorge (one river)
Number of river centre line crossings in each corridor (calculated) (also refer to Figure 3)	8	7	4	1
Sub-quaternary reaches (DWS, 2015)	Not applicable	Not applicable	Not applicable	Not applicable
River stream orders (Nel *et al.,* 2011) (also refer to Figure 4)	1 and 2	1 and 2	1 and 2	1
Flow conditions (Nel *et al.,* 2011) (also refer to Figure 4)	Ephemeral	Ephemeral	Ephemeral	Ephemeral
River types (Nel *et al.,* 2011) (also refer to Figure 4)	Not permanent/flashy upper foothills (majority of rivers) to Not permanent/flashy lowland river (one river)	Not permanent/flashy upper foothills (majority of rivers) to Not permanent/flashy lowland river (one river)	Not permanent/flashy upper foothills	Not permanent/flashy upper foothills
Present Ecological State (Nel *et al.,* 2011) (also refer to Figure 4)	B (Largely natural)	B (Largely natural)	B (Largely natural)	B (Largely natural)
River condition (Nel *et al.,* 2011) (also refer to	AB (Intact)	AB (Intact)	AB (Intact)	AB (Intact)

	Route Corridor 1	Route Corridor 2	Route Corridor 3	Deviation 3A
Figure 4)				
Conservation status (Driver *et al.,* 2004) (also refer to Figure 4)	Endangered (majority of rivers) and Non threatened (one reach)	Endangered (majority of rivers) and Non threatened (one reach)	Endangered	Endangered
FEPA river classes (Nel *et al.,* 2011) (also refer to Figure 4)	2 x FEPA (Kaboeb River and an unnamed tributary of Goob se Laagte); 6 x upstream management area rivers	2 x FEPA reaches (Kaboeb River and an unnamed tributary of Goob se Laagte); 4 x upstream management area rivers	1 x FEPA (Kaboeb River); 3 x upstream management area rivers	Upstream management area river
Combined river length in each route corridor (calculated) (also refer to Figure 4)	25.46 km	20.58 km	9.96 km	2.10 km

Results from the 1:50000 river drainage line assessment, which include headwater channels as well as larger rivers, indicate that route corridor 1 has the highest number of drainage line crossings along its centre line (Figure 53; Table 19). Route corridor 2 is closely second with only 5 fewer centre line crossings, while route corridor 3 has 22 fewer crossings compared to route corridor 2.

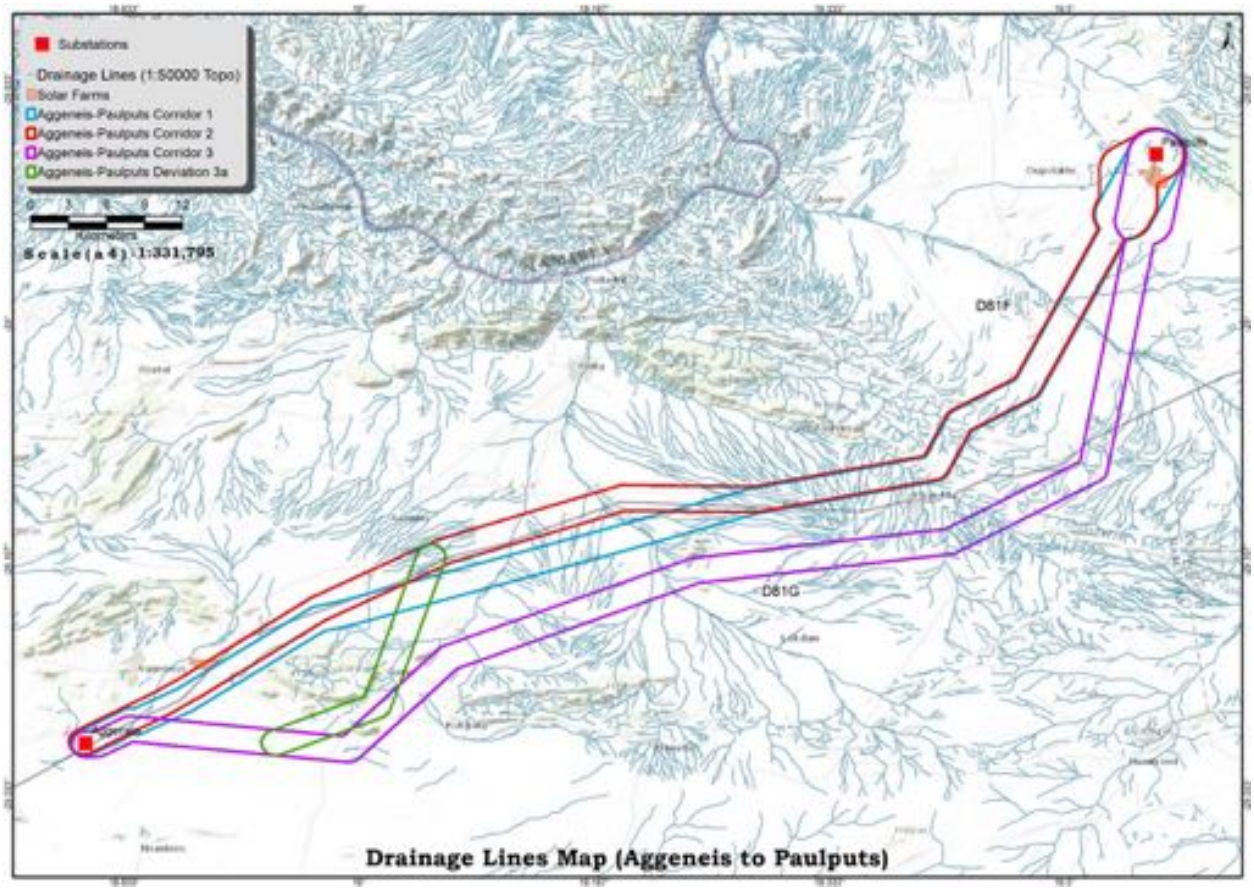


Figure 53: Illustrate the drainage network for the study area and its surroundings based on the 1:50000 river lines datasets from the corresponding topographical maps

Route corridor 3 has the longest combined surface area of NFEPA wetlands, while the values for route corridors 1 and 2 are the same (Figure 52: Table 20).

Table 20: Summary of properties for the NFEPA wetland dataset (Nel et al., 2011 in Grobler, 2016) for each route corridor. Calculated maximum and minimum values for each of the three corridor route alternatives are indicated in red and green respectively. Deviation 3A does not directly form part of the comparision as it is not a viable alternative on its own

	Route Corridor 1	**Route Corridor 2**	**Route Corridor 3**	**Deviation 3A**
Combined area of NFEPA wetlands (all wetland types) within route corridor	2.54 ha	2.54 ha	6.80 ha	0.44 ha

Road lines obtained from the 1:50000 topographical map dataset indicates that route corridor 2 has the largest combine length of existing roads and also has the highest number of centre line road crossings, followed by route corridor 1 (Table 21).

Table 21: Summary of road properties obtained from the different 1:50000 topographical map roadlines datasets in each route corridor and along each route corridor centre line. Calculated maximum and minimum values for each of the three corridor route alternatives are indicated in red and green respectively. Deviation 3A does not directly form part of the comparision as it is not a viable alternative on its own.

	Route Corridor 1	Route Corridor 2	Route Corridor 3	Deviation 3A
Number of road crossings along each route centre line	88	91	50	12
Combined length of roads within each route corridor	218.47 km	266.56 km	146.70 km	37.49 km

Existing Eskom power line alignments within the study area overlap primarily with route corridor 1, which has an existing line along its entire length (Figure 54). Existing powerlines, specifically transmission lines, will be associated with existing access roads/tracks for maintenance, which makes new alignments along these existing lines more favourable, as fewer new access road and track crossings through watercourses are expected to be required.

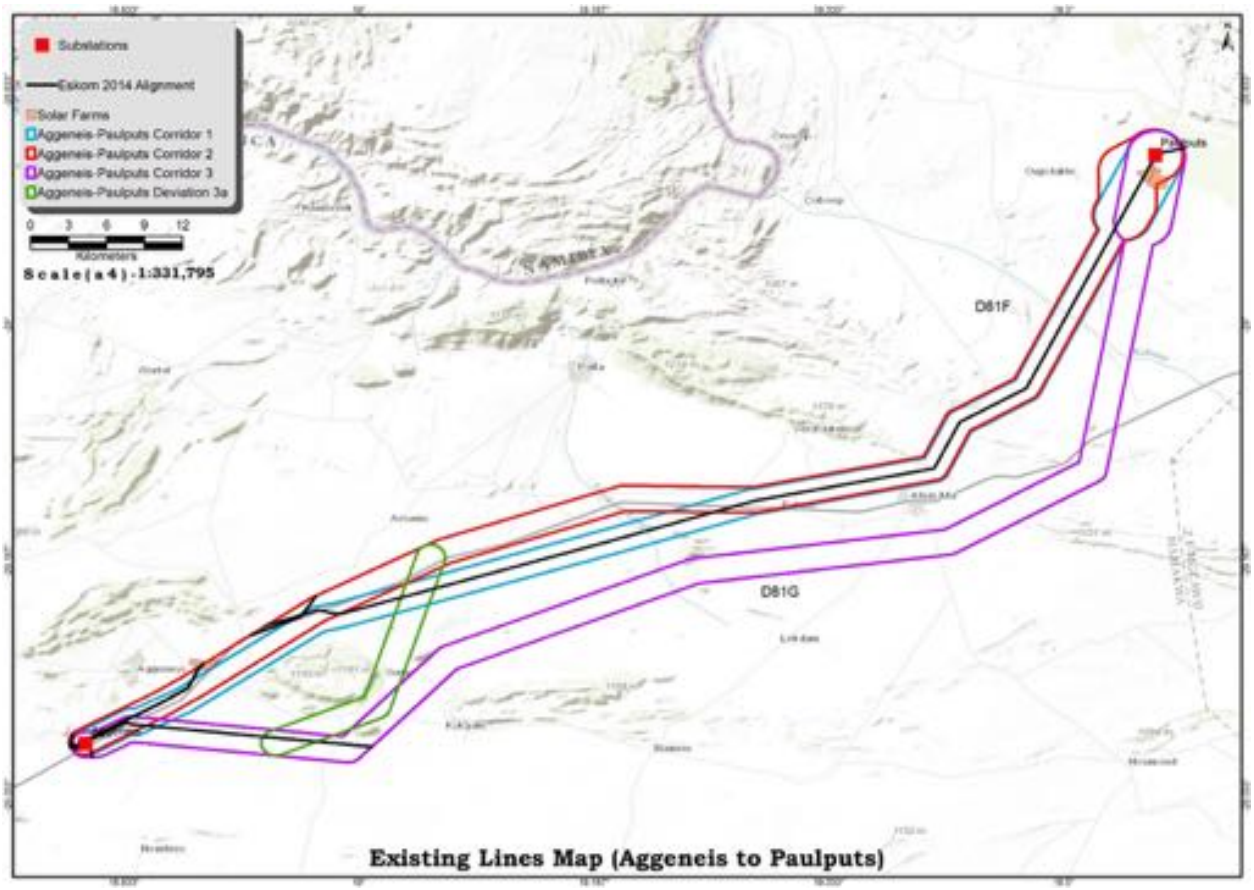


Figure 54: Illustrates existing powerlines within the study area

Table 22 below shows comparisons of watercourse classes that were delineated and grouped as part of the watercourse assessment. Route corridor 2 has the highest number of delineated 'ephemeral channels and drainage lines', as well as 'washes and ephemeral rivers', followed closely by route corridor 1 Route corridor 3 has 51 % fewer 'ephemeral channels and drainage lines' and 42 % fewer 'washes and ephemeral rivers', compared to route corridor 1

Route corridor 1 has the largest combined surface area of 'ephemeral channels and drainage lines', as well as 'washes and ephemeral rivers', with route corridor 3 again having the lowest value for both watercourse classes.

Route corridor 3 does, however, have the largest number and combined surface area for 'pan/depression wetlands', but both these values are regarded as low compared to the other watercourse classes present in the study area.

Table 22: Properties of different types of delineated watercourses, which overlap with each of the route corridor alternatives. Calculated maximum and minimum values for each of the three corridor route alternatives are indicated in red and green respectively. Deviation 3A does not directly form part of the comparison as it is not a viable alternative on its own.

	Route Corridor 1	Route Corridor 2	Route Corridor 3	Deviation 3A
Number of Washes and ephemeral rivers in corridor	57	61	30	3
Total surface area of Washes and ephemeral rivers in corridor	733.43 ha	594.19 ha	479.80 ha	135.28 ha
Number of Ephemeral channels and drainage lines in corridor	1709	1874	995	272
Total length of Ephemeral channels and drainage lines in corridor	638.55 km	627.66 km	398.96 km	108.50 km
Number of Pan/depression wetlands in corridor	1	2	10	2
Total surface area of Pan/depression wetlands in corridor	2.49 ha	2.64 ha	35.12 ha	0.84 ha

9.4.2 Wetland Impacts and Mitigations

Project-related impacts on identified watercourses, as well as recommended mitigation measures are discussed below for different project phases. The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

NATURE OF IMPACT (Corridor 1)	MITIGATION

1. Compaction of watercourse soils	Avoid driving through watercourses during construction and stick on existing roads and tracks as far as possible, in order to prevent vehicle track entrenchment and avoid the potential for new channel initiation and erosion. Where this is unavoidable crossing structures can be put in place across channelled watercourses and pan/depression wetlands and other watercourses along with relevant Water Use License requirements. Linear watercourses that are unchannelled or contain weakly developed channel features (e.g. swales) and are dry/ephemeral may not require road crossing but can be driven as is. Recommended crossings structures or the absence of crossing structures can include the following, but should ideally be based on site conditions for individual watercourse crossings along with engineering input:
	• A wearing course (wear surface) should be added as a surface layer on top of geotextile fabrics, which forms base for surface capping.
	• A wearing course (surface cap) of good quality clastic or gravel material also has the potential to reduce surface scour by creating a mix that will easily bind together and minimise detachment of particles.
	• Geotextiles provide four important functions in temporary road and trail surface construction that includes separation, drainage, reinforcement, and stabilisation.
	• Geotextiles work as separation fabrics when they are placed between gravel caps and underlying soils to prevent the materials from mixing.
	• Additional benefits of such as crossing structure include:
	  o It defines a single route alignment for vehicle travel.
	  o Provides a 'wear and carry' surface over unsuitable and easily compactable watercourse, especially wetland, soils.
	  o This results in a stable, durable crossing surface for vehicle access, including heavy motor vehicle traffic.
	  o Halts the widening and the development of braided crossing sections, while formerly used track alignments are allowed to naturally stabilise and

	revegetate.
Significance Without Mitigation	Low
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 2)	MITIGATION
1. Compaction of watercourse soils	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 3)	MITIGATION
1. Compaction of watercourse soils	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 1)	MITIGATION
2. Flow, sedimentation and erosion in watercourses due to infrastructure construction	• Restrict the construction of infrastructure in watercourses as far as possible. • Tower construction in watercourses should only be allowed in exceptional circumstances where these areas cannot be spanned. • All unavoidable overlap between individual towers and watercourses, and new or upgraded watercourse road crossings will require a Water Use License (WUL) in order to be allowable. Efforts should therefore be undertaken during the planning phase and proposed walk down phase to avoid infrastructure overlap as far as possible. This includes the use of existing access roads. • New access roads and tracks should also be located outside of watercourses as far as possible (see mitigation measures provided for the compaction of watercourse soils impact). • Road crossings should make provision for dispersed flow and energy dissipation. Refer to the abovementioned recommendation regarding pylon (tower) construction in watercourses.

- Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads that have to be constructed. To minimise sediment load, an unsealed road network should have an emphasis on slowing drainage flows and dispersing them more frequently.
- Stormwater should be diverted away from the road early and often, so as to reduce the catchment area of the road.
- The use of drains, such as table drains and cut-off drains, should not be used in any of the watercourse crossings. These types of drains typically have concentrated high-velocity flows and can frequently form channels within the watercourse. These channels provide an easy pathway for sediment to reach streams and adversely impact on water quality.
- Alternative options for stormwater control should therefore be considered. These include the use of:
  - Vegetated swales.
  - Entrenched rock (rip rap) aprons.
  - Sediment traps, such as hay bales or silt traps. These structures do, however, require maintenance.
  - Vegetated buffer/ filter strips. The use of vegetation in the watercourse, especially downstream of unsealed road surfaces, will help to provide soil stability and reduce sediment input. It is important to use local and indigenous plant species.
- Permanent crossing structures across channelled watercourses can include unvented fords that are constructed of riprap, gabions, or concrete to provide a stream crossing without the use of pipes. Water will periodically flow over the crossing structure. Measures therefore need to be incorporated into the design to protect downstream watercourse habitat from scour erosion during flow events. This is more important in large watercourses, such as ephemeral rivers.
- If the construction of a crossing is unavoidable make sure that substrate continuity in the watercourse is maintained within upstream and downstream portions of the channel bed.
- Unvented fords are best suited for ephemeral or intermittent streams (streams that are dry most of the year). Unvented fords may also be used across some shallow, low velocity perennial streams.
- Other important best management practices associated with ford design, construction, operation and

	maintenance that should be adhered to as far as possible, include (Anon 2006 in Grobler, 2016): o Where possible locate crossings on straight channel segments (avoid meanders). o To the extent possible align crossings perpendicular to the stream channel. o Minimize the extent and duration of the hydrological disruption. o Use appropriate energy dissipaters and erosion control at the outlet drop. o Minimize impact to riparian vegetation during construction o Prevent excavated material from running into water bodies and other sensitive areas. o Use appropriate sediment barriers (silt fence and hay bales). o Dewater prior to excavation. o Check construction surveys to ensure slopes and elevations meet design specifications. o Use appropriately graded material (according to design specifications) that has been properly mixed before placement inside the structure. o Compact bed material. o Tie constructed banks into upstream and downstream banks. o Evaluate structure stability
Significance Without Mitigation	Low
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 2)	MITIGATION
2. Flow, sedimentation and erosion in watercourses due to infrastructure construction	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 3)	MITIGATION
2. Flow, sedimentation and erosion in watercourses due to infrastructure construction	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 1)	MITIGATION
3. Loss of watercourse habitat due to infrastructure construction	• No towers, construction camps or quarries should not be constructed within watercourses. • The smallest possible footprint should be utilized and positioned as close to the boundary of the affected watercourse in cases where tower construction in a watercourse is unavoidable. • Tower construction activities in these areas should be completed in the shortest possible time and preferably during the dry season. • Excavated watercourses should be re-sloped to a stable gradient (e.g. a slope of 1:3), revegetated with naturally occurring indigenous species or annual grass species, such as *Eragrostis tef*, and covered with biojute to help facilitate revegetation soon after construction. • Towers in watercourses should not be located on steep slopes, channels or other surfaces with visible erosion features. • New roads and access tracks should not be constructed in watercourses as far as possible. Existing access tracks and roads should rather be used where available. • Please note that these tower construction recommendations are the last mitigation option and all other attempts should first be attempted to prevent towers in watercourses. Infrastructure construction in watercourses would also require a Water Use License from the DWS.
Significance Without Mitigation	Low
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 2)	MITIGATION
3. Loss of watercourse habitat due to infrastructure construction	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 3)	MITIGATION
3. Loss of watercourse habitat due to infrastructure construction	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridors 1,2 & 3)	MITIGATION
4. Low water quality inflows into watercourses	• No refuelling of construction vehicles should occur within 50 m of demarcated watercourses. • Hydrocarbons should not be stored within 50 m of watercourses. • Drip trays should be used when working with generators within watercourses or within a 50 m buffer around them.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 1)	MITIGATION
5. Encroachment of alien species into watercourses	• Powerline towers and access roads/tracks should be located outside of demarcated watercourses to restrict disturbances and opportunities for alien and invasive species (AIS) to encroach and become established within watercourses. • Restrict the clearing of watercourse vegetation as far as possible. Areas that have been cleared should be revegetated with indigenous species after construction. • Compile and implement an alien plant control program near the end of the construction phase.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 2)	MITIGATION
5. Encroachment of alien species into watercourses	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

NATURE OF IMPACT (Corridor 3)	MITIGATION
5. Encroachment of alien species into watercourses	Refer to Corridor 1 mitigations above.
Significance Without Mitigation	Medium
Significance With Mitigation	Low

9.4.3 Assessment of Cumulative Watercourse Impacts

The assessed cumulative impacts are based only on relevant impacts identified during the construction and operation phases for each corridor alternative and Deviation 3A. It pertains to specifically to activities and infrastructure associated with the proposed Aggeneis-Paulputs 400kV transmission line by Eskom, such as vehicle access tracks/roads and towers. It consequently excludes other types of Eskom infrastructure that are present in a 30km buffer around the assessed study area, such as solar farms, which have different types of watercourse impacts and different impact significance scores, compared to the proposed 400kV transmission line development

The three corridor alternatives and Deviation 3A are assessed together in terms of their cumulative impacts, as identified project-related impacts in the corridor alternatives and deviation are assessed as a single entity and compared with adjacent land in a 30km radius around the study area. The identification and quantification of other powerlines in this surrounding 30km buffer area are constrained by the inconspicuous nature of powerlines when assessed through a mainly desktop approach. An Eskom dataset received in 2014 was used to help identify known powerlines within this 30km buffer. Known powerlines present within the corridor alternatives and deviation (i.e. the study area) were assessed as part of the study area specific impact assessment and are illustrated in Figure 54. The extent of powerlines within the study area and within a 30km buffer thereof, is regarded as low to moderate when compared to areas that do not contain powerlines. The extent is, however, expected to increase over time due to the creation of new solar farms that will require connectivity to the two substations.

Low water quality inflows into watercourses is not regarded as a cumulative impact, as this impact is restricted to a period of the construction phase and is no longer expected to be present in existing/operational powerlines located within a 30km buffer around the study area. If a cumulative impact has to be determined, it will be the same as that calculated within the study area (Table 2.3 in Annexure C of this report).

Relevant cumulative impacts are listed and assessed in Table 2.4 (in Annexure C of this report). Based on this and considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that any of these assessed impacts will result in spatial and temporal cumulative change. With mitigation measures, all four of the assessed cumulative impacts can be regarded as marginal / slight / minor. The significance of cumulative impacts can be further reduced should existing infrastructure features be used, such as existing access roads/tracks present in Corridor 1 and 2. This will further reduce cumulative impacts in watercourses, such as flow changes, increased sedimentation and erosion in watercourses, and compaction of watercourse soils.

NATURE OF CUMULATIVE IMPACT (Corridors 1,2 & 3)	MITIGATION MEASURE

Flow changes, increased sedimentation and erosion in watercourses	• Restrict the construction of infrastructure in watercourses as far as possible.
	• Tower construction in watercourses should only be allowed in exceptional circumstances where these areas cannot be spanned.
	• All unavoidable overlap between individual towers and watercourses, and new or upgraded watercourse road crossings will require a Water Use License (WUL) in order to be allowable. Efforts should therefore be undertaken during the planning phase and proposed walk down phase to avoid infrastructure overlap as far as possible. This includes the use of existing access roads.
	• New access roads and tracks should also be located outside of watercourses as far as possible (see mitigation measures provided for the compaction of watercourse soils impact).
	• Road crossings should make provision for dispersed flow and energy dissipation. Refer to the abovementioned recommendation regarding pylon (tower) construction in watercourses.
	• Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads that have to be constructed. To minimise sediment load, an unsealed road network should have an emphasis on slowing drainage flows and dispersing them more frequently.
	• Stormwater should be diverted away from the road early and often, so as to reduce the catchment area of the road.
	• The use of drains, such as table drains and cut-off drains, should not be used in any of the watercourse crossings. These types of drains typically have concentrated high-velocity flows and can frequently form channels within the watercourse. These channels provide an easy pathway for sediment to reach streams and adversely impact on water quality.
	• Alternative options for stormwater control should therefore be considered. These include the use of:
	  o Vegetated swales.
	  o Entrenched rock (rip rap) aprons.
	  o Sediment traps, such as hay bales or silt traps. These structures do, however, require maintenance.
	  o Vegetated buffer/ filter strips. The use of vegetation in the watercourse, especially downstream of unsealed road surfaces, will help to provide soil stability and reduce sediment input. It is important to use local and

indigenous plant species.

- Permanent crossing structures across channelled watercourses can include unvented fords that are constructed of riprap, gabions, or concrete to provide a stream crossing without the use of pipes. Water will periodically flow over the crossing structure. Measures therefore need to be incorporated into the design to protect downstream watercourse habitat from scour erosion during flow events. This is more important in large watercourses, such as ephemeral rivers.
- If the construction of a crossing is unavoidable make sure that substrate continuity in the watercourse is maintained within upstream and downstream portions of the channel bed.
- Unvented fords are best suited for ephemeral or intermittent streams (streams that are dry most of the year). Unvented fords may also be used across some shallow, low velocity perennial streams.
- Other important best management practices associated with ford design, construction, operation and maintenance that should be adhered to as far as possible, include (Anon 2006):
    - Where possible locate crossings on straight channel segments (avoid meanders).
    - To the extent possible align crossings perpendicular to the stream channel.
    - Minimize the extent and duration of the hydrological disruption.
    - Use appropriate energy dissipaters and erosion control at the outlet drop.
    - Minimize impact to riparian vegetation during construction
    - Prevent excavated material from running into water bodies and other sensitive areas.
    - Use appropriate sediment barriers (silt fence and hay bales).
    - Dewater prior to excavation.
    - Check construction surveys to ensure slopes and elevations meet design specifications.
    - Use appropriately graded material (according to design specifications) that has been properly mixed before placement inside the structure.
    - Compact bed material.
    - Tie constructed banks into upstream and downstream banks.
    - Evaluate structure stability

Loss of watercourse

- No towers (pylons), construction camps or quarries should

habitat	not be constructed within watercourses. • The smallest possible footprint should be utilized and positioned as close to the boundary of the affected watercourse in cases where tower construction in a watercourse is unavoidable. • Tower construction activities in these areas should be completed in the shortest possible time and preferably during the dry season. • Excavated watercourses should be re-sloped to a stable gradient (e.g. a slope of 1:3), revegetated with naturally occurring indigenous species or annual grass species, such as *Eragrostis tef*, and covered with biojute to help facilitate revegetation soon after construction. • Towers in watercourses should not be located on steep slopes, channels or other surfaces with visible erosion features. • New roads and access tracks should not be constructed in watercourses as far as possible. Existing access tracks and roads should rather be used where available. • Please note that these tower construction recommendations are the last mitigation option and all other attempts should first be attempted to prevent towers in watercourses. Infrastructure construction in watercourses would also require a Water Use License from the DWS.

Compaction of watercourse soils	• A wearing course (wear surface) should be added as a surface layer on top of geotextile fabrics, which forms base for surface capping.
	• A wearing course (surface cap) of good quality clastic or gravel material also has the potential to reduce surface scour by creating a mix that will easily bind together and minimise detachment of particles.
	• Geotextiles provide four important functions in temporary road and trail surface construction that includes separation, drainage, reinforcement, and stabilisation.
	• Geotextiles work as separation fabrics when they are placed between gravel caps and underlying soils to prevent the materials from mixing.
	• Additional benefits of such as crossing structure include:
	  o It defines a single route alignment for vehicle travel.
	  o Provides a 'wear and carry' surface over unsuitable and easily compactable watercourse, especially wetland, soils.
	  o This results in a stable, durable crossing surface for vehicle access, including heavy motor vehicle traffic.
	  o Halts the widening and the development of braided

	crossing sections, while formerly used track alignments are allowed to naturally stabilise and revegetate
Encroachment of alien species into watercourses	• Powerline towers and access roads/tracks should be located outside of demarcated watercourses to restrict disturbances and opportunities for alien and invasive species (AIS) to encroach and become established within watercourses. • Restrict the clearing of watercourse vegetation as far as possible. Areas that have been cleared should be revegetated with indigenous species after construction. • Compile and implement an alien plant control program near the end of the construction phase. • Continue with alien control along access roads and underneath the powerline during the operational phase of the project.

9.4.4 Wetland Conclusion and Recommendations

Route corridor 1 is regarded as the most sensitive and the least favourable alternative for the proposed powerline based on the significance analyses in the impact assessment. It is the only route corridor that has an existing powerline along its entire length. The presence of an existing powerline is of special significance, as existing access roads should already be in place for maintenance purposes along the existing powerline within route corridor 1. Road impacts are regarded to be of greater significance compared to tower positions and other impacts, which increases the favourability of Corridor 1. Corridor 3, including Deviation 3a, has no known existing powerlines along the majority of its length and the fewest of all three corridor alternatives. It has the lowest number of existing roads based on available data from the 1:50000 topographical map datasets. Corridor 2 has existing powerlines along more than 50% of its length and also has the second highest number of roads indicated on the 1:50000 topographical map datasets.

Based on the cumulative impacts, it is unlikely that any of the assessed impacts will result in spatial and temporal cumulative change. With mitigation measures, all four of the assessed cumulative impacts can be regarded as marginal / slight / minor. The significance of cumulative impacts can be further reduced should existing infrastructure features be used, such as existing access roads/tracks present in Corridor 1 and 2.

Recommendations:

- Careful tower (pylon) positioning that prevent overlap with delineated watercourses. This will reduce the length of powerline sections and number of towers in watercourse crossings. Many watercourse crossings can be spanned through this process as part of initial planning, prior to the start of the EMPR phase of the project.
- Impacts associated with the construction of permanent access tracks for maintenance of pylons and the servitude line are more difficult to mitigate. Planning in the alignment route of

the powerline can help to make use of existing access tracks as far as possible in order to help prevent the creation of new access roads in watercourses.

- All delineated watercourses are regarded as sensitive features. These areas should therefore be avoided by all practical means and no construction may be undertaken in these areas without the necessary environmental authorization and adherence to mitigation measures.
- It follows, that construction impacts should be avoided or reduced as far as possible in watercourses and headwater drainage lines due to their vulnerability to erosion and potential to support rare and protected biodiversity.
- Watercourse lines and polygons that were delineated as part of this study and submitted with this report as GIS shapefiles should be used by the Eskom engineers and technical personnel to help find a best fit route alignment in the selected corridor alternative prior to the start of the EMP phase of the proposed development.
- Such a best fit would require planning input to reduce the number of watercourse crossings and the number of crossing lengths that cannot be spanned. The extent and positioning of watercourse boundaries can then be refined through a field verification process along the final alignment (EMPR Walk Down assessment).
- A summer survey is recommended for the EMP Walk Down survey in order to allow the use of the widest array of watercourse indicators, as the study area primarily overlaps with a summer rainfall area. This will enable a more accurate identification and demarcation of watercourses as defined by the NWA as more indicators will be available. It will also enable the provision of tower specific recommendations regarding watercourse impacts.
- A summer survey will also enable a more reliable assessment of 'species of conservation concern' (sensu Raimondo *et al.,* 2009 in Grobler, 2016), which will inform the Ecological Importance and Sensitivity (EIS) assessment of associated watercourses.
- Watercourse boundaries should be marked for the construction teams to ensure easy identification and trigger appropriate mitigation measures/actions.
- It is important to determine whether new project-related infrastructure structures in watercourses will be permanent or temporary. Water Use License requirements for permanent structures, such as road crossings, are expected to require more thorough mitigation compared to temporary watercourse road crossing structures.
- The creation of new watercourse road crossings should be kept to the absolute minimum by giving preference to the use of existing access roads and vehicle tracks.
- Monitoring is recommended along sediment control structures and road crossings in and through watercourse crossings during the construction phase. Vehicle tracks / roads that have been created for access and maintenance in watercourses should be monitored for erosion and blockages during the operational phase of the project.

9.5 AGRICULTURAL ASSESSMENT

9.5.1 Agricultural Potential Findings

In a dry, hot part of South Africa like this area of the Northern Cape, the limiting factor to agriculture is not soil, but climate. Unless there is a source of water for irrigation, it will not make a significant difference which soils are occurring within a specific area.

A summary of the dominant soil characteristics is given in Table 23. The colours correspond to those used in the map of land types (Figure 55). The dominant class of agricultural potential within each specific land type is shown in **bold font**.

As can be seen from the information contained in the table below, there is only one reasonably significant portion of moderately deep soils that are not dunes (Land Type **Ae67**, north-east of Pofadder).

Table 23: Broad soil patterns occurring (with general soil characteristics)

Land Type	Dominant and sub-dominant soil forms	Agric. Potential
Ae67	Hu32/35/42/45 – Moderately deep (500-1000 mm), red, freely-drained sandy soils on calcrete (49%) Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on calcrete (30%)	High – 6.0% **Mod – 49.0%** Low – 45.0%
Ae94	Hu32/35 – Moderately deep to deep (400-800 mm), red sandy soils on dorbank (68%) Hu31 – Deep (>1200 mm), red, freely-drained sandy soils (16%)	High – 26.7% **Mod – 68.1%** Low – 5.2%
Af14	Hu30/31/32 – Deep (>1200 mm), red, freely-drained sandy dune soils (70%) Hu30/32 – Moderately deep (600-1000 mm), red, freely-drained sandy soils on calcrete (12%)	High – 4.0% Mod – 12.5% **Low – 83.5%**
Af21	Hu31 – Deep (>1200 mm), red, freely-drained sandy dune soils (75%) Hu32 – Shallow to moderately deep (300-700 mm), red, freely-drained sandy soils on calcrete (11%)	High – 0.0% Mod – 14.0% **Low – 86.0%**
Ag25	Hu32/42 – Shallow (150-300 mm), red, freely-drained sandy soils on dorbank or calcrete (49%) Rock (16%)	High – 0.0% Mod – 1.6% **Low – 98.4%**
Ag26	Hu31/32 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank or calcrete (53%) Hu34/35 – Shallow (300-500 mm), red, freely-drained sandy soils on dorbank or calcrete (23%)	High – 9.6% Mod – 5.6% **Low – 84.6%**
Ag36	Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank, calcrete or rock (48%) Rock (32%)	High – 0.0% Mod – 3.0% **Low – 97.0%**
Ag37	Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank, calcrete or rock (48%) Rock (20%)	High – 0.0% Mod – 23.0% **Low – 67.0%**

Ag43	Hu32/35 – Shallow (200-350 mm), red, freely-drained sandy soils on dorbank or calcrete (47%) Hu32/35 – Shallow (400-600 mm), red, freely-drained sandy soils on dorbank or calcrete (35%)	High – 4.0% Mod – 10.5% **Low – 85.5%**
Ag63	Hu35 – Shallow (200-300 mm), red, freely-drained sandy/loamy soils on dorbank or calcrete (52%) Hu32/42 – Shallow (150-300 mm), red, freely-drained sandy soils on dorbank or calcrete (23%)	High – 4.0% Mod – 12.5% **Low – 83.5%**
Ic136	Rock (89%) Mispah 10/20 – Shallow (100 -300 mm), red and brown, freely-drained sandy soils on rock (7%)	High – 0.0% Mod – 3.5% **Low – 96.5%**
Ic137	Rock (82%) Mispah 10/20 – Shallow (50 -150 mm), red and brown, freely-drained sandy soils on rock (10%)	High – 0.0% Mod – 0.0% **Low – 100%**
Ic151	Rock (86%) Mispah 10 – Shallow (50 -100 mm), red and brown, freely-drained sandy soils on rock (7%)	High – 0.0% Mod – 0.0% **Low – 100%**

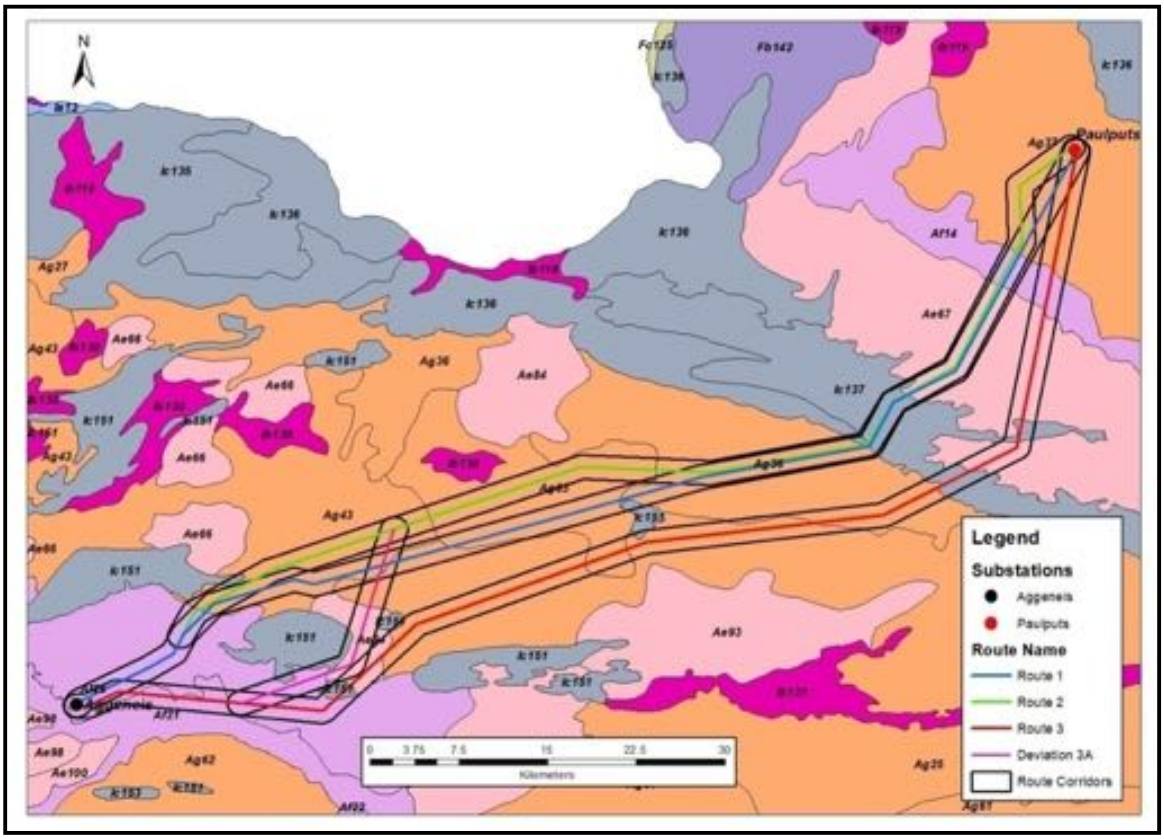


Figure 55: Map of land types

The very low rainfall in the area means that the only means of cultivation would be by irrigation. The satellite image of the area (Figure 56) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit (ARC-ISCW, 2004 in Paterson, 2017).

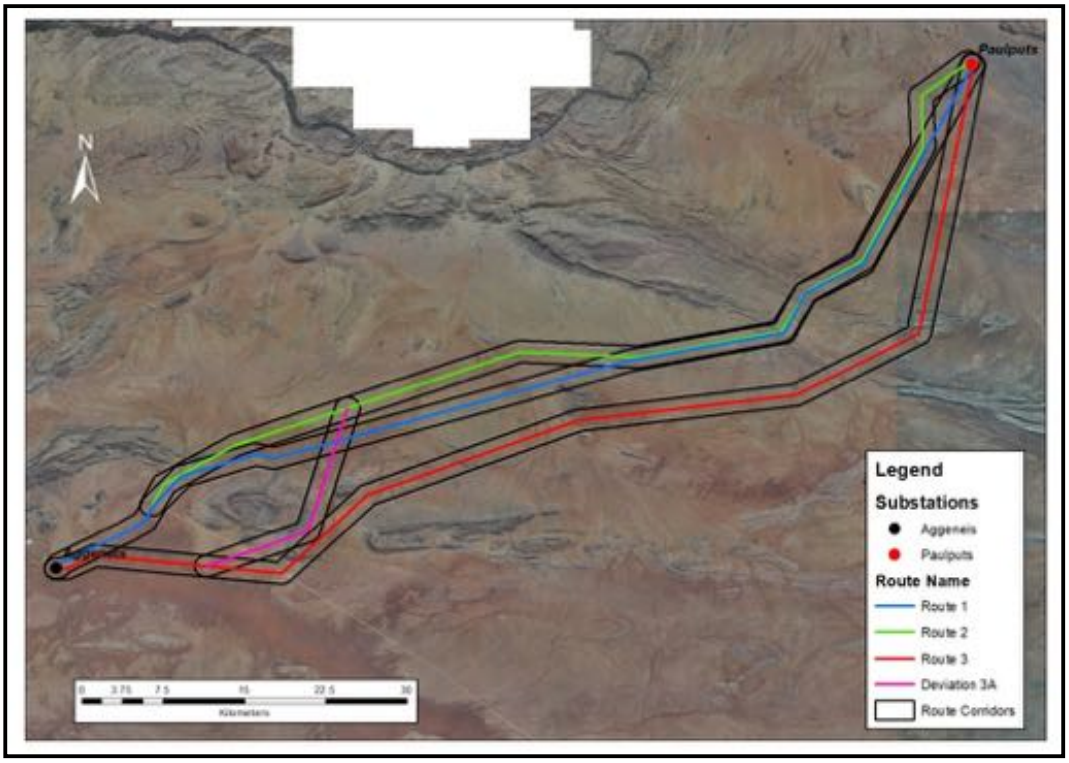


Figure 56: Remote sensing image of study area

9.5.2 Agricultural Impacts and Mitigations

The impacts can be summarized as follows. The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

NATURE OF IMPACT (Corridors 1, 2 & 3)	MITIGATION
1. Loss of agricultural land Land that is no longer able to be utilized due to construction of infrastructure.	• Minimize the footprint to ensure that as little physical disturbance as possible occurs during the construction phase. • To ensure that if disturbance (roads, pylons etc) takes place on steep slopes, appropriate soil conservation measures are put in place. • As little disturbance as possible (especially removal of vegetation) in areas of dunes, to minimize wind erosion.

Significance Without Mitigation	Low
Significance With Mitigation	Low

NATURE OF IMPACT (Corridors 1, 2 & 3)	MITIGATION
2. Increased wind erosion hazard	• Minimize the footprint to ensure that as little physical disturbance as possible occurs during the construction phase. • To ensure that if disturbance (roads, pylons etc) takes place on steep slopes, appropriate soil conservation measures are put in place. • As little disturbance as possible (especially removal of vegetation) in areas of dunes, to minimize wind erosion. • Re-vegetation should take place immediately, along with appropriate soil conservation measures (geotextiles, contours, windbreaks etc), as needed. • Regular monitoring of all mitigation measures (at least bi-annually for the first two years, annually thereafter).

Significance Without Mitigation	Moderate
Significance With Mitigation	Low

Please note: There are no cumulative impacts anticipated on agricultural potential areas.

9.5.3 Agricultural Conclusion and Recommendations

For many developments, the major impact on the natural resources of the study area would be the loss of arable land due to the construction of infrastructure. However, for the project under consideration, this impact would in all probability be of limited significance and would be local in extent, due mainly to the limited footprint of the towers for the transmission line and the upgrade of the two substations. At the end of the project life, it is anticipated that removal of any structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

However, with the prevailing climate (especially the low rainfall), coupled with sandy topsoils (Table 23), there could potentially be an increased possibility of soil erosion due to wind action, especially where vegetation cover is disturbed, leading to the bare soil becoming exposed.

Based on the reconnaissance-level soil and climate information, it is clear that the three corridors and deviation traverse very similar soil units in the same or very similar proportion.

<u>There is no clear preference for any one of the three proposed alternatives and all are rated equally</u>. No fatal flaws are expected from a soils perspective.

Recommended impact mitigation measures are provided in section 9.5.2 above.

9.6 VISUAL ASSESSMENT

9.6.1 Visual Findings

A Visual Impact Assessment (VIA) assesses the potential visual changes/impacts to an existing baseline environment resulting from the implementation of a proposed project. The associated visual changes could potentially have an impact on the character and value of the landscape and affect the views and perceptions of observers in the study area.

In the following pages, Photographs 27 to 31 are selected as representative views of specific viewpoints that are deemed sensitive. The purpose of the photographs was to record the baseline condition of the environment, and to understand the impact of a new powerline. It is also recognised that viewers experience the landscape in different ways and are exposed to the impacts in varying degrees. An infinite number of viewpoints can be chosen, but to keep the study precise and pragmatic, only highly sensitive or representative views were selected.

Some areas are considered more sensitive than others. The open plains are regarded somewhat featureless and mundane, but the areas north of Pofadder and the region near Gamsberg offer higher topographical variation, which often translates into visually pleasing experiences. Succulent vegetation such as *Aloe dichotoma* is more present in these landscapes and provides picturesque photo opportunities.

The study area is generally regarded as a landscape with medium sensitivity, but has regions of higher sensitivity near Gamsberg and north of Pofadder.

The following Figure 57 illustrates the various locations where Photographs 27 to 31 were taken.

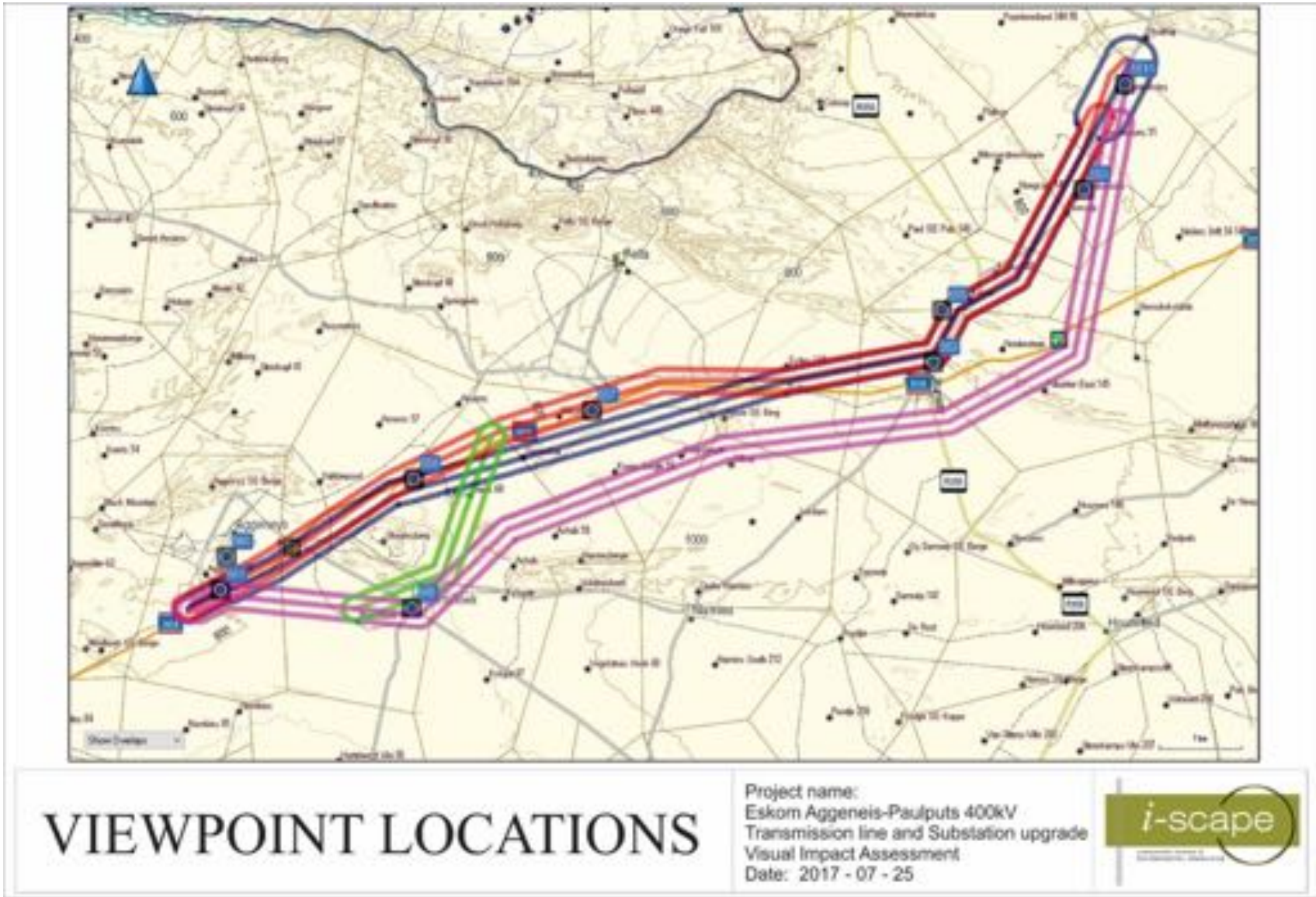


Figure 57: Viewpoint Locations

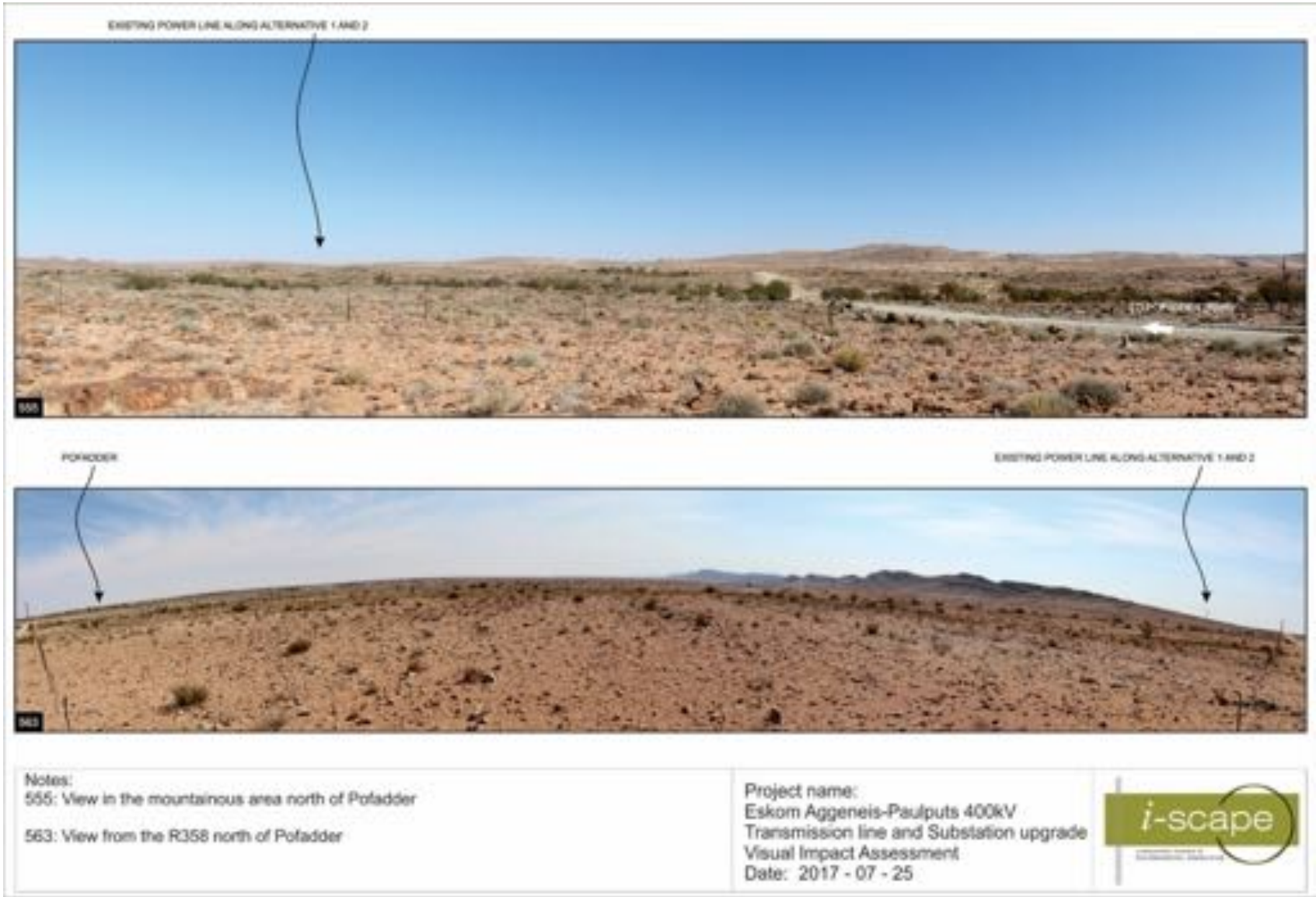
Notes:
5511: View of the landscape from Paulputs Substation towards the south west. Alternative 1&2 are proposed along side the existing power line in view.

553: View of the landscape at a farmstead near Konkonsies. Alternative 1 and 2 is proposed to the right of the picture near the existing power line.

Project name:
Eskom Aggeneis-Paulputs 400kV Transmission line and Substation upgrade
Visual Impact Assessment
Date: 2017 - 07 - 25

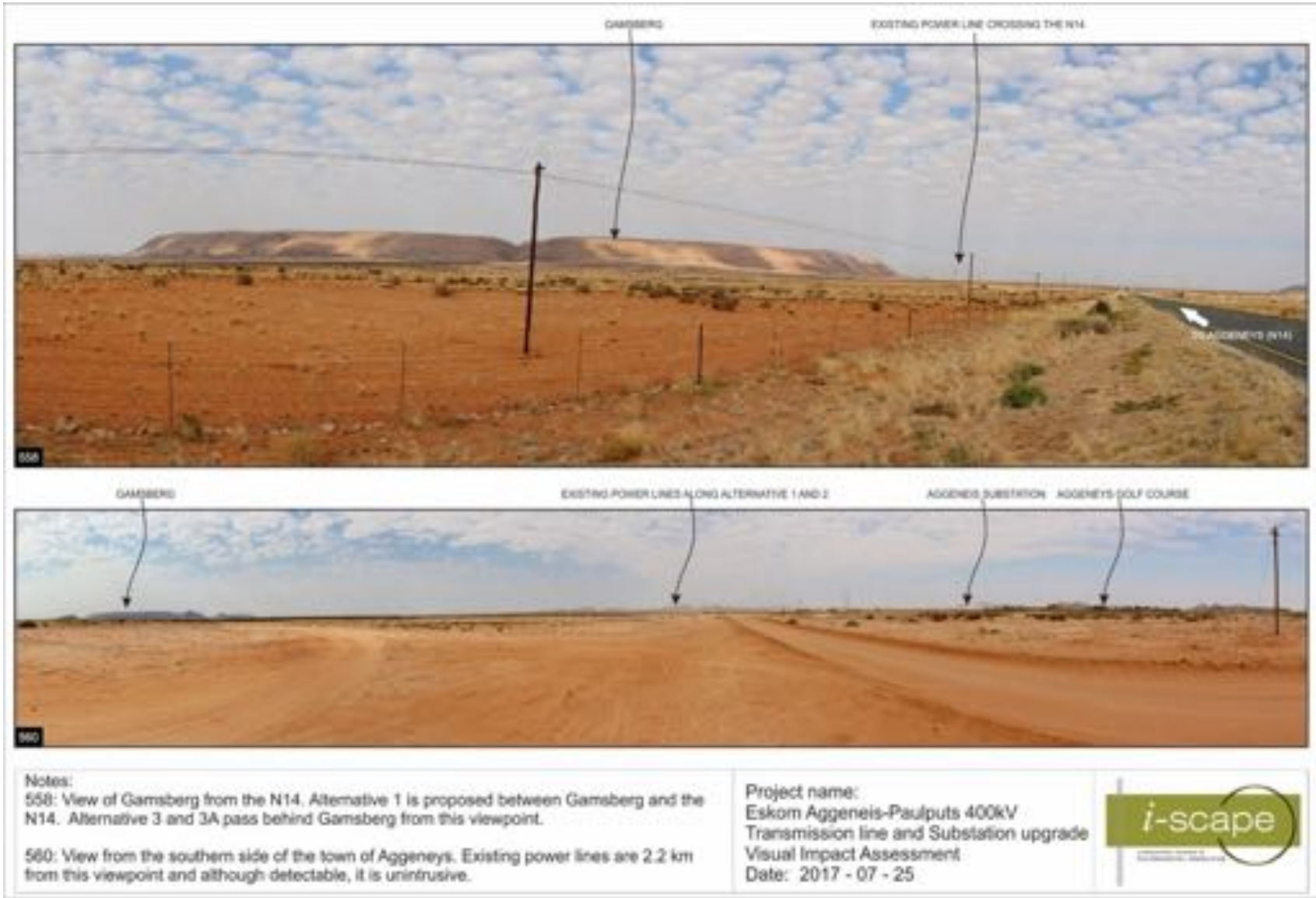
i-scape

Photograph 27: Viewpoints 5511 & 553

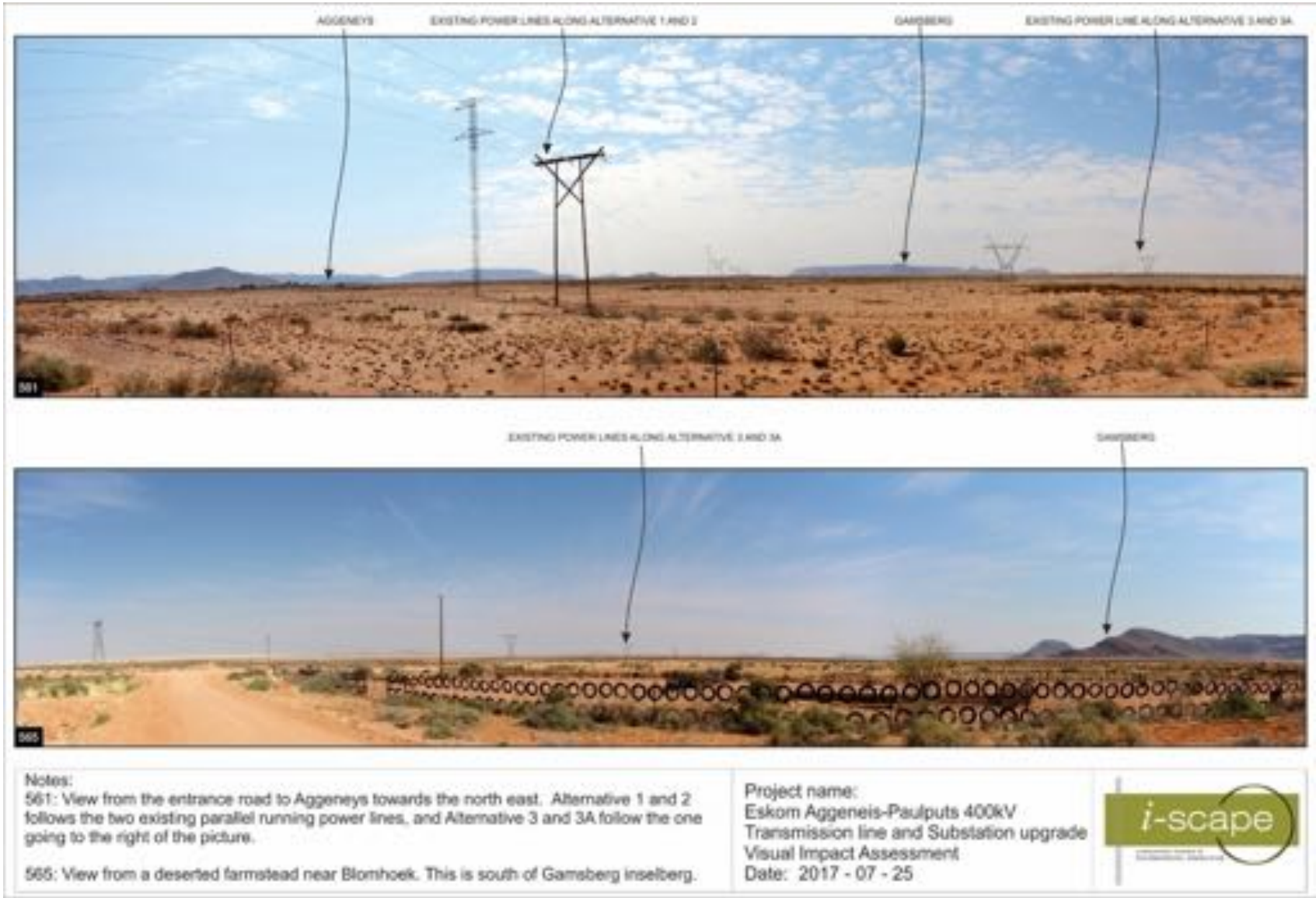


Photograph 28: Viewpoints 555 & 563

Photograph 29: Viewpoints 557



Photograph 30: Viewpoints 558 & 560



Photograph 31: Viewpoints 561 & 565

9.6.2 Visual Impacts and Mitigations

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

CONSTRUCTION PHASE	
VISUAL IMPACT SERVIRITY – CORRIDOR 1 – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect on observers in the ZMVE during the initial construction process which will be limited to surface disturbances. As the towers gain height, the visibility and visual exposure will increase gradually. Viewer incidence is generally expected to be medium as the route passes through desolate areas with a sparse farming community, but also passes within 2 km of the town of Pofadder, cross the N14 twice and remains within 2.5 km of the N14 for approximately 55 km of its length. A visual change will occur and will become progressively more substantial as the project nears completion. It will cause a visual intrusion attributable to disturbances caused by the construction activity. The workforce and equipment is considered uncharacteristic elements in the study area that may have an impact on scenic views.	**1. Avoidance** • Do not locate the construction camp or laydown yards within 1 km from any residential area or visually sensitive area, unless it can be completely screened from sensitive viewpoints. Preferably, construction camps should be located in a dedicated construction camp near a built-up area or in an area that is already disturbed. A number such areas exist; the first is at the Paulputs Substation where the immediate area surrounding the substation is disturbed, near the KaXu Solar One power plant, or in the construction camp that is located in the town of Aggeneys. The Aggeneis Substation also have a fenced area surrounding it, which could theoretically also serve as a laydown yard and construction camp site. • Avoid the construction of additional access roads by keeping to existing roads. **2. Reduction** • Clearly demarcate the construction site to limit the area of disturbance. • Keep dust levels down by implementing dust suppression methods on the dirt roads and at the substation construction sites. • Remove rubble and other waste that is generated by the construction process as soon as possible and dispose at an appropriate dump site. • Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed soil surfaces. Monitor the rehabilitated areas for at least 6 months to ensure a sufficient vegetation cover is established that will prevent erosion from occurring. **3. Remediation** • Keep the construction camp neat and tidy at all times. Remove any waste from the site or contain it in an enclosed area out of sight from sensitive viewpoints. • Enhance screening of the construction camps by erecting a temporary fence with a 3m high shade

	cloth to limit the intrusive nature of such a site.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

OPERATIONAL PHASE	
VISUAL IMPACT SERVIRITY – CORRIDOR 1 – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be added to the visual environment. It will be highly visible throughout most of the study area due to the low VAC, with reduced visibility in the more mountainous regions, north of Pofadder. Viewer incidence is generally expected to be medium as the route passes through desolate areas with a sparse farming community, but also passes within 2 km of the town of Pofadder, cross the N14 twice and remains within 2.5 km of the N14 for approximately 55 km of its length. Generally, the observers within the ZMVE will be most severely affected, with the severity decreasing over greater distances. A visual change will occur as a result of the new transmission line. It will interfere with panoramic views of the expansive undeveloped landscape in the fore and middle ground, and the scenic northern mountain views in the background. The transmission line will intrude on the observer's visual experience.	**1. Avoidance** • Maintaining a minimum buffer of 1km around sensitive viewers such as residential areas, will avoid the transmission line intersecting with the ZMVE and reduce the negative visual intrusion on the specific viewers. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. • Avoid landscapes and natural features that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill over which the transmission line must go. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. **2. Reduction** • The consolidation of powerlines in parallel servitudes is highly recommended and will have the greatest reduction in the severity of the impacts. Cumulative impacts are considered highly likely along all the alternatives and parallel powerlines increase the visual dominance of electrical infrastructure to potentially intolerable levels. Consolidating powerlines will result in the removal of one of the existing powerlines and incorporating it into the new powerline, thus reducing cumulative visual impacts. • Where the proposed powerline is sharing a corridor with an existing transmission line, use the same type of towers and uphold the same tower spacing in order to maintain visual coherence. • Keep to the minimum number of directional changes to limit the number of strain towers to be used. Strain towers are considered the most visually intrusive due to their larger visual footprint. • Cross-rope towers are generally the preferred choice as they are considered the least visible.

	3. Remediation • Treat the steel members of the transmission towers with a low gloss, galvanized paint to mitigate the initial shiny appearance of a new tower. • Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species or unsightly erosion. **4. Route diversion** • A proposed route diversion is illustrated in **Figure 58**. Essentially it is a combination of Alternative 1 and 3 and avoids most of the sensitive observers and landscape features in the study area. A route diversion connects the two alternatives at the approximate midway point.
Significance Without Mitigation	Moderate
Significance With Mitigation	Moderate

Cumulative impacts:

Cumulative impacts are highly likely due to the existing powerline between the two substations on the same route. Theoretically, the new 400kV transmission line will more than double the visual prominence of electrical infrastructure in the study area as its physical size is larger than the existing powerline. It is expected to cause an increased visual intrusion along its linear length and comes closer to a visual intolerance threshold.

CONSTRUCTION PHASE	
CORRIDOR 1 – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect, primarily on the desolate sense of place and the farming land use that primarily utilises the natural landscape. For the duration of the construction phase machinery, material and workforce will be uncharacteristic to the visual resource and will contrast with the natural landscape and farming practices. The construction activity is considered incompatible with the prevailing character and will interfere with the sense of place and scenic qualities of the study area.	Refer to the Construction Phase Mitigations above.
Significance Without Mitigation	Minor
Significance With Mitigation	Minor

OPERATIONAL PHASE	
CORRIDOR 1 – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be a prominent addition to the baseline environment. The complex industrial character and enormous scale of the towers will contrast with the predominantly flat topography, desolate sense of place and natural landscape. Pleasant views of the distant northern mountains will be negatively affected. This will cause a reduction in scenic quality	Refer to the Operational Phase Mitigations above.

of the visual resource.

Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

Cumulative impacts

Cumulative impacts are highly likely due to the existing powerline between the two substations on the same route. Theoretically, the new 400kV transmission line will more than double the visual prominence of electrical infrastructure in the study area as its physical size is larger than the existing powerline. It is expected to increase the contrast with the natural character of the study area, thereby reducing the scenic quality of the visual resource.

CONSTRUCTION PHASE

VISUAL IMPACT SERVIRITY – CORRIDOR 2 – OBSERVERS

NATURE OF IMPACT	MITIGATION
The construction activity will result in a negative effect on observers in the ZMVE during the initial construction process which will be limited to surface disturbances. As the towers gain height, the visibility and visual exposure will increase gradually. Viewer incidence is generally expected to be medium as the route passes through desolate areas with a sparse farming community and within 2 km of the town of Pofadder. A higher viewer incidence is expected where the route lines up within 1 km of the N14 for approximately 55 km of its length. A visual change will occur and will become progressively more substantial as the project nears completion. It will cause a visual intrusion attributable to disturbances caused by the construction activity. The workforce and equipment is considered uncharacteristic elements in the study area that may have an impact on scenic views	**1. Avoidance** • Do not locate the construction camp or laydown yards within 1 km from any residential area or visually sensitive area, unless it can be completely screened from sensitive viewpoints. Preferably, construction camps should be located in a dedicated construction camp near a built-up area or in an area that is already disturbed. A number such areas exist; the first is at the Paulputs Substation where the immediate area surrounding the substation is disturbed, near the KaXu Solar One power plant, or in the construction camp that is located in the town of Aggeneys. They Aggeneis Substation also have a fenced area surrounding it, which could theoretically also serve as a laydown yard and construction camp site. • Avoid the construction of additional access roads by keeping to existing roads. **2. Reduction** • Clearly demarcate the construction site to limit the area of disturbance. • Keep dust levels down by implementing dust suppression methods on the dirt roads and at the substation construction sites. • Remove rubble and other waste that is generated by the construction process as soon as possible and dispose at an appropriate dump site. • Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed soil surfaces. Monitor the rehabilitated areas for at least 6 months to ensure a sufficient vegetation cover is established that will prevent erosion from occurring. **3. Remediation** • Keep the construction camp neat and tidy at all

	times. Remove any waste from the site or contain it in an enclosed area out of sight from sensitive viewpoints. • Enhance screening of the construction camps by erecting a temporary fence with a 3m high shade cloth to limit the intrusive nature of such a site.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

OPERATIONAL PHASE	
VISUAL IMPACT SERVIRITY – CORRIDOR 2 – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be added to the visual environment. It will be highly visible throughout most of the study area due to the low VAC, with reduced visibility in the more mountainous regions, north of Pofadder. Viewer incidence is generally expected to be medium as the route passes through desolate areas with a sparse farming community and within 2 km of the town of Pofadder. A higher viewer incidence is expected where the route lines up within 1 km of the N14 for approximately 55 km of its length. Generally, the observers within the ZMVE will be most severely affected, with the severity decreasing over greater distances. A visual change will occur as a result of the new transmission line. It will interfere with panoramic views of the expansive undeveloped landscape in the fore and middle ground, and the scenic northern mountain views in the background. The transmission line will intrude on the observer's visual experience.	**1. Avoidance** • Maintaining a minimum buffer of 1km around sensitive viewers such as residential areas, will avoid the transmission line intersecting with the ZMVE and reduce the negative visual intrusion on the specific viewers. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. • Avoid landscapes and natural features that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill over which the transmission line must go. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. **2. Reduction** • The consolidation of powerlines in parallel servitudes is highly recommended and will have the greatest reduction in the severity of the impacts. Cumulative impacts are considered highly likely along all the alternatives and parallel powerlines increase the visual dominance of electrical infrastructure to potentially intolerable levels. Consolidating powerlines will result in the removal of one of the existing powerlines and incorporating it into the new powerline, thus reducing cumulative visual impacts. • Where the proposed powerline is sharing a corridor with an existing transmission line, use the same type of towers and uphold the same tower spacing in order to maintain visual coherence.

- Keep to the minimum number of directional changes to limit the number of strain towers to be used. Strain towers are considered the most visually intrusive due to their larger visual footprint.
- Cross-rope towers are generally the preferred choice as they are considered the least visible.

3. Remediation

- Treat the steel members of the transmission towers with a low gloss, galvanized paint to mitigate the initial shiny appearance of a new tower.
- Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species or unsightly erosion.

4. Route diversion

- A proposed route diversion is illustrated in **Figure 58**. Essentially it is a combination of Alternative 1 and 3 and avoids most of the sensitive observers and landscape features in the study area. A route diversion connects the two alternatives at the approximate midway point.

Significance Without Mitigation	Moderate
Significance With Mitigation	Moderate

Cumulative impacts:

Cumulative impacts are highly likely along sections of the proposed route due to the existing powerline between the Paulputs substation and Pofadder, and 15km before Aggeneis Substation. Theoretically, the new 400kV transmission line will more than double the visual prominence of electrical infrastructure in the study area as its physical size is larger than the existing powerline. It is expected to cause an increased visual intrusion along its linear length and near the visual intolerance threshold.

CONSTRUCTION PHASE

CORRIDOR 2 – VISUAL RESOURCE

NATURE OF IMPACT	MITIGATION
The construction activity will result in a negative effect, primarily on the desolate sense of place and the farming land use that primarily utilises the natural landscape. For the duration of the construction phase machinery, material and workforce will be uncharacteristic to the visual resource and will contrast with the natural landscape and farming practices. The construction activity is considered incompatible with the prevailing character and will interfere with the sense of place and scenic qualities of the study area.	Refer to the Construction Phase Mitigations above.
Significance Without Mitigation	Minor
Significance With Mitigation	Minor

OPERATIONAL PHASE

CORRIDOR 2 – VISUAL RESOURCE

NATURE OF IMPACT	MITIGATION
A new transmission line will be a prominent addition to the baseline environment. The complex industrial character and enormous scale of the towers will contrast with the predominantly flat topography, desolate sense of place and natural landscape. Pleasant views of the distant northern mountains will be negatively affected. This will cause a reduction in scenic quality of the visual resource.	Refer to the Operational Phase Mitigations above.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

Cumulative impacts:

Cumulative impacts are highly likely along sections of the proposed route due to the existing power line between the Paulputs Substation and Pofadder, and 15km before Aggeneis Substation. Theoretically, the new 400kV transmission line will more than double the visual prominence of electrical infrastructure in the study area as its physical size is larger than the existing powerline. It is expected to increase the contrast with the natural character of the study area, thereby reducing the scenic quality of the visual resource.

CONSTRUCTION PHASE

VISUAL IMPACT SERVIRITY – CORRIDOR 3 – OBSERVERS

NATURE OF IMPACT	MITIGATION
The construction activity will result in a negative effect on observers in the ZMVE during the initial construction process which will be limited to surface disturbances. As the towers gain height, the visibility and visual exposure will increase gradually. Viewer incidence is generally expected to be low as the route passes through desolate areas with a sparse farming community and within 2.3 km of the town of Pofadder. A higher viewer incidence is expected where the route crosses the N14 twice. A visual change will occur and will become progressively more substantial as the project nears completion. It will cause a visual intrusion attributable to disturbances caused by the construction activity. The workforce and equipment is considered uncharacteristic elements in the study area that may have an impact on scenic	**1. Avoidance** • Do not locate the construction camp or laydown yards within 1 km from any residential area or visually sensitive area, unless it can be completely screened from sensitive viewpoints. Preferably, construction camps should be located in a dedicated construction camp near a built-up area or in an area that is already disturbed. A number such areas exist; the first is at the Paulputs Substation where the immediate area surrounding the substation is disturbed, near the KaXu Solar One power plant, or in the construction camp that is located in the town of Aggeneys. They Aggeneis Substation also have a fenced area surrounding it, which could theoretically also serve as a laydown yard and construction camp site. • Avoid the construction of additional access roads by keeping to existing roads. **2. Reduction** • Clearly demarcate the construction site to limit the area of disturbance. • Keep dust levels down by implementing dust suppression methods on the dirt roads and at the substation construction sites. • Remove rubble and other waste that is generated by the construction process as soon as possible and dispose at an appropriate dump site.

views.	• Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed soil surfaces. Monitor the rehabilitated areas for at least 6 months to ensure a sufficient vegetation cover is established that will prevent erosion from occurring. **3. Remediation** • Keep the construction camp neat and tidy at all times. Remove any waste from the site or contain it in an enclosed area out of sight from sensitive viewpoints. • Enhance screening of the construction camps by erecting a temporary fence with a 3m high shade cloth to limit the intrusive nature of such a site.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

OPERATIONAL PHASE	
VISUAL IMPACT SERVIRITY – CORRIDOR 3 – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be added to the visual environment. It will be highly visible throughout most of the study area due to the low VAC. Viewer incidence is generally expected to be low as the route passes through desolate areas with a sparse farming community and within 2.3 km of the town of Pofadder. A higher viewer incidence is expected where the route crosses the N14 twice. Generally, the observers within the ZMVE will be most severely affected, with the severity decreasing over greater distances. A visual change will occur as a result of the new transmission line. It will interfere with panoramic views of the expansive undeveloped landscape and the scenic mountains near Gamsberg. The transmission line will intrude on the observer's visual experience.	**1. Avoidance** • Maintaining a minimum buffer of 1km around sensitive viewers such as residential areas, will avoid the transmission line intersecting with the ZMVE and reduce the negative visual intrusion on the specific viewers. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. • Avoid landscapes and natural features that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill over which the transmission line must go. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. **2. Reduction** • The consolidation of powerlines in parallel servitudes is highly recommended and will have the greatest reduction in the severity of the impacts. Cumulative impacts are considered highly likely along all the alternatives and parallel powerlines increase the visual dominance of electrical infrastructure to potentially intolerable levels. Consolidating powerlines will result in the removal

	of one of the existing powerlines and incorporating it into the new powerline, thus reducing cumulative visual impacts. • Where the proposed powerline is sharing a corridor with an existing transmission line, use the same type of towers and uphold the same tower spacing in order to maintain visual coherence. • Keep to the minimum number of directional changes to limit the number of strain towers to be used. Strain towers are considered the most visually intrusive due to their larger visual footprint. • Cross-rope towers are generally the preferred choice as they are considered the least visible. **3. Remediation** • Treat the steel members of the transmission towers with a low gloss, galvanized paint to mitigate the initial shiny appearance of a new tower. • Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species or unsightly erosion. **4. Route diversion** • A proposed route diversion is illustrated in **Figure 58**. Essentially it is a combination of Alternative 1 and 3 and avoids most of the sensitive observers and landscape features in the study area. A route diversion connects the two alternatives at the approximate midway point.
Significance Without Mitigation	Moderate
Significance With Mitigation	Moderate

Cumulative impacts:

Cumulative impacts are highly likely along an 18km sections of the proposed route south of Aggeneis substation, where it is parallel to an existing 400kV transmission line. Theoretically, the new 400kV transmission line will double the visual prominence of electrical infrastructure in this region. It is expected to cause an increased visual intrusion along its linear length and comes closer to a visual intolerance threshold.

CONSTRUCTION PHASE	
CORRIDOR 3 – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect, primarily on the desolate sense of place and the farming land use that primarily utilises the natural landscape. For the duration of the construction phase machinery, material and workforce will be uncharacteristic to the visual resource and will contrast with the natural landscape and farming practices. The construction activity is considered incompatible with the prevailing character and will interfere with the sense of place and scenic qualities of the study area.	Refer to the Construction Phase Mitigations above.

Significance Without Mitigation	Minor
Significance With Mitigation	Minor

OPERATIONAL PHASE	
CORRIDOR 3 – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be a prominent addition to the baseline environment, which is generally free of electrical infrastructure. The complex industrial character and enormous scale of the towers will contrast with the predominantly flat topography, desolate sense of place and natural landscape. Pleasant views of the mountains near Gamsberg will be negatively affected. This will cause a reduction in scenic quality of the visual resource.	Refer to the Operational Phase Mitigations above.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

Cumulative impacts:

Cumulative impacts are highly likely along an 18km sections of the proposed route south of Aggeneis Substation, where it is parallel to an existing 400kV transmission line. Theoretically, the new 400kV transmission line will double the visual prominence of electrical infrastructure in this region. It is expected to increase the contrast with the natural character of the study area, thereby reducing the scenic quality of the visual resource.

CONSTRUCTION PHASE	
VISUAL IMPACT SERVIRITY – DEVIATION 3A – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect on observers in the ZMVE during the initial construction process which will be limited to surface disturbances. As the towers gain height, the visibility and visual exposure will increase gradually. Viewer incidence is generally expected to be low as the route passes through desolate areas with a sparse farming community and within 2.3 km of the town of Pofadder. A higher viewer incidence is expected where the route crosses the N14 twice. A visual change will occur and will become progressively more substantial as the project nears completion. It will cause a visual intrusion attributable to	**1. Avoidance** • Do not locate the construction camp or laydown yards within 1 km from any residential area or visually sensitive area, unless it can be completely screened from sensitive viewpoints. Preferably, construction camps should be located in a dedicated construction camp near a built-up area or in an area that is already disturbed. A number such areas exist; the first is at the Paulputs Substation where the immediate area surrounding the substation is disturbed, near the KaXu Solar One power plant, or in the construction camp that is located in the town of Aggeneys. They Aggeneis Substation also have a fenced area surrounding it, which could theoretically also serve as a laydown yard and construction camp site. • Avoid the construction of additional access roads by keeping to existing roads. **2. Reduction** • Clearly demarcate the construction site to limit the area of disturbance.

disturbances caused by the construction activity. The workforce and equipment is considered uncharacteristic elements in the study area that may have an impact on scenic views.	• Keep dust levels down by implementing dust suppression methods on the dirt roads and at the substation construction sites. • Remove rubble and other waste that is generated by the construction process as soon as possible and dispose at an appropriate dump site. • Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed soil surfaces. Monitor the rehabilitated areas for at least 6 months to ensure a sufficient vegetation cover is established that will prevent erosion from occurring. **3. Remediation** • Keep the construction camp neat and tidy at all times. Remove any waste from the site or contain it in an enclosed area out of sight from sensitive viewpoints. • Enhance screening of the construction camps by erecting a temporary fence with a 3m high shade cloth to limit the intrusive nature of such a site.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

OPERATIONAL PHASE	
VISUAL IMPACT SERVIRITY – DEVIATION 3A – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be added to the visual environment. It will be highly visible throughout most of the study area due to the low VAC. Viewer incidence is generally expected to be low as the route passes through desolate areas with a sparse farming community and within 2.3 km of the town of Pofadder. A higher viewer incidence is expected where the route crosses the N14 twice. Generally, the observers within the ZMVE will be most severely affected, with the severity decreasing over greater distances. A visual change will occur as a result of the new transmission line. It will interfere with panoramic views of the expansive undeveloped	**1. Avoidance** • Maintaining a minimum buffer of 1km around sensitive viewers such as residential areas, will avoid the transmission line intersecting with the ZMVE and reduce the negative visual intrusion on the specific viewers. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. • Avoid landscapes and natural features that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill over which the transmission line must go. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. **2. Reduction** • The consolidation of powerlines in parallel servitudes is highly recommended and will have the

landscape and the scenic mountains near Gamsberg. The transmission line will intrude on the observer's visual experience.	greatest reduction in the severity of the impacts. Cumulative impacts are considered highly likely along all the alternatives and parallel powerlines increase the visual dominance of electrical infrastructure to potentially intolerable levels. Consolidating powerlines will result in the removal of one of the existing powerlines and incorporating it into the new powerline, thus reducing cumulative visual impacts. • Where the proposed powerline is sharing a corridor with an existing transmission line, use the same type of towers and uphold the same tower spacing in order to maintain visual coherence. • Keep to the minimum number of directional changes to limit the number of strain towers to be used. Strain towers are considered the most visually intrusive due to their larger visual footprint. • Cross-rope towers are generally the preferred choice as they are considered the least visible. **3. Remediation** • Treat the steel members of the transmission towers with a low gloss, galvanized paint to mitigate the initial shiny appearance of a new tower. • Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species or unsightly erosion. **4. Route diversion** • A proposed route diversion is illustrated in **Figure 58**. Essentially it is a combination of Alternative 1 and 3 and avoids most of the sensitive observers and landscape features in the study area. A route diversion connects the two alternatives at the approximate midway point.
Significance Without Mitigation	Moderate
Significance With Mitigation	Moderate

Cumulative impacts:

Cumulative impacts are highly likely along the 13km sections of the proposed route south of Aggeneis substation, where it is parallel to an existing 400kV transmission line. Theoretically, the new 400kV transmission line will double the visual prominence of electrical infrastructure in this region. It is expected to cause an increased visual intrusion along its linear length and comes closer to a visual intolerance threshold.

CONSTRUCTION PHASE	
DEVIATION 3A – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect, primarily on the desolate sense of place and the farming land use that primarily utilises the natural landscape. For the duration of the	Refer to the Construction Phase Mitigations above.

construction phase machinery, material and workforce will be uncharacteristic to the visual resource and will contrast with the natural landscape and farming practices. The construction activity is considered incompatible with the prevailing character and will interfere with the sense of place and scenic qualities of the study area.	
Significance Without Mitigation	Minor
Significance With Mitigation	Minor

OPERATIONAL PHASE	
DEVIATION 3A – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
A new transmission line will be a prominent addition to the baseline environment, which is generally free of electrical infrastructure. The complex industrial character and enormous scale of the towers will contrast with the predominantly flat topography, desolate sense of place and natural landscape. Pleasant views of the mountains and hills on the southern and eastern side of Gamsberg as well as distant panoramic views of the mountains towards the Namibian border, will be negatively affected. This will cause a reduction in scenic quality of the visual resource.	Refer to the Operational Phase Mitigations above.
Significance Without Mitigation	Moderate to minor
Significance With Mitigation	Moderate to minor

Cumulative impacts:

Cumulative impacts are highly likely along an 18 km sections of the proposed route south of Aggeneis Substation, where it is parallel to an existing 400kV transmission line. Theoretically, the new 400 kV transmission line will double the visual prominence of electrical infrastructure in this region. It is expected to increase the contrast with the natural character of the study area, thereby reducing the scenic quality of the visual resource.

CONSTRUCTION PHASE	
VISUAL IMPACT SERVIRITY – SUBSTATION UPGRADES – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect on observers in the ZMVE during the initial stages of construction which will include earthworks. As the substations approach completion, the visibility and visual exposure may increase with the addition of more components. Viewer incidence will be very low at both the Paulputs and Aggeneys Substations. Paulputs is located	**1. Avoidance** • Do not locate the construction camp or laydown yards within 1 km from any residential area or visually sensitive area, unless it can be completely screened from sensitive viewpoints. Preferably, construction camps should be located in a dedicated construction camp near a built-up area or in an area that is already disturbed. A number such areas exist; the first is at the Paulputs Substation where the immediate area surrounding the substation is disturbed, near the KaXu Solar One power plant, or in the construction camp that is located in the town of Aggeneys. They Aggeneis

far from any community or farm residence. A gravel road leading to some of the farms passes east of the substation but is mostly used by local farmers. Aggeneys Substation is 5 km south west of the town Aggeneis, but is next to the N14. Motorists travelling on the N14 will have a fleeting view of the construction activity. A visual change is expected occur as the construction activity will cause visual disturbances and change the status quo scenario.	Substation also have a fenced area surrounding it, which could theoretically also serve as a laydown yard and construction camp site. • Avoid the construction of additional access roads by keeping to existing roads. **2. Reduction** • Clearly demarcate the construction site to limit the area of disturbance. • Keep dust levels down by implementing dust suppression methods on the dirt roads and at the substation construction sites. • Remove rubble and other waste that is generated by the construction process as soon as possible and dispose at an appropriate dump site. • Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed soil surfaces. Monitor the rehabilitated areas for at least 6 months to ensure a sufficient vegetation cover is established that will prevent erosion from occurring. **3. Remediation** • Keep the construction camp neat and tidy at all times. Remove any waste from the site or contain it in an enclosed area out of sight from sensitive viewpoints. • Enhance screening of the construction camps by erecting a temporary fence with a 3m high shade cloth to limit the intrusive nature of such a site.
Significance Without Mitigation	Minor to negligible
Significance With Mitigation	Negligible

OPERATIONAL PHASE	
VISUAL IMPACT SERVIRITY – SUBSTATION UPGRADES – OBSERVERS	
NATURE OF IMPACT	**MITIGATION**
An existing Paulputs Substation will be enlarged by approximately 150%. A noticeable visual change can be expected. Viewer incidence will however be very low as it is located far from any community or farm residence. A gravel road leading to some of the farms passes east of the substation but is mostly used by local farmers. Aggeneys Substation is 5 km south west of the town Aggeneis, but is next to the N14. Motorists travelling on	**1. Avoidance** • Maintaining a minimum buffer of 1km around sensitive viewers such as residential areas, will avoid the transmission line intersecting with the ZMVE and reduce the negative visual intrusion on the specific viewers. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. • Avoid landscapes and natural features that are considered scenic and contributes to the aesthetic value of the visual resource. Such features include any rocky outcrop, ridge or hill over which the

the N14 will have a fleeting view of the construction activity. The upgraded substations are not expected to cause any significant visual intrusion due to the distance of from sensitive observers.	transmission line must go. This is not always an option and could lead to major route diversions, thus avoidance mitigation can only be considered if the diversion is feasible, implementable and does not impact on other sensitive receptors. **2. Reduction** • The consolidation of powerlines in parallel servitudes is highly recommended and will have the greatest reduction in the severity of the impacts. Cumulative impacts are considered highly likely along all the alternatives and parallel powerlines increase the visual dominance of electrical infrastructure to potentially intolerable levels. Consolidating powerlines will result in the removal of one of the existing powerlines and incorporating it into the new powerline, thus reducing cumulative visual impacts. • Where the proposed powerline is sharing a corridor with an existing transmission line, use the same type of towers and uphold the same tower spacing in order to maintain visual coherence. • Keep to the minimum number of directional changes to limit the number of strain towers to be used. Strain towers are considered the most visually intrusive due to their larger visual footprint. • Cross-rope towers are generally the preferred choice as they are considered the least visible. **3. Remediation** • Treat the steel members of the transmission towers with a low gloss, galvanized paint to mitigate the initial shiny appearance of a new tower. • Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species or unsightly erosion. **4. Route diversion** • A proposed route diversion is illustrated in **Figure 58**. Essentially it is a combination of Alternative 1 and 3 and avoids most of the sensitive observers and landscape features in the study area. A route diversion connects the two alternatives at the approximate midway point.
Significance Without Mitigation	Minor to negligible
Significance With Mitigation	Minor to negligible

Cumulative impacts:

Cumulative impacts are likely to occur as an increased dominance of electrical infrastructure can be expected near the substations. The KaXu Solar One power plant, existing Paulputs and Aggeneis Substations, and the convergence of power lines at the substations, provide a baseline environment that is already impacted by electrical infrastructure. One can argue that the substation upgrades are compatible with the baseline environment and that a low risk of

cumulative impact will occur.

CONSTRUCTION PHASE	
SUBSTATION UPGRADES – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
The construction activity will result in a negative effect, primarily on the desolate sense of place and the farming land use that primarily utilises the natural landscape. For the duration of the construction phase machinery, material and workforce will be uncharacteristic to the visual resource and will contrast with the natural landscape and farming practices. The construction activity is considered incompatible with the prevailing character and will interfere with the sense of place and scenic qualities of the study area.	Refer to the Operational Phase Mitigations above.
Significance Without Mitigation	Minor to negligible
Significance With Mitigation	Minor to negligible

OPERATIONAL PHASE	
SUBSTATION UPGRADES – VISUAL RESOURCE	
NATURE OF IMPACT	**MITIGATION**
The upgrade to the Paulputs and Aggeneis Substations is considered relatively small additions to the visual resource and will remain within the parameters of the existing baseline environment without major impacts to the prevailing character of the site and local visual resource. No major impact on visual quality or aesthetic value is expected.	Refer to the Operational Phase Mitigations above.
Significance Without Mitigation	Minor to negligible
Significance With Mitigation	Minor to negligible

Cumulative impacts:

Cumulative impacts are likely to occur as an increased dominance of electrical infrastructure can be expected near the substations. The KaXu Solar One power plant, existing Paulputs and Aggeneis Substations, and the convergence of power lines at the substations, provide a baseline environment that is already impacted by electrical infrastructure. One can argue that the substation upgrades are compatible with the baseline environment and that a low risk of cumulative impact will occur.

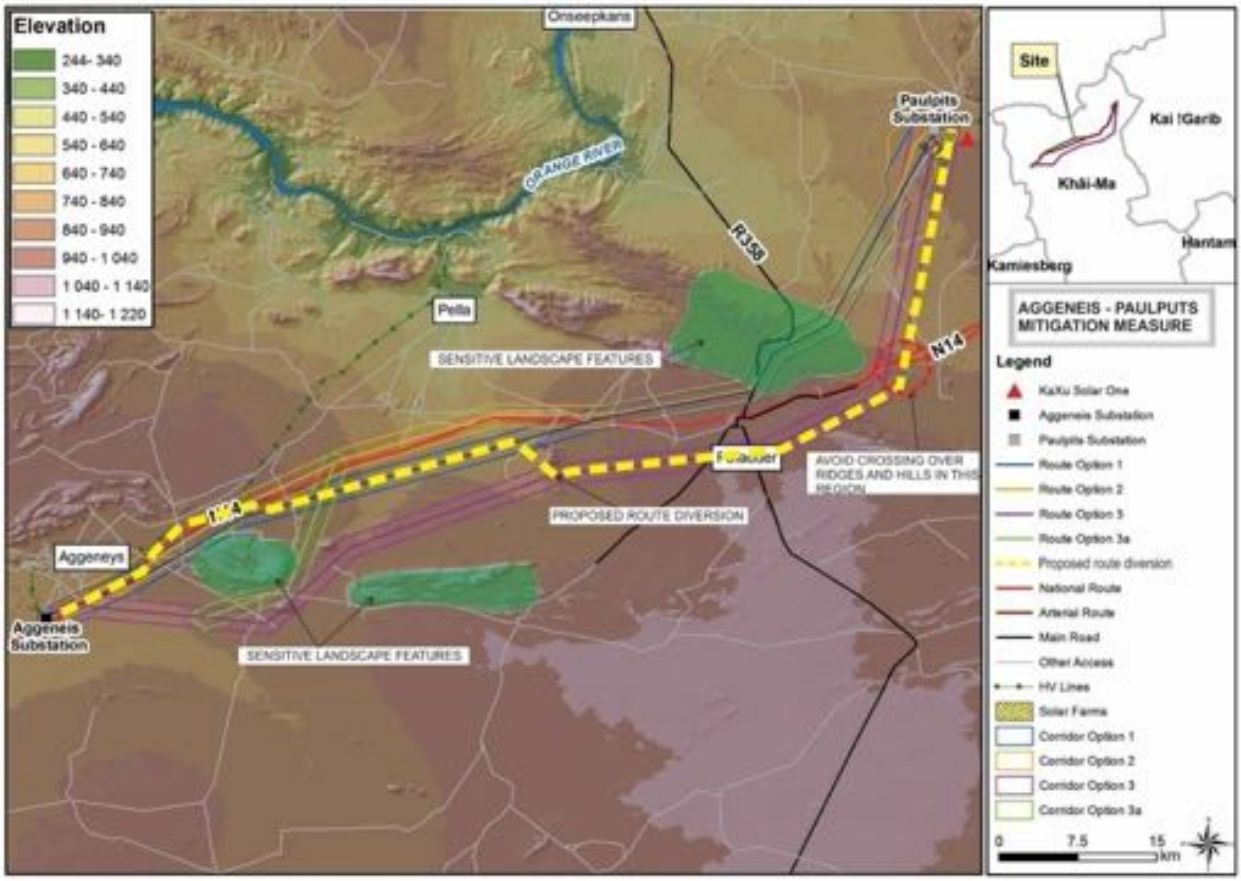


Figure 58: Proposed Route Diversion (Source: i-scape, 2017)

9.6.3 Visual Conclusion and Recommendations

All route corridors traverse a study area that is an arid landscape with a low topographic variance, but with isolated instances of rocky outcrops, hills and ridges. Generally, the landscape is considered semi-natural with a low level of transformation and open panoramic views.

In most cases, the transmission line will impact on the scenic qualities of the visual resource by interfering with the prevailing semi-natural character of the study area, or interfering with distant scenic views of the mountainous terrain, north of the study area. Areas or features of high aesthetic value and scenic quality have been identified as:

- The rocky ridges and elevated terrain north of Pofadder;
- Gamsberg east of Aggeneis; and
- The distant views that can be experienced of the highly elevated mountainous terrain near the Namibian border.

Alternative Corridor 1 is the most preferred route. The motivation is that the baseline environment is already impacted by a parallel running existing powerline which lowers the

sensitivity of the visual environment to some degree. One can argue that the project is more compatible with the baseline environment along Alternative 1 than along the other two alternative routes. It is generally more acceptable to have two powerlines in one corridor, thereby concentrating the impact in that corridor, than to spread the impact over a larger area, thereby impacting on other landscapes that are free from transmission lines. Empirical research has indicated that two parallel running powerlines are considered below the visual tolerance threshold in most cases, but three or more powerlines nears, or exceeds the threshold, increasing cumulative impacts to unacceptable levels. This is especially relevant in landscapes that are considered scenic or is highly exposed due to a low VAC.

Alternative 3 is less preferred than Alternative 1. It traverses a part of the study area that is largely free of any electrical infrastructure, but remains far from the towns. It is considered less acceptable to impact on a landscape that is free of electrical infrastructure that to keep powerlines in the same corridor, thereby concentrating impacts in one servitude.

Alternative 2 is marginally less preferred than Alternative 3. It follows much the same route as Alternative 1 but keeps north of the N14. Distant views of the northern mountains will be blemished by the introduction of a new transmission line in the foreground as experienced from the N14. A higher viewer incidence is also expected due to the route's proximity to the N14.

Alternative 3A is the least preferred option. It passes through a scenic area between Gamsberg and the isolated hills south and west of it and then links up again with Alternative 2 which is considered less preferred than Alternative 1 & 3.

Recommended impact mitigation measures are provided in section 9.6.2 above.

9.7 HERITAGE ASSESSMENT

9.7.1 Heritage Findings

SPECIFIC OBSERVATIONS ALONG THE NORTHERN AND CENTRAL CORRIDORS

Figure 59: The northern and central corridors (light blue) follow the same route for a major part of the route, diverging from part of the route between Pofadder and Aggeneis

Generally, it was found that the sites of the Paulputs and Aggeneis substations and the terrain through which the proposed powerline would pass is not rich in archaeological and colonial era heritage traces. Over virtually the entire development area stone artefacts (the predominant heritage resource noted) were found to occur in extremely low densities of between 0 and <1 per 10 x 10m area. In the dune east of Paulputs, for example, the only visible trace of what is taken to be Later Stone Age occupation was the occurrence of very low numbers of ostrich eggshell fragments and no more than about five widely scattered quartz flakes (Figure 59).

Figure 60: Quartz flakes found on dunes east of Paulputs Substation

Similar findings were repeated along the generalised route of the three alternative transmission line routes, where artefacts were generally either absent or widely scattered as isolated finds. A few exceptions to this regard were found:

In the vicinity of 29.19952 ^{o} S 18.98030 ^{o} E there is a small cluster of Later Stone Age sites north of the national road Pofadder-Aggeneys and situated amongst exposures of bedrock where water collects after rain. Here a fair abundance of Ceramic Later Stone Age artetacts was noted including stone tools, pottery and ostrich eggshell fragments, probably representing repeated short-duration encampments dating from within the last millennium (see also Morris 2009).

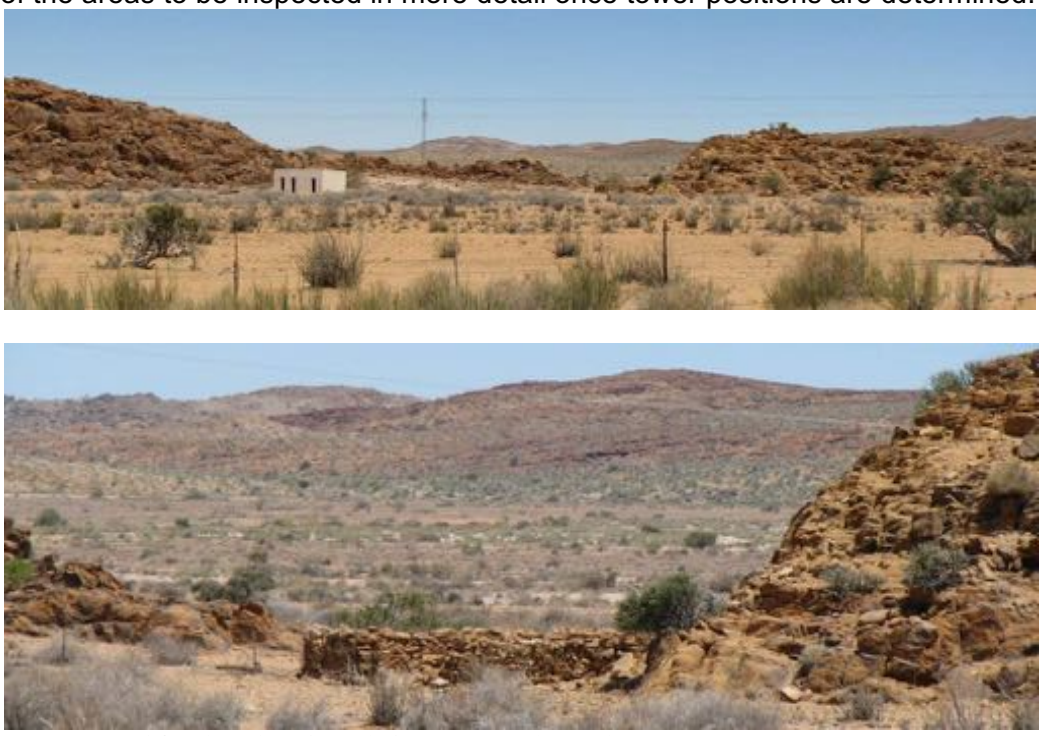
Just north of Pofadder, in the vicinity of 29.10232 ^{o} S 19.39923 ^{o} E remains of a probably later twentieth century explosives magazine were noted (Photograph 32), not of major heritage significance but relating to pre-1961 mining nearby (A.B. Thomas pers. comm.). No Stone Age traces were found here nor in the stream course nearby; however it was reported that sites with pottery had been found on the north side of the adjacent hills, but away from the proposed route of the transmission line.

Photograph 32: Remains of pre-1961 mining infrastructure

In the vicinity of 29.09366 S 19.41174 E no sites were found but the minimal past impact of the existing Eskom tower was noted which confirmed the impression based on Sampson's (1985) in Morris, 2017 observation, that transmission lines would tend to have a low or negligible impact on Stone Age archaeological traces in this kind of landscape (Photograph 33).

Photograph 33: Minimal disturbance in the vicinity of a tower on an existing transmission line

In the vicinity of 29.05551 ° S 19.44380 ° E Photograph 34 shows sensitive farm-related features including stone walling. Farm grave yards may exist in this valley and the vicinity would be one of the areas to be inspected in more detail once tower positions are determined.



Photograph 34: Historical farm infrastructure including stone-walled kraals (above and below)

Significant vernacular architecture along the generalised route, in this instance not in a good state of repair, was noted at 28.97807 ° S 19.52695 ° E. Nearby farm infrastructure in photograph 35 is possibly of more recent vintage and from a heritage/architectural perspective less significant.

Photograph 35: Farm worker dwelling (above) and main homestead (below) at the farm Konkonsies I

The area of proposed expansion of the Paulputs Substation at 28.87937 ° S 19.56397 ° E, in the foreground of the following photograph, is already disturbed and no traces of heritage features were found.

Photograph 36: Already disturbed areas around the Paulputs Substation – no heritage traces found

Relative Impacts of Alternative Northern and Central Corridors

Given the absence of specific route details within the 2 km width of each corridor, and given the general sparsity of heritage traces in this landscape, there appears to be little specific basis to judge one corridor over the other. Where possible, from the point of view of visual impact in the heritage landscape between Aggeneis and Pofadder, the impact of the line could be minimised by keeping the new transmission line on the same side of the national road as the existing line. This is particularly the case between Pofadder and the Pella turn-off where the existing view of the Pella Mountains to the north of the national road should not be compromised if possible.

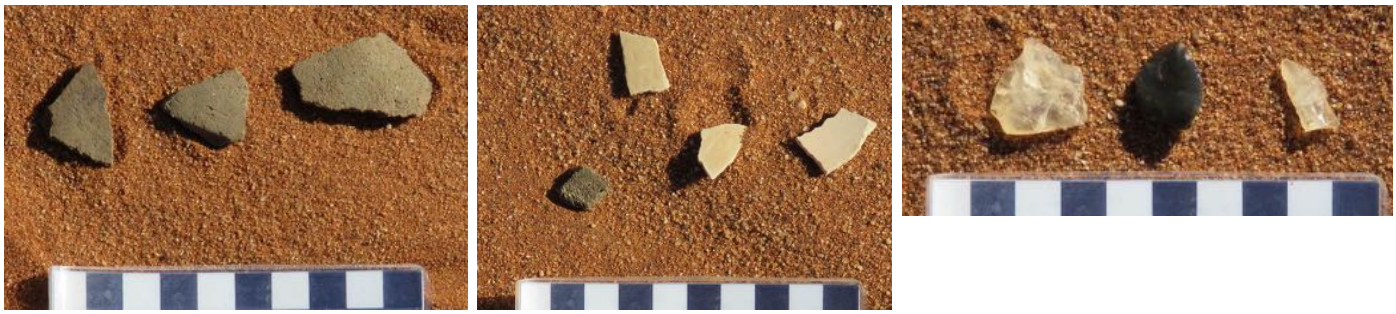
Photograph 37: Landscape north of the road towards the Pella Mountains

SPECIFIC OBSERVATIONS ALONG THE SOUTHERN CORRIDOR

Figure 61: The southern corridor (darker blue) follows a route quite distinct from the northern and central corridors

As for the northern and central corridors discussed above, the same general observation applies along the southern corridor. Extremely low densities of heritage traces (essentially stone artefacts), occur in quantities from 0 to <1 per any given 10 x 10m area. A few exceptions to this regard were found:

South from Paulputs, in dunes on the farm Konkonsies 1, a deflated area was found where stone artefacts, potsherds and ostrich eggshell fragments eroded out of the top of a dune, at 28°58'31.1"S; 19°32'11.3"E (Photograph 38). At the base of the dunes nearby a further Ceramic Later Stone Age site was located at 28°58'35.7"S; 19°32'08.4"E (Photograph 39).



Photograph 38: Potsherds, ostrich eggshell fragments and stone tools found on a dune crest at 28o58'31.1"S; 19o32'11.3"E.at Konkonsies 1

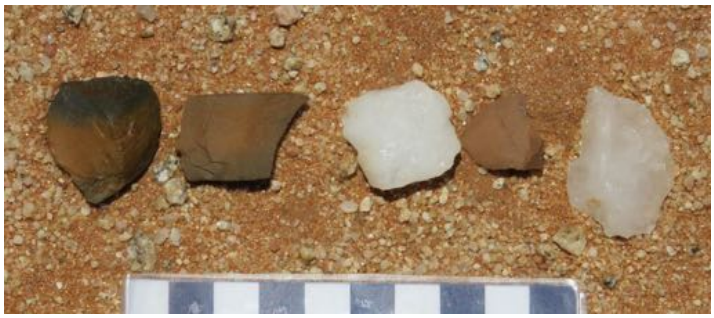

Photograph 39: The Ceramic Later Stone Age site on the dune crest at Konkonsies 1 (left). Ceramic Later Stone Age site at base of dune, Konkonsies 1 (right)

Photograph 40: Potsherds found along with quartz flaked stone artefacts at the base of the dune at 28o58'35.7"S; 19o32'08.4"E at Konkonsies 1

Rocky outcrops known as *bakkes* or *goras*, where water collects after good rains, were found to occur on terrain within the 2km broad corridor south of Pofadder. A number of these were inspected closely and found to have been the focus of past human activity, resulting in moderately high densities of artefacts, principally stone tools. But these sites were not as rich as similar localities documented near Gamsberg. These instances, south of Pofadder, were noted in the vicinities of 29°09'06.9"S 19°24'37.1"E (Photograph 41); and 29°09'45"S 19°22'16.5"E (Photograph 42). In Photograph 42 there is a grinding groove on exposed bedrock. Stone artefacts are based on quartz, predominantly, and to a lesser extent on jaspilite, most likely derived from the Orange River.


Photograph 41: One of the bakkes within the corridor south of Pofadder, at 29o09'06.9"S; 19o24'37.1"E (left) and grinding area on bedrock in vicinity of 29o09'06.9"S; 19o24'37.1"E (right)





Photograph 42: Grinding groove at a further exposure at 29o09'45"S; 19o22'16.5"E (top left). Bakkes or goras in the vicinity of 29o09'45"S; 19o22'16.5"E (top right). Later Stone Age stone artefacts in the vicinity of 29o09'45"S; 19o22'16.5"E (bottom left)

At and near where an existing Eskom line crosses the Aggeneis-Loop 10 road, there is a cluster of stone kraals at 29°17'50.7"S; 18°59'22.7"E (Photograph 43) against the southern side of a small inselberg. In this vicinity there are also scatters of Later Stone Age artefacts together with grinding grooves in bedrock exposures at 29°17'47.3"S; 18°59'24.2"E and 29°17'45.9"S; 18°59'20.6"E (Photograph 44)

Photograph 43: Stone kraals at 29o17'50.7"S; 18o59'22.7"E

Photograph 44: Grinding groove at 29o17'47.3"S; 18o59'24.2"E (top left); Grinding surfaces at 29o17'45.9"S; 18o59'20.6"E (top right); and Ostrich eggshell fragment, stone artefact and potsherd alongside grinding surfaces (bottom right)

The proposed southern corridor alternative is indicated as being routed south-westwards between Namiesberg and Gamsberg (Figure 62) before veering westwards towards Aggeneis substation. This is a historically sensitive landscape associated with the genocide against Bushman people. A much more prominent appreciation now exists concerning the history of genocide against the Bushmen in this area (Anthing 1863 in Morris, 2016), with strong indications that a kloof on the south east side of Gamsberg (Photograph 45) was one of the

massacre sites, referred to by Dunn in 1872 (Robinson 1978 in Morris, 2016), by Burger (1986) in Morris, 2016 and, more obliquely, by Anthing (1863; Jose Manuel de Prada-Samper pers. comm. 2009) in Morris, 2016. A call has already been made for massacre sites to be identified on the ground and declared as Provincial Heritage Sites (eg by the folklorist Jose de Prada-Samper in discussion with staff of the Northern Cape Struggle History Project and the Northern Cape Provincial Heritage Resources Authority). It is suggested that any development or visual impact on this landscape would be insensitive (with regard to possible mining on the south side of Gamsberg, one comment received was that "mining here would be like mining Auschwitz"). Such sites could ultimately form part of a /Xam and Khomani Heartland World Heritage Site, already on South Africa's Tentative List, although the main centre for the /Xam is likely to be further to the south east in the area between Kenhardt and Carnarvon.

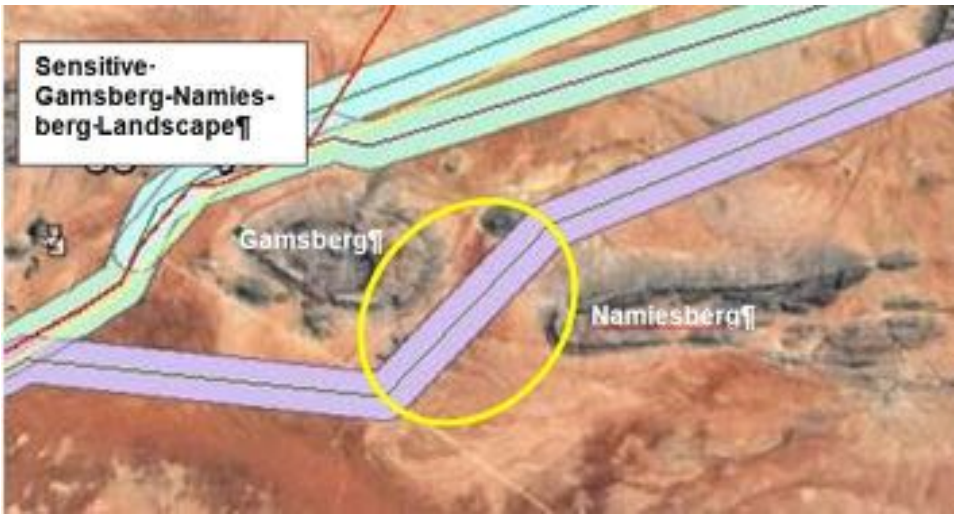


Figure 62: Historically sensitive landscape

Photograph 45: Sensitive landscape view westwards from the Namiesberg side towards Gamsberg (top left); 'Inkruip Kloof' at the south eastern side of Gamsberg – possible site of genocidal massacre (top right); and view south eastwards towards Namiesberg with Gamsberg

9.7.2 Heritage Impacts and Mitigations

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

At Areas of Substations Expansions and along all Alternative Corridors	
NATURE OF IMPACT	**MITIGATION**
Activities resulting in disturbance of surfaces and / or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected).	Mitigation Measures: Artefact densities are close to zero over virtually all of the proposed routes. The areas of proposed substation expansions are already disturbed and devoid of artefacts visible at the present surface (not more than very low density expected if pristine). It is however, recommended that final tower positions in key locales should be inspected before the need for mitigation is ruled out.
Significance Without Mitigation	Low
Significance With Mitigation	Low

Please note: There are no cumulative impacts anticipated on heritage resources.

9.7.3 Conclusion and Recommendations

From an archaeological perspective the observed heritage resources, with a few exceptions, are of low significance, but places and areas of higher sensitivity in terms of sites and visual impact are noted in the report.

In terms of the alternative corridors, this report recommends that the higher landscape sensitivities associated with the southern corridor should make this the *least* favoured route, and therefore recommends that, instead, either the northern or the central route should be preferred.

Recommendations:

Sensitivities concerning the heritage landscape of genocide between Gamsberg and Namiesberg make this a highly sensitive area which should not be impacted. It is recommended that on these grounds the southern corridor should not be considered as viable.

Visual impacts along the main road between Pofadder and the turn-off to Pella should be considered in choice of powerline alignment – avoid a route north of this road at this point if possible.

A small Later Stone Age site cluster in the vicinity of 29.199525 ^{o} S 18.980306^{o} E should be avoided.

Final approval should depend on inspection of tower positions in key parts of the final route chosen.

9.8 SOCIAL ASSESSMENT

9.8.1 Social Findings

The social environment characteristics are outlined in Chapter 6 of this report describes in detail in Mpofu (2016) It gives an overview of the land use and settlement patterns as well as the demographic and socio-economic profile of the project affected area in the Namakwa land district.

Outcome of the Stakeholder Consultation Process

In order to enhance and deepen public participation, Social Impact Specialists also visited the project-affected area from the 12th to the 15th of July 2016. The Social Impact Assessment Specialists held discussions with various stakeholders to get their reactions to the project. The stakeholders identified included all those who have an interest in the project or those affected by the project. This site visit was important so that Specialists and Eskom could confirm stakeholder understanding of and concern on key issues. On-site appreciation of impacts is indispensable for projects that may cause displacement. The visit also enhanced specialists and Eskom's local knowledge that can be invaluable in finding alternatives that help avoid or at least reduce the magnitude and severity of adverse impacts. Other Consultative forums were held between Eskom, Mokgope Environmental Specialists and stakeholder on the 25th of October, 2016 at Aggeneis Recreational Club (at 10h00),.at Pella Library hall (at 14h00): and at Pofadder Hotel on 26 Oct at 10h00:

Most of the stakeholders consulted concur with the proposed development in the view that the proposed powerline project will improve power supplies, stabilize the quality of the electricity and provide diverse source of power in the region. Stakeholders were of the view that in the long term, the District and Local Municipalities will benefit in terms of improved industrial development, and reduced power cut problems, particularly in agro processing, which has been identified in the District IDP a key activity for future economic development in the area. Responding to this overwhelming view, Eskom pointed out that, in fact, the primary aim of the proposed project is to comply with NERSA N-1 criteria even though it would benefit the region at large with an added electricity infrastructure that can attract future IPPs in the area.

Perceived advantages of the project identified by diverse stakeholders were as follows:

- Project is a manifestation of government commitment to development in the project area.
- Supply of electricity will unlock economic development in the targeted areas.
- The locals will be employed in the construction work.
- People will sell land for proposed servitude and thus generate money for investment.
- People will be compensated for lost utility and assets (trees, crops, etc.) within the servitude.
- Electricity will be available for rural supply.

- Security enhancement in the area due to enhanced electricity supply resulting in enhanced distribution.
- Local power distribution to support and boost growth of the District Municipality's infant agro processing industry and other cottage industries.

Perceived disadvantages of the project were identified as follows; -

- The project will displace people and their property and fail to pay adequate compensation.
- Presence of electric lines will expose people to accidents and health hazards.
- Fear of transmission lines interfering with communication.
- Increase in social vices due to influx of population in the project area as a result of emergence of new industries as well as general development in the area.
- Possibility of occurrence of accidents on the sites during construction.

Specific concerns: Servitude Acquisition and concerns over adequacy of compensation for acquired land

Some stakeholders, more-so those farmers whose properties risk being affected by the project expressed the need for clear mechanisms for servitude acquisition and compensation. The Eskom team confirmed that indeed some people are likely to lose property in order to create a 55 metre servitude for the 400kV power transmission line. The team further emphasised that comprehensive consultations will continue to take place with all stakeholders

Matters pertaining to land acquisition and compensation were a major concern to the Farmers and hence considered to be very critical. The farmers requested that in the event that land acquisition has to be done, then, adequate compensation for land and property that are likely to be taken up by the ROW be adequate. The major concern from the farmers is whether Eskom would provide fair compensation. Some stakeholders are concerned that the proposed powerline may negatively affect local biodiversity particularly the natural habitat. However, the intensity of damage potentially caused by the proposed development is going to be minor, given the nature of the project and the span between successive pylons. The mine officials were concerned about one of the alternatives, corridor 3, which traverses a conservation area and that Eskom should also be aware of the sand dunes around the area.

Community members wanted to find out if there would be any job opportunities during the construction. The Eskom Project Manager responded to them that the construction needed highly technically skilled workers who would be employed by Eskom. However, the Project manager did also point out that if Eskom needed low skilled workers at any point during work progress, they would inform the surrounding communities.

The farmers/landowners who attended the forums were all opposed corridor 3. They were in support of corridor 1 which was along the existing 220kV powerline and has minimal impact on the farms. They were also concerned about compensation and wanted to know if they would be compensated for their land that would be used by Eskom. Eskom responded that they would be compensated for the area that Eskom is going to use, and this process would take place after the Environmental Authorisation has been granted.

Overall picture from the stakeholder consultations

The overall picture emergent from the stakeholder consultations is that the project is seen as being strategic to stabilising rural power supply which is crucial to sustained economic growth. In order to sustain this overwhelming public support, project development should proceed simultaneously with resolution of stakeholder concerns.

9.8.2 Social Impacts and Mitigations

The possible impacts, as described below, were assessed based on the Significance Scoring Matrix in **Annexure C** of this report.

CONSTRUCTION PHASE - Corridors 1, 2, & 3	
NATURE OF IMPACT	**MITIGATION**
1. Destruction of Fences and Gates Presently, a number of land owners have erected paddock fences and gates to keep their livestock from going astray or getting lost; some of paddock fences and gates cross the proposed transmission line servitude. From the field surveys conducted, it is likely that the project may cause potential security concerns if construction would lead to removal of paddock fences and gates that separate individual livestock farm lands. The construction phase has to manage livestock farming among alternative neighbours even as they build access routes and transmission line itself.	Eskom should avoid destruction of the fences and gates during construction and return them as they were or better after construction is complete to maintain paddock gates and fences to keep the integrity of individual paddocks
Significance Without Mitigation	Low
Significance With Mitigation	Low

CONSTRUCTION PHASE - Corridors 1, 2, & 3 NATURE OF IMPACT	MITIGATION
2. Impacts associated with construction disturbance: **a) Construction Traffic:** During the process of construction, some dust and exhaust fumes will be generated from the construction vehicles as they make their way through the mainly dry and perched terrain in the parts of the project areas the proposed transmission line corridor. In some areas the ground conditions are rocky and therefore there will be need to use a compressor to break hard ground. These processes will lead to dust generation and exhaust fumes. **b) Hazardous Substances:** Use of engines (construction vehicles) and other equipment on site has the potential to lead to spillage of petroleum products. It is however worth noting that the risks of a major oil spillages occurring are minimal because only a few construction vehicles will be needed in the construction of the transmission line. Highly-refined, mineral insulating oils will be used to cool transformers and provide electrical insulation between live components. **c) Solid Waste Generation:** During the construction period, solid waste will be generated from the actual construction activities (packaging materials, excess materials, recovered materials, among other waste) and from the workforce itself (waste in the form of food, wrappers, bottles, containers, cartons, and other disposable or personal items). The workforce on site at any given time is relatively small however the accumulative impact of waste generation can create a significant problem if mitigation measures are not made available. **e) Construction Noise pollution:** The noise impact during construction is expected to be negative but short term. Sources of noise will be trucks and the off-road vehicles in transit, use of compressor to break hard ground and the use of motorized chain saws for vegetation clearing. Impacts of noise include noise-induced hearing loss and/or nuisance for the project workers and the affected settlements.	• The Contractor to develop and implement a construction HSE management plan to manage the impact of construction disturbances on the environment. • Contractor should manage contraction traffic especially its impact on grassland resources.
Significance Without Mitigation	Low
Significance With Mitigation	Low

CONSTRUCTION PHASE - Corridors 1, 2, & 3 NATURE OF IMPACT	MITIGATION
3. Improved utilization of compensation payments The compensation payments proposed are likely to be attractive considering that the local community whose households have little and irregular income streams. It is anticipated that compensation payments made to transmission servitude affected property owners will be utilized for beneficial socio-economic purposes to progress their livelihoods This is seen as a positive impact to the affected assets along the transmission line servitude who sign compensation agreements with Eskom.	• The transmission line servitude land owners and their families should be provided with basic training on financial management through financial institutions available in towns like Pofadder and Aggeneis. • The land owners should be provided with legal training to enable them safeguard their wealth from compensation payments.
Significance Without Mitigation	Low
Significance With Mitigation	Low

OPERATIONAL PHASE - Corridors 1, 2, & 3 NATURE OF IMPACT	MITIGATION
1. Electronic Magnetic field (EMF) Exposure The establishment of a servitude and the need to have limitations of land use are mitigations measures which help manages the effects of EMF on public health. Scientific research has not demonstrated any significant impacts of EMF from conventional 30-40m high transmission lines. The finding and conclusions are that the field strength on a 132 kV line at the distance of exposure heights of 30-40m is less than what one would ordinarily be exposed to in a domestic setup.	• Eskom develops and administers a community sensitisation plan • Eskom manages the limits for building houses as pressure on land increases.
Significance Without Mitigation	Low
Significance With Mitigation	Low

OPERATIONAL PHASE - Corridors 1, 2, & 3 NATURE OF IMPACT	MITIGATION
2. Maintenance of transmission line servitude During the operational phase, the transmission line servitude will require periodic maintenance to ensure that the grasses do not grow too large. Additionally, it will be important to ensure that paddock fences and gates erected by the land owners to keep their livestock within their parcels are not destroyed by Eskom during transmission line maintenance operations. Thirdly, it will be important to ensure that the servitude is not utilized as an informal road by vehicle	• Eskom should consider providing employment to local youths in the transmission line project area for keeping the vegetation height to management levels. • The proponent should engage land owners in maintaining the gates and

drivers. During public meetings, the local community expressed their interest of being provided with employment by Eskom for purposes of security and surveillance. The employment of local youth to ensure that the servitude is always maintained in a good state would be a positive social impact.	fences throughout the operations period.
Significance Without Mitigation	Low
Significance With Mitigation	Low

OPERATIONAL PHASE - Corridors 1, 2, & 3 **NATURE OF IMPACT**	**MITIGATION**
3. Organizational Capacity Impacts – Lack of skilled workers The proposed transmission line will require skilled, semi-skilled and unskilled labour for the construction and operational phase of the project respectively. Currently the local community has limited skilled and semi-skilled workers among the families. Disciplines such as back-hoe excavator operators, crane operators, etc. are limited among the community. This will imply that in the absence of skilled and semi-skilled workers, the plum jobs may be offered to people from other parts of the Province or the country to the detriment of the local community.	• Eskom to develop and implement a social and environmental organizational capacity development performance plan that includes designated management, human resources, financial systems. • The organizational capacity development plan should include a Human Resource Management plan that has a Training system for implementation to achieve the objectives of the Plan. • All sub-contractor standard social and environmental guidelines for third parties working on the project. • An Emergency preparedness and Response plan in consultation with the community. • Community participation in the project's established monitoring and review system
Significance Without Mitigation	Low
Significance With Mitigation	Low

Please note: There are no cumulative impacts anticipated on social resources.

9.8.3 Social Conclusion and Recommendations

The purpose of this SIA's was to identify and assess the changes that are likely to occur in Khai Ma communities or to individuals in Khai Ma as a result of the construction of the proposed Aggeneis-Paulputs powerline. The study thus intended to assess the consequences to Khai Ma human populations of the powerline and look at the ways in which it would possibly alter the ways in which Khai Ma people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of the Khai Ma community.

The likely impacts assessed also included cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society. It is important to emphasize that social impacts are both positive and negative. Consultations were also undertaken as part of the SIA in order to obtain the views of immediate community, interested groups and affected groups within the project's immediate area of influence. The consultation was done with the immediate neighbourhood of the proposed site and involved use of a semi-structured public participation form and direct face to face discussions with key stakeholder influencers. In general, the project is acceptable and no objections were raised concerning the proposed 400kV electrical transmission line and the upgrading of the two substations.

Recommendations:

The three alternatives fall within the same study area and there are no significant social impact differences between the three proposed alternatives. However, Alternative 2 is recommended. It ensures the health and safety of people in the area, as it does not pass through heavily settled areas. Most of the line passes over grazing land and animals can still freely move around towers and underneath the transmission powerline, which implies minimal razing pasture loss, where the sub-transmission powerline cannot avoid crossing over cultivated land, the cultivated land is minimal.

Following on the alignment of the N14, Alternative 2 does not affect any scattered households. Where the alternative intersects with Alternatives 1 and 3, it should follow on with Alternative 1 following the alignment of the existing line as the area is already disturbed.

The following outlines a summary of the main positive and negative social impacts of the proposed project as well as recommended mitigation and enhancement measures.

Impact		Mitigation / Enhancement Measures
Potential Positive Impacts		
1	Improved electrical capacity in the Aggeneis-Paulputs grid and reliability of supply	Conforming to NERSA N-1 standards, meeting power demands, reducing power outages, improved efficiency and productivity in businesses, growth of regional agro-processing industry, more connectivity.
2	Job creation	Job opportunities for local community member during project life cycle in relation to provision of labour for site works and provision of goods and services
3	Increased economic activity	Short term increase in economic activity during construction phase from potential purchase of construction materials and other goods and services bought by construction workers
4	Improved road infrastructure	Roads installed/improved to serve the project could also be of long term benefit to the area.
5	Gender Issues	Opportunities for women small businesses to provide catering and other services to construction workers and also to be recruited to work during project life cycle.
6	Capacity building	Opportunities for skills training for local workers recruited to work on the line and also in health and safety issues
Potential Negative Impacts		
1	Displacement of persons	Potential displacement of people to make way for the Servitude. This will be extremely minimal because the routes follow sparsely populated areas and any displacement will be compensated for.
2	Restriction of land use and land rights	Limitation of choice for land owners on choice and rights over the land. Sensitisation as to the suitable future land uses as well as health and safety related to the transmission line and upgraded substation sites.
3	Change in land ownership	Need to register land for compensation leading to changing in local land holding patterns.
4	Impacts on land use	There will be some loss of farmland especially grazing areas, however compensation will be made for loss of crop and awareness campaigns will implemented regarding grazing land on servitude during project life cycle.
5	Visual Impact	Route alternatives do not pass through concentrated settlement area and tourist spots. Awareness campaigns on energy transmission to be launched to sensitive community to lessen adverse effects of the OHTL .Roads /worker camps to be removed after construction where these will not serve any purpose for the community after the works.
6	Impact on archaeological sites and cultural heritage	Proposed project routes do not pass or affect any world or local heritage sites, Contractor to report any chance findings during construction works.
7	Traffic and Road infrastructure	Project related traffic movements likely to be minimal. Occasional requirements for movements of abnormal

		loads may result in need for temporary diversions. Location of access roads to be undertaken in consultation with local communities.
8	Noise and Vibrations	Temporary increase in noise during construction works from site machinery. Use of silencers/mufflers, provision of hearing protection devices for workers and careful selection and use of plant in sensitive settled areas.
9	Air Quality	Dust generated by excavations/earthmoving and exhaust emissions from construction vehicles, plant and equipment. Minimise by covering stockpiles, limiting speed limits in dusty areas avoid idling of motor vehicles and damping down.
10	Solid waste	Increase in pressure on local landfill facilities as well as the potential for unauthorised disposal/littering. Recycle and reuse of construction materials. Managed disposal at designated sights.
11	Electric and magnetic fields	OHTL considered a source of electronic and magnetic fields which may have adverse health effects. Internationally accepted of servitude ROW width along transmission line to be adopted

9.9 RANKING OF THE ALTERNATIVE CORRIDORS

The alternative corridors below were given a rating on a scale of 1 to 3, with 1 being the most preferred corridor and 3 being the least preferred corridor option.

Table 24: Ranking of the Alternative Corridors

Order Of Rank	Vegetation	Fauna	Avifauna	Wetland	Agriculture	Visual	Heritage	Social	I&APs
1	Corridor 2 or Corridor 1	Corridor 1 and Corridor 2	Corridor 1	Corridor 1	All Corridors	Corridor 1	Corridor 1 or Corridor 2	Corridor 2	Corridor 1
2	Corridor 1	Corridor 3 and Deviation 3A	Corridor 2	Corridor 2	-	Corridor 3	-	-	Deviation 3A[8]
3	Corridor 3 and Deviation 3A		Corridor 3	Corridor 3	-	Corridor 2 and Deviation 3A	Corridor 3 and Deviation 3A	-	Corridor 3

The rankings above show that in average, Corridor 1 is the most preferred route. This is mainly because Corridor 1 has an existing 220kV powerline along most of its length. The presence of the existing powerline is of special significance, as existing access roads should already be in place for maintenance purposes along the existing powerline within Corridor 1. Corridor 2 is the second preferred route. It has the existing 220kV powerline along more than 50% of its length and also has the second highest number of roads. Corridor 3 including Deviation 3A are the least preferred routes. There are no known existing powerlines along the majority of the corridor lengths.

[8] Should Corridor 3 be the preferred route, Deviation 3A should be used to deviate from Corridor 3. This was suggested by the I&APs at the public meeting held in Pofadder in October 2016.

10.1 SUMMARY OF KEY FINDINGS

Vegetation

The powerline corridors traverse CBAs (T1 and T2) as well as ESAs through-out their extent. Both the T1 (Critical Terrestrial Habitats) and T2 (Important Terrestrial Areas) were identified by experts as being important for biodiversity areas and include features such as quartz patches, as well as important fauna habitats.

Only alternative Corridor 3 traverses inselberg vegetation and are therefore not a preferred route alternative. Alternative 1 and 2 runs parallel to an existing powerline through the quartz veld and if the existing disturbed footprint can be utilised for much of the construction, these routes are preferable.

Corridors 1 and 2 are similar in route alignment and vegetation associations traversed. However, Corridor 1 is situated parallel and within 100m of an existing 220kV powerline for most of its extent, except around the Gamsberg area. Existing servitudes and access roads could therefore be used, limiting the clearing of natural vegetation. In its southern extent, prior to reaching Aggeneis substation, alternative corridor 1 passes closer to the Gamsberg and its associated sensitivities, this increases its potential impact on vegetation of concern. Therefore Corridor 2 is the preferred route, as it traverses fewer areas of sensitivity. Corridor 1 could also be considered if the section west of the Gamsberg is moved further west, or linked with Corridor 2 for that section. Only alternative Corridor 3 and deviation 3A traverse inselberg vegetation of a high conservation importance and are therefore not preferred route alternatives.

Fauna

Low density species may occur along portions of the route, although at low numbers within their required habitats.
A degree of disturbance will occur to fauna that are present within and immediately adjacent to the footprint area during construction. Animals will likely avoid these areas during this time, but should use such areas post-construction.

Corridor 3 is more sensitive, as it traverses a greater extent of both Critically Biodiversity Areas and Important Bird Areas than do the other two routes. In this regard, Corridors 1 and 2 are preferable, and any deviation within those routes that followed existing lines or roads, would be most acceptable.

Avifauna

This is an arid, relatively uniform study area, in which it is challenging to identify areas of higher and lower sensitivity. However, two features do stand out: the red dune areas, which are particularly important for the Red Lark; and the Martial Eagle nests.

It is concluded that Corridor 1 is the preferred route from an avifaunal perspective. This is primarily because the line can be placed adjacent to an existing line for its entire route, an

option not possible with the other alternatives. It also passes through Important Bird Areas for the least possible distance.

No construction activities for the new line should take place within 1km of the Martial Eagle nest (see Photograph 25) on the existing powerline during breeding season if it is active. The coordinates of this particular tower are: **28 54' 32.30" S 19 32' 53.21" E.** The exact timing of breeding season will need to be confirmed just prior to construction, but is likely to be approximately March to September

Wetland

In summary, Corridor 3 has the fewest watercourse crossings and smallest combined surface area for most linear watercourses, apart from washes and ephemeral rivers, in which case the value is only marginally larger than the two other route corridors. Pan/depression wetlands are most prominent within route corridor 3, but still occurs at relatively low values compared to the two other route corridors. Route corridors 1 and 2 collectively have the highest number and combined surface area for delineated 'ephemeral streams and drainage lines' and 'washes and ephemeral rivers'. These two corridors also have the highest collective number of centre line crossings for delineated 'ephemeral channels and drainage lines' and washes and ephemeral rivers'.

Corridor 1 is regarded as the most sensitive and the least favourable alternative for the proposed powerline based on the significance analyses in the impact assessment. It is the only route corridor that has an existing powerline along its entire length. The presence of an existing Eskom line is of special significance, as existing access roads should already be in place for maintenance purposes along the existing powerline within route corridor 1. Road impacts are regarded to be of greater significance compared to tower positions and other impacts, which increases the favourability of route corridor 1. Route corridor 3, including Deviation 3a, has no known existing powerlines along the majority of its length and the fewest of all three corridor alternatives. It has the lowest number of existing roads based on available data from the 1:50000 topographical map datasets. Route corridor 2 has existing Eskom powerlines along more than 50 % of its length and also has the second highest number of roads indicated on the 1:50000 topographical map datasets.

Agriculture

In a dry, hot part of South Africa like this area of the Northern Cape, the limiting factor to agriculture is not soil, but climate. Unless there is a source of water for irrigation, it will not make a significant difference which soils are occurring within a specific area. However, with the prevailing climate (especially the low rainfall), coupled with sandy topsoil, there could potentially be an increased possibility of soil erosion due to wind action, especially where vegetation cover is disturbed, leading to the bare soil becoming exposed.

Based on the investigated soil and climate information, it is clear that the three corridors and deviation traverse very similar soil units in the same or very similar proportion. There is no clear preference for any one of the three proposed alternatives and all are rated equally.

Visual

In most cases, the transmission line will impact on the scenic qualities of the visual resource by interfering with the prevailing semi-natural character of the study area, or interfering with distant scenic views of the mountainous terrain, north of the study area. Areas or features of high aesthetic value and scenic quality have been identified as:

- The rocky ridges and elevated terrain north of Pofadder;
- Gamsberg east of Aggeneis; and
- The distant views that can be experienced of the highly elevated mountainous terrain near the Namibian border.

Alternative Corridor 1 is the most preferred route. The motivation is that the baseline environment is already impacted by a parallel running existing powerline which lowers the sensitivity of the visual environment to some degree.

Heritage

Sensitivities concerning the heritage landscape of genocide between Gamsberg and Namiesberg make this a highly sensitive area which should not be impacted. It is recommended that on these grounds Corridor 3 should not be considered as viable. Instead, either the Corridor 1 or 2 should be preferred.

Visual impacts along the main road between Pofadder and the turn-off to Pella should be considered in choice of powerline alignment – avoid a route north of this road at this point if possible.

A small Later Stone Age site cluster in the vicinity of 29.199525 ^{o} S 18.980306^{o} E should be avoided.

Social

The three alternatives fall within the same study area and there are no significant social impact differences between the three proposed alternatives. However, Corridor 2 is recommended. It ensures the health and safety of people in the area, as it does not pass through heavily settled areas. Most of the line passes over grazing land and animals can still freely move around towers and underneath the transmission powerline, which implies minimal razing pasture loss, where the sub-transmission powerline cannot avoid crossing over cultivated land, the cultivated land is minimal.

Some of the benefits associated with the proposed powerline on the affected communities comprise:

- Improved electrical capacity in the Aggeneis-Paulputs grid and reliability of supply;
- Job opportunities for local community member during project life cycle in relation to provision of labour for site works and provision of goods and services;
- Short term increase in economic activity during construction phase from potential purchase of construction materials and other goods and services bought by construction workers;
- Roads installed/improved to serve the project could also be of long term benefit to the area;

- Opportunities for women small businesses to provide catering and other services to construction workers and also to be recruited to work during project life cycle; and
- Opportunities for skills training for local workers recruited to work on the line and also in health and safety issues.

Some of the above key findings indicate sensitivities that are geographically represented in the map below:

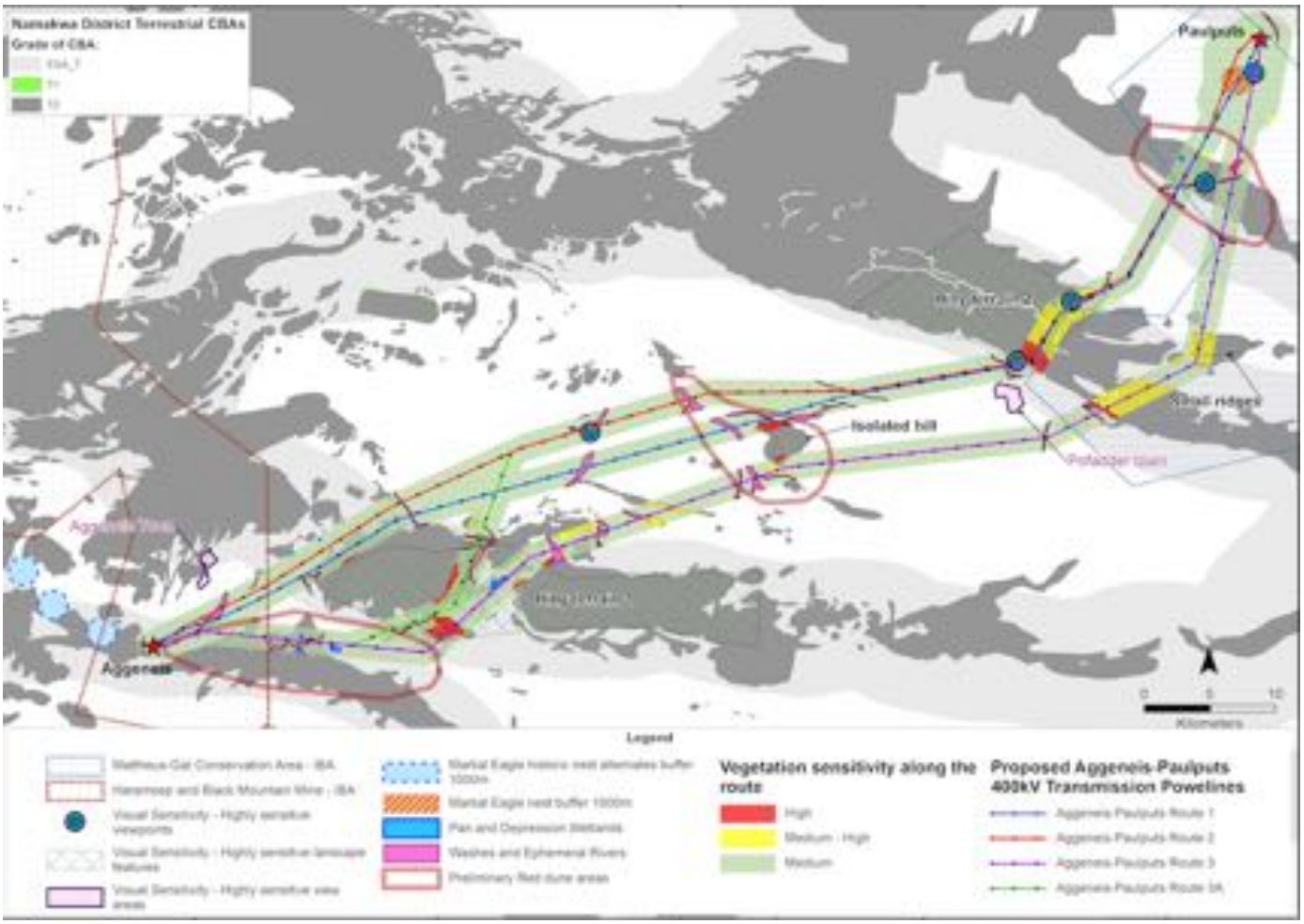


Figure 63: Proposed Corridors, overlain with sensitivity features and areas of strategic conservation importance

The above map is provided in Annexure B.

10.2 SUMMARY OF IMPACTS

The following impacts could be of medium to high significance if mitigation measures are not adhered to. Impacts of high, medium and low significance are detailed in the Significant Scoring Matrix provided in **Annexure C** of this report.

Clearance and destruction of natural vegetation, fauna bird and watercourse habitats:
The construction of the powerline would inevitably require the removal of vegetation for the purpose of access, and the tower footprint. In particular, the clearance of vegetation and plants of conservation concern would cause habitat loss. Heavy vehicles and machinery as well as trampling by workers will crush succulents. This will result in irreversible deterioration of such plant species. A degree of disturbance will occur to fauna that are present within and immediately adjacent to the footprint area during construction.

Soil compaction, disruption of quartz fields / gravel / calcrete areas:
The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation, sterilise quartz and inhibit re-vegetation. Soil compaction as a result of construction vehicles and traffic, could lead to a decrease of water infiltration and an increase of water runoff.

Exposure to Erosion:
The removal or destruction of surface vegetation will expose topsoil, which in the event of rain could cause erosion. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully. Furthermore, lack of rehabilitation or failed rehabilitation after construction, can result in erosion after construction is completed. In addition, maintenance vehicles could disturb rehabilitated areas which could lead to soil erosion.

Potential increase in invasive vegetation:
If rehabilitation of the indigenous vegetation along the route and within watercourses is not enforced, invasive vegetation may invade the area.

Collision of birds with earth wires and conductors:
Collision with powerlines is a well-known conservation problem for many birds, and for some species can be a significant source of mortality.

Flow, sedimentation and erosion changes in watercourses due to infrastructure construction:
This refer to changes in the pattern of surface and subsurface flow in watercourses, as well as resultant sediment depositional impacts and erosion impacts, which are associated with new access road crossings through, and tower positioning within watercourses.

Compaction of watercourse soils:
Driving through watercourses during the construction and operational phases of the project will result in soil compaction within watercourse, which may affect watercourse vegetation and result in erosion

Visual impact on sensitive landscape:
A visual change will occur as a result of the new transmission line. It will interfere with panoramic views of the expansive undeveloped landscape and the scenic mountains near Gamsberg.

Disturbance of heritage artefacts:
Construction activities may cause disturbance of surfaces containing artefacts resulting in the destruction, damage, excavation, alteration, removal or collection from its original position of any archaeological material or object

Impacts on land use:
The proposed powerline will traverse farmland which will result in loss of land use such as grazing land, amongst others. However during the operational phase, such land use, grazing of livestock may continue within the vicinity of the powerline. This excludes irrigation land where irrigation pivot centres cannot operate close to powerlines.

Cumulative impacts on biodiversity: The large solar plant at Paulputs substation, the proposed wind farms around Aggeneys and the proposed 400kV powerline between Paulputs and Aggeneys will disturbed and modify vegetation and habitat. In addition, these developments will also cause edge effects into adjacent natural vegetation, which cumulatively will increase the transformed or impacted areas and increase fragmentation. The amount of servitudes should thus be kept to a minimum, with lines rather running parallel in a wider servitude where feasible, with only one maintenance track necessary in such servitude, rather than each project having a distinct servitude for most of the line route.

Cumulative impacts on birds: It is hoped that if each project within 30km radius provides sufficient mitigation, the overall cumulative impact can be reduced. However, it is a challenge to define the spatial extent of a Cumulative Impact Assessment, because some of the relevant bird species move hundreds of kilometres across the landscape and could theoretically be affected by developments within this entire range.

Cumulative impacts on watercourses/wetlands: Based on the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that any of the assessed impacts will result in spatial and temporal cumulative change. With mitigation measures, all four of the assessed cumulative impacts can be regarded as marginal / slight / minor. The significance of cumulative impacts can be further reduced should existing infrastructure features be used, such as existing access roads/tracks present in Corridor 1 and 2. This will further

reduce cumulative impacts in watercourses, such as flow changes, increased sedimentation and erosion in watercourses, and compaction of watercourse soils

Cumulative impacts on visual receptors and observers: Cumulative impacts are highly likely due to the existing powerline between the two substations on the same route. Theoretically, the new 400kV transmission line will more than double the visual prominence of electrical infrastructure in the study area as its physical size is larger than the existing powerline. It is expected to increase the contrast with the natural character of the study area, thereby reducing the scenic quality of the visual resource

Positive impacts:
The proposed powerline will improve electrical capacity in the Aggeneis-Paulputs grid and reliability of supply, conforming to the NERSA N-1 standards. Another positive impact would be the creation of temporary unskilled employment opportunities for local communities during construction phase.

10.3 RECOMMENDATIONS

It is recommended that the proposed transmission line be constructed along Corridor 1, due to the presence of existing servitudes and access roads. Corridor 1 could also be considered from a vegetation perspective, if the section west of the Gamsberg could move further west within the corridor.

In this regard it is fundamental that the Environmental Management Programme (EMPr) and all other mitigation measures in this Environmental Impact Report be instituted during all phases of the proposed project. The following recommendations must form part of the conditions of approval:

- A walk-down by the relevant specialists will be required prior to the construction phase commencing in order to confirm: feasible tower positions; the location of the construction camps; laydown areas; and access routes.

- The whole powerline should be marked with anti-collision marking devices as well as nocturnal makings. Subsequently, it is suggested that there should be a 3 monthly monitoring system for the first 3 years of the operational phase of the line.

- Clear all alien species identified by the vegetation specialist in the area within the footprint of the proposed development.

- No natural watercourses, boreholes or dams should be disturbed by the development with a 50m buffer zone (marked during the construction phase) allowed for between the edge of any of the above mentioned features.

- Landowners in close proximity to the proposed powerline route must be notified of any construction activities that may lead to disruption of their day to day activities or services such as access routes. The contractors and engineers should ensure that any grievances from the local community are remedied as soon as possible.

- Areas that are not part of the site development plan should be marked as no-go zones.

- Although not expected, the process of negotiating compensation in respect to the loss of any infrastructure or resources along the route must commence prior to construction taking place.

- Unskilled labour must be sourced from local communities to assist in local economic development initiatives.

- Although a Heritage Impact Assessment has already been conducted and no sensitive heritage features were identified, work must cease and SAHRA must be contacted should any heritage and cultural resources be identified during construction and earthmoving activities, this includes grave sites.

The Draft EMPr provided in **Annexure N** should be approved as part of the Environmental Authorisation and be strictly adhered to during the construction and operational phase of the proposed 400kV transmission powerline and substations upgrade to ensure that activities are environmentally sound.

A suitably qualified independent Environmental Control Officer (ECO) must be appointed to guide the contractor through the construction phase and ensure compliance with the EMPr and the conditions of Environmental Authorisation.

All parties involved in the construction and ongoing maintenance of the powerline (including contractors, engineers, and administrators) are, in terms of NEMA's "Duty of Care" and "Remediation of Damage" principals (Section 28), required to prevent any pollution or degradation of the environment, be responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment. Removal of alien invasive plants with specific follow-up control measures, and reclamation and management of soil erosion along the proposed construction route alignment is an ongoing requirement in terms of national legislation.

11. CONCLUSION

Mokgope Consulting was appointed by Eskom to conduct the EIA process for the construction of the Aggeneis-Paulputs 400kV transmission powerline as well as the substations upgrades.

The current Aggeneis-Paulputs network does not meet the minimum reliability standards of the South African Grid Code which require minimum N-1 reliability for the transmission network. The other problem faced by the Aggeneis-Paulputs network is that planned transmission capacity will soon be exhausted at Paulputs if electricity generation by Independent Power Producers (IPPs) continues at present levels. Therefore, to address the N-1 reliability, the construction of the Aggeneis-Paulputs 400kV line is a preferred solution. It ensures the network is firm for N-1 contingency, as well as to ensure that there is sufficient line capacity to evacuate potential IPPs in the area.

Three main alternative corridor routes were considered. The regarded preferred corridor would have to consider minimum biophysical, biodiversity, social, visual and heritage impacts. From an environmental perspective, Corridor 1 is considered over Corridor 2 and 3. This is mainly because Corridor 1 has an existing 220kV powerline along most of its length. The presence of the existing powerline is of special significance, as existing access roads should already be in place for maintenance purposes along the existing powerline within Corridor. Corridor 1 could also be considered from a vegetation perspective if the section west of the Gamsberg is moved further west. Corridor 2 is the second preferred route. It has the existing 220kV powerline along more than 50% of its length and also has the second highest number of roads. Only alternative Corridor 3 and deviation 3A traverse inselberg vegetation of a high conservation importance and are therefore are the least preferred route corridors.

Similar to the Scoping phase, I&APs in the EIA phase have been identified, contacted, informed of the project through electronic mailing system and hard copies of letters were sent through the post. Notices of the project and invitations to register on the I&AP database were posted at focal points in Aggeneys, Pella and Pofadder. Notice of the project was also published Namakwalander and Gemsbok newspapers.

The Draft EIAR is available for public review from 20 September to 23 October 2017 at Aggeneys Mine and at Pella and Pofadder libraries and will be sent via e-mail upon request. All I&APs and stakeholders are afforded an opportunity to raise objections, comment on the Draft report and send all their comments to the EAP. All comments and issues raised during the Scoping phase and Draft EIAR phase will be considered by the EAP for recommendations in the Final EIAR phase.

The specialist assessments that have been undertaken in the EIA phase have found different levels of significant impacts on the various portions of the Alternatives Route Corridors. Recommended mitigation measures are to be adhered to in order to minimise impacts along the construction of the route corridor.

The construction draft EMPr developed will be implemented under the supervision of the site Engineer/Project Manager and / or Environmental Control Officer. The final EMPr shall be adhered to during the construction and operational phase.

12. REFERENCE

Bohlweki Environmental (BE) (2006) *Environmental Scoping Study for the proposed construction of a 400 kV Transmission powerline between Mercury Substation and Ferrum Substation – Free State, North West and Northern Cape Provinces*, Bohlweki Environmental, South Africa

CEA (Corporate Environmental Affairs) (2003) *Standard for Bush Clearance and Maintenance within Overhead Powerline Servitudes,* Eskom, South Africa.

DEA (Department of Environmental Affairs) (2017) *Environmental Impact Assessment Regulations in terms of the National Environmental Management Act (Act No. 107 of 1998) Government Notice No. R.326 in the Government Gazette No. 40772 of 07 April 2017,* Pretoria: Department of Environmental Affairs.

DME (Department of Minerals and Energy) (2006) *Electricity Regulation Act No. 4 of 2006*. Pretoria: Department of Minerals and Energy.

DME (Department of Minerals and Energy) (2003a) *Integrated Energy Plan*. Pretoria: Department of Minerals and Energy.

DME (Department of Minerals and Energy) (2003b) *White Paper on Renewable Energy*. Pretoria: Department of Minerals and Energy.

DME (Department of Minerals and Energy) (2002) *The Mineral and Petroleum Resources and Development Act No. 28 of 2002*. Pretoria: Department of Minerals and Energy.

DME (Department of Minerals and Energy) (1998) *White Paper on the Energy Policy*. Pretoria: Department of Minerals and Energy.

DOA (Department of Agriculture) (1983) *Conservation of Agricultural Resources Act No 43 of 1983*. Pretoria: Department of Agriculture.

DOE (Department of Energy) (2009) *Electricity Regulations on New Generation Capacity*, Department of Energy, Pretoria.

DWAF (Department of Water Affairs and Forestry) (1998) *National Water Act No. 36 of 1998*. Pretoria: Department of Water Affairs and Forestry.

Eskom (2015) *Transmission Development Plan 2016 to 2025*, Public Forum [On-line] www.eskom.co.za, Accessed 19 August 2016.

Eyssell, A. (2017) *The Proposed Aggeneis-Paulputs 400kV Powerline and Substations Upgrades, Northern Cape Province,* Vegetation Assessment Report for Mokgope Consulting. Compiled by Dimela Eco-Consulting, Pretoria.

Friedmann, Y. and B. Daly (2004). *Red Data Book of Mammals of South Africa: A Conservation Assessment*. South Africa, Conservation Specialist Breeding Group, Endangered Wildlife Trust.

Grobler, L.E.R. (2016) *Watercourse EIA Report for the Proposed Aggeneis-Paulputs 400 kV Power Line, Northern Cape Province.* Final Specialist Report for Mokgope Consulting. Compiled by Imperata Consulting, Pretoria.

Government Gazette No 32689, (2009): *Draft National List of Threatened Ecosystems in terms of the National Environmental Management Act, 2004 (Act 10 of 2004).* Department of Environmental Affairs Notice 1477 of 2009 in Government Gazette No 32689, 6 November 2009.

Harvey, J. (2017) *Terrestrial Fauna Biodiversity Assessment Proposed Aggeneis-Paulputs 400kV Powerline and Substations Upgrades, Northern Cape Province.* Final Report for Mokgope Consulting. Compiled by Harvey Ecological, Pietermaritzburg.

Morris, D. (2016) *Heritage Impact Assessment for the Proposed Aggeneis-Paulputs 400kV Transmission Powerline and Substations Upgrade, Northern Cape.* Final Specialist Report for Mokgope Consulting. Compiled by McGregor Museum, Kimberley.

Mpofu, A. (2016) *Social Impact Assessment Study for the Proposed 400kV Transmission Line linking the Aggeneis and Paulputs Substations (including the substation upgrades) in the Namakwa District, Northern Cape.* Final Report for Mokgope Consulting. Compiled by Alcinof Resources Management, Mayville.

Mucina, L and Rutherford, M.C (eds)

(2006) *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South Africa National Biodiversity Institute, Pretoria.

OHSA (1993) *Occupational Health and Safety Act 1993, Electrical Machinery Regulations, 1988.* Department of Labour

PAJA (2000) *Promotion of Administrative Justice Act No. 3 of 2000* The Presidency, Pretoria

Paterson, D.G. (2016) *Soil Information for Proposed Aggeneis-Paulputs 400 kV Transmission Line, Northern Cape.* Final Report for Mokgope Consulting. Compiled ARC-Institute for Soil, Climate and Water, Pretoria.

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama P.A., (eds) (2009) *Red List of South African plants 2009*. *Strelitzea* 25, South African National Biodiversity Institute.

Smallie, J. (2017) *Aggeneis-Paulputs 400kV Overhead Powerline.* Final Avifaunal Impact Assessment Report for Mokgope Consulting. Compiled by Wild Skies, East London.

South Africa (1999) *National Heritage Resources Act No. 25 of 1999* Pretoria: Government Printer.

van den Berg, M. (2017) *Visual Impact Assessment for the Proposed Aggeneis-Paulputs 400kV Transmission Line and Substations Upgrade, EIA Phase.* Final Report for Mokgope Consulting. Compiled by i-scape, Zuurfontein