AMENDMENT OF THE DRAFT ENVIRONMENTAL IMPACT REPORT

The Proposed Kronos-Aries 765kV Transmission Power Line and Substations Upgrade (Part of Cape Corridor Strengthening Phase 5) Northern Cape Province (NEAS Ref: DEA/EIA/0001557/2012) (DEA Ref: 14/12/16/3/3/2/440)

OCTOBER 2015

Submitted to:

National Department of Environmental Affairs

Submitted by:

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EXECUTIVE SUMMARY

Eskom Holdings SOC Ltd (hereafter to be referred as Eskom) intends establishing a new 765kV transmission power line from the existing Kronos Substation near Copperton to Aries Substation near Kenhardt in Northern Cape. This is part of the Cape Corridor Strengthening Phase 5 Network.

The proposed 765kV transmission power line would be associated with upgrades at the substations to accommodate the power line. The total length of the transmission power line from Kronos to Aries substation would be approximately 180km. Furthermore, a servitude width of 80m would be required to accommodate the installation of towers upon which the transmission power line would be strung. Eskom would need to negotiate for legal right of the servitude with individual landowners within the authorised corridor.

The main purpose for this proposed power line is to improve the transmission network supply in the country by linking the Western Cape and Gauteng Provinces. This is due to the increasing energy demand from various land use activities such as farming, mining industries as well as domestic uses in the country, particularly in Johannesburg. Furthermore, the proposed power line will serve to evacuate all the local renewable energy power generated in the Northern and Western Cape to the rest of the country.

The aim of the proposed transmission power line and substation upgrades is to ensure that adequate and reliable electricity supply in the country is achieved. The advantages of the proposed transmission power line would include: avoiding current and future possible voltage collapse; contributing towards a more flexible electrical network; improvement in the overall reliability of the electrical systems, which would benefit electricity users; and to sustain economic growth in all provinces of South Africa.

The construction of the 765kV transmission power line 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 of 2010, and may not commence without Environmental Authorisation from the National Department of Environmental Affairs (DEA).

Mokgope Consulting has been appointed by Eskom to conduct a full Environmental Impact Assessment (EIA) process for the proposed development. The EIA process comprises the Scoping phase and EIA phase. The Scoping phase formed part of the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application. Scoping phase commenced in January 2013 and was approved by the Authorities in October 2013. In the EIA phase, decision making was made in terms of choosing the preferred alternative corridor on the basis of specialist recommendations. In addition, all comments and issues raised by interested and affected parties (I&APs) were recorded and considered by the Environmental Assessment Practitioner (EAP) to finalise the Environmental Impact Report (EIR). The construction of the proposed 765kV transmission power line will only take place after the DEA has granted Environmental Authorisation (EA) and any appeals from I&APs have been dealt with successfully.

I&APs were identified, contacted and informed of the of the Scoping and EIR phase through electronic mailing system, and hard copies of registered letters were sent through the post. Furthermore, notices of the project and invitation to register on the I&AP Register were posted at Kenhardt and Prieska. Notices were published in regional and local newspapers in English and Afrikaans. The draft EIR was also available for review in Kenhardt library and Prieska library. All I&APs were afforded an opportunity to raise objections, issues and comments on the draft EIR from 30 June to 8 August 2014 and send all their comments and issues to the Environmental Assessment Practitioner (EAP).

Please note: Subsequent to the draft EIR phase, additional minor Deviations: 3A and 3B were introduced to the preferred Corridor 3. Deviation 3A was necessary to avoid the proposed airfield near Kronos substation. Deviation 3B was necessary to avoid hilly areas as well as to provide a link between Corridor 3 to Corridor 2 to avoid the Alkantpan Testing Range (ATR) area.
Consequently various specialist assessments were conducted for the deviation corridors to consider sensitive areas that could be impacted along the deviations. Moreover, landowners affected by the deviation corridors would be provided with the opportunity to comment on this Amendment of the Draft EIR. All stakeholders and I&APs would be afforded up to 30 days (22 October to 20 November) to raise objections, issues and comments on the amended draft EIR and direct all their comments and issues to the EAP. This report may also be accessed on the Mokgope website (www.mokgope.co.za), and electronic copies of the EIR would be as e-mailed to individuals upon request.

Specialist findings were assessed and summarised in this report. Potential environmental impacts associated with the proposed transmission power line 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 and Fauna impacts** are due to the disturbance of habitats within the power line servitude and the tower footprints. Mitigation measures should take the form of preventing construction of towers in / on ecologically sensitive areas.

- **Avifauna impacts** are as a result of collisions of birds with power lines and habitat destruction during construction phase. To minimise this impact would require marking the earth wires of the entire proposed power line with a suitable anti-collision marking device according to Eskom Transmission guidelines. A suitable system for nocturnal marking of the cables will need to be developed or sourced.

- **Wetland impacts** are as a result of changing the sediment amount entering water resources and the disposal of human sewage during the construction phase of the development. Recommended mitigation measures should take the form of maintaining buffer zones (50m from the watercourses) to trap sediments with associated toxins. During construction phase, provision of adequate sanitation facilities should be located outside its associated buffer zone.

- **Agricultural impacts** are caused by the transmission power line constructed on agricultural potential land / arable cultivation land and overhead irrigation systems, where high value crops and valuable infrastructure will be affected. Mitigation measures

should take the form of ensuring towers are sited away from any areas of intensive cultivation, such as areas of irrigation.

- **Visual impacts** are on quality of landscape due to the presence of a transmission power line in the operational phase and unsightly views caused by construction camps. Mitigations should take the form of avoiding transmission power lines to cross through ridges, rivers or any natural features that have visual value. The vegetation occurring in the area to be disturbed by construction camps must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation.

- **Ecotourism impacts** that may be caused by this development include: visual impacts on ecotourism; impacts on existing tourism attractions; and impacts on future establishments and expansions on protected areas. Construction activities, camp and lay down areas may impact on the quality of the product which ecotourism destinations in the study area can provide to the market place. If practically possible, construction camps should be located in areas that are already disturbed.

- **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.

- **Socio-economic impacts** are as a result of influx of workers in the area and disturbance on land use and hence affecting adjacent landowners. As a mitigation measure; 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 unskilled employment opportunities for local communities during construction phase.

An Environmental Management Programme (EMPr) has been compiled and should be used as a guide during the construction phase of the project. A competent Environmental Control Officer (ECO) should be appointed to monitor the implementation of this plan.

Conclusions and Recommendations:
Linear developments such as the proposed Kronos-Aries 765kV transmission power line are rarely able to avoid crossing ecologically sensitive areas and watercourses. Nonetheless, such sensitive areas could be avoided and / or minimize impacts by applying the recommended mitigation measures during construction and operational phases. Three main alternative corridors including deviations 3A and 3B, were considered and investigated for the proposed development.

From Kronos to Aries substation, **Corridor 3 with Deviation 3A and 3B linking to Corridor 2,** is considered to be a suitable route alignment for the proposed 765kV transmission power line and is recommended to be granted Environmental Authorisation to satisfy the purpose and need of the proposed project.

Overall, the specialist studies have not found any significantly detrimental issues that can be caused by constructing the proposed transmission power line. In general, the proposed

development will have a *moderate to low significance* impact provided there is effective application of the mitigation measures recommended by the specialist assessments.

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LIST OF ABBREVIATIONS AND ACRONOMYS

Background Information Document	BID
Basic Assessments	BA
Civil Aviation Authority	CAA
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 Report	EIR
Environmental Management Programme	EMP
Final Scoping Report	FSR
Geographic Information Systems	GIS
Government Notice Regulation Number	GNR
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

NEAS REF NO **DEA REF NO**	**DEA/EIA/0001557/2012** **14/12/16/3/3/2/440**
TITLE:	Amendment of the Draft Environmental Impact Report for the Proposed Kronos-Aries 765kV Transmission Power Line and Substations Upgrade (part of Cape Corridor Strengthening Phase 5).
CLIENT	Eskom Holdings SOC Ltd
PREPARED BY	Mokgope Consulting CC 49 3rd Avenue Highlands North Johannesburg, 2036
AUTHOR:	Mpho Nenweli / Judith Fasheun
PROJECT STATUS	DRAFT EIA Phase
REVIEW PERIOD	**October / November 2015**

APPROVED BY:

ESKOM PROJECT MANAGER: **Lerato Mokgwatlheng**

_____ _____

Signature Date

MOKGOPE CEO: **Manako Matemane**

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Signature Date

1. PROJECT BACKGROUND

1.1 INTRODUCTION

Eskom plans to construct a 765kV transmission power line of approximately 180km connecting Kronos to Aries substation. The proposed Kronos-Aries 765kV power line is a sub-project of the Cape Corridor Strengthening Phase 5 project which entails passing through the Northern Cape and Western Cape, to be in proximity to Independent Power Producers (IPPs) of solar farms and wind farms respectively.

Kronos Substation is located within the Siyathemba Local Municipality within the jurisdiction of the Karoo District Municipality in the Northern Cape Province.

Aries Substation is located approximately 40km south-west of Kenhardt within the Kai Garib Local Municipality within the jurisdiction of Siyanda District Municipality, in the Northern Cape Province.

The proposed project also entails the upgrade capacity and footprints of the existing Kronos and Aries Substations to accommodate the proposed 765kV transmission power line.

1.1.1 Need and Desirability

Eskom has to supply reliable power to meet the increasing needs of electricity users. Therefore on a continuous basis, Eskom needs to maintain, construct and upgrade its infrastructure of transmission power lines and substations. According to Eskom TDP 2013–2022, some of the objectives include 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.

The Greater Cape network (comprising the Eastern Cape, Northern Cape and Western Cape Provinces) supplies a combined diversified load of over 6 000 MW. The load is supplied by a network of HVAC transmission lines, referred to as the Cape corridor, operating at 400kV and now at 765kV as part of Phase 3 and 4 of the Cape Corridor Strengthening (see Figure 1).

The load forecast indicates that the load supplied by the Cape corridor will reach more than 8 000 MW by the year 2021. Forecasts indicate that the maximum power transfer through the Cape corridor may result in a power transfer deficit going forward. It is for this reason that Eskom Grid Planning initiated a Strategic EIA for the requirement of an additional 765kV line into the Cape network traversing the Northern Cape Province. The line will originate from Perseus Substation in the Free State and terminate at Sterrekus Substation in the Western Cape (via Kronos, Aries, Kronos, Juno and Aurora Substations). This will be referred to as Cape Corridor Strengthening Phase 5.

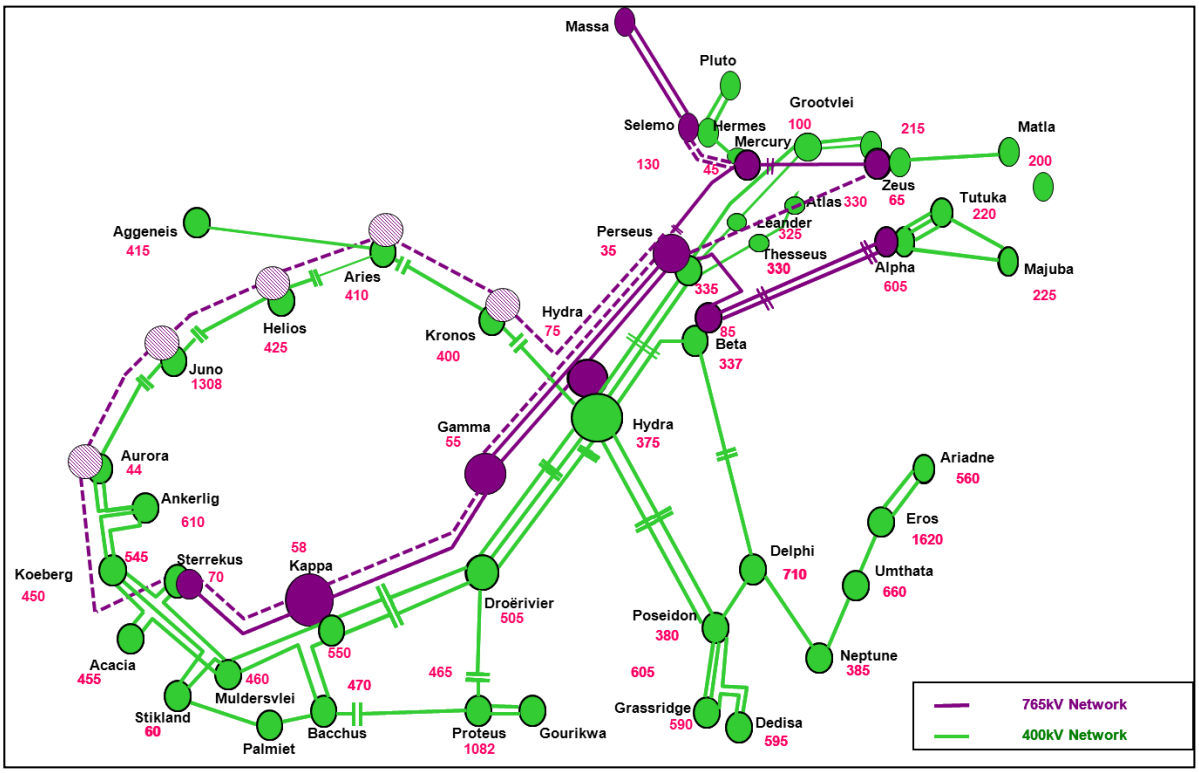


Figure 1: Cape network - 400kV and 765kV

The aim of the proposed transmission power line is to ensure that adequate and reliable electricity supply in the provinces is achieved.

The advantages of the proposed transmission power line would include:

- avoiding current and future possible voltage collapse;
- contributing to a more flexible electrical network;
- improvement in the overall reliability of the electrical systems, which would benefit electricity users in the regions;
- evacuate power generated from number of solar renewable installations in Northern Cape and wind farms on west coast of West Cape ; and
- to sustain economic growth in all Provinces of South Africa.

1.2 SCOPE OF THE PROJECT

The proposed 765kV overhead transmission power line would be constructed from Kronos to Aries Substation for approximately 180km in length, depending on the final route alignment. Eskom would need to register an 80m wide servitude over the final alignment, which would be required to accommodate the towers upon which the 765kV power line will be strung and control activities below the transmission cables.

In order to facilitate the final route determination, 2km wide alternative corridors were identified for specialist assessment study surveys along the proposed power line study area, as well as to

avoid any environmentally sensitive areas during servitude acquisition negotiations and during construction phase of the project.

Furthermore, the transmission power line would require support structures and towers which would be spaced at approximately 400m intervals along the power line route, as well as vehicular access along the route for construction and maintenance purposes.

The project will require suitable areas to accommodate construction camps. It is anticipated that the construction camps would be set up on farms at central locations next to the preferred route alignment. The construction camps would consist of temporary structures such as tents or temporary buildings, as well as ablution facilities which are expected to be portable toilets and temporary shower facilities.

Once the final 2km route corridor is authorised, subsequently an 80m servitude would be acquired within the 2km corridor, which would require negotiations with the affected landowners. Thereafter, a walk-down would be undertaken with the relevant specialists to guide on tower positions. At that stage, the required access roads, construction camps and laydown areas would be assessed and included in the site specific EMPr.

The project would also entail the upgrade of the capacity and expansion footprint of the existing Kronos and Aries Substations, to accommodate additional transmission capacity.

1.2.1 Associated work at Substations

The upgrade of the Aries and Kronos Substations would include the following:

- Construct a 765kV power line to connect to the substations;
- Include a 765kV yard at each substation;
- Include a 765kV busbar at each substation;
- Include a 2 x 765/400kV transformer at each substation;
- Extend the 400kV yard at each substation; and
- Extend the 400kV busbars at each substation.

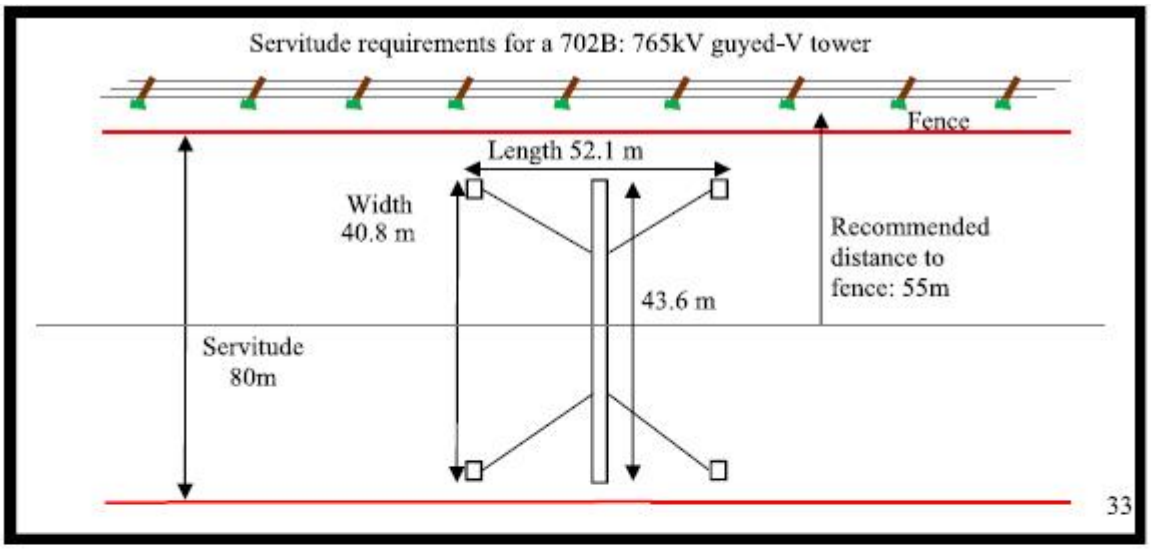
1.2.2 Tower Types

Towers for the proposed power line would be between approximately 35m and 55m in height and extend over a footprint area ranging from approximately 14.5m x 14.5m to 40.8m x 52.1m, depending on the tower type used.

The distance between each tower would be approximately +/- 450m - 500m, however, this is influenced by the topography and the need for bends in the line to remain within negotiated servitudes. The actual number of towers, the type of towers and other support structures associated with the proposed power line would be confirmed and detailed following approval of the proposed development and once the final alignment is negotiated with property owners.

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 power line routes are planned with as few bends along the route as possible.

Examples of some of the towers that Eskom is likely to use for the proposed 765kV transmission power line and which have been widely used in similar developments are illustrated below.



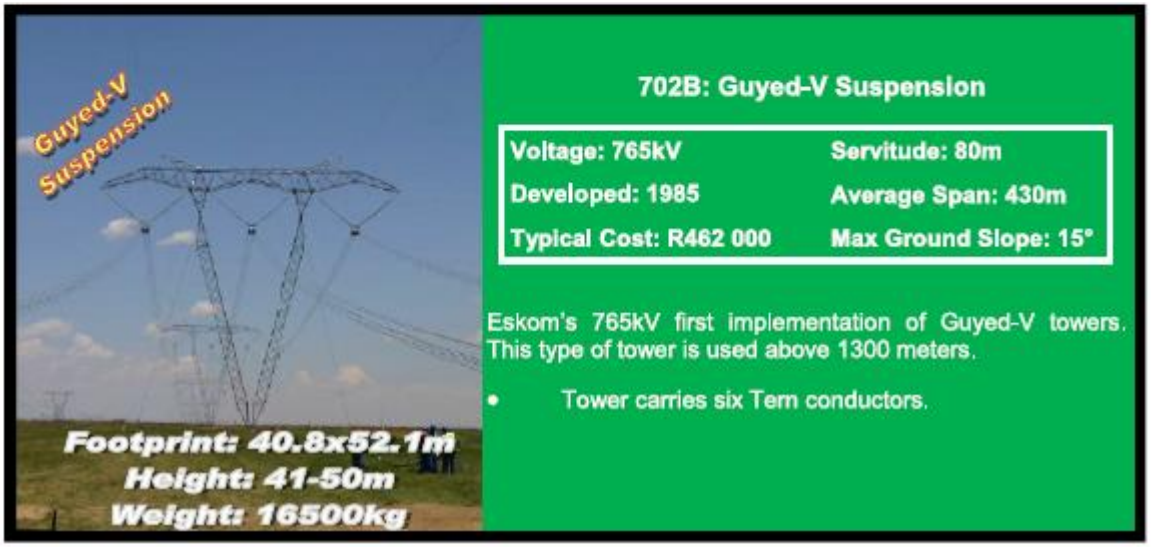
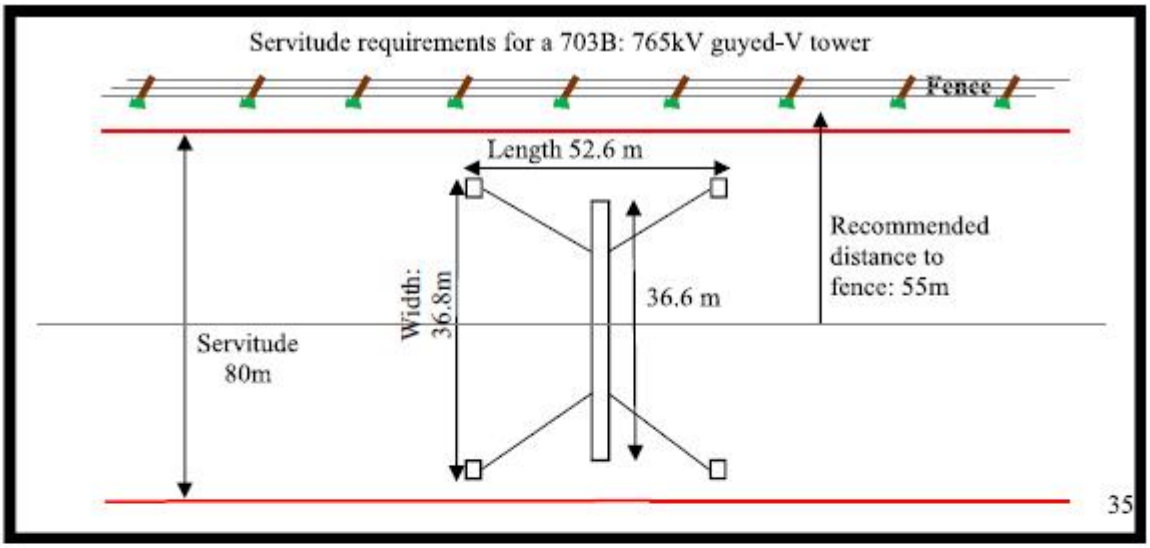


Figure 2: 702B Guyed-V Suspension Voltage: 765 kV Developed: 1985.



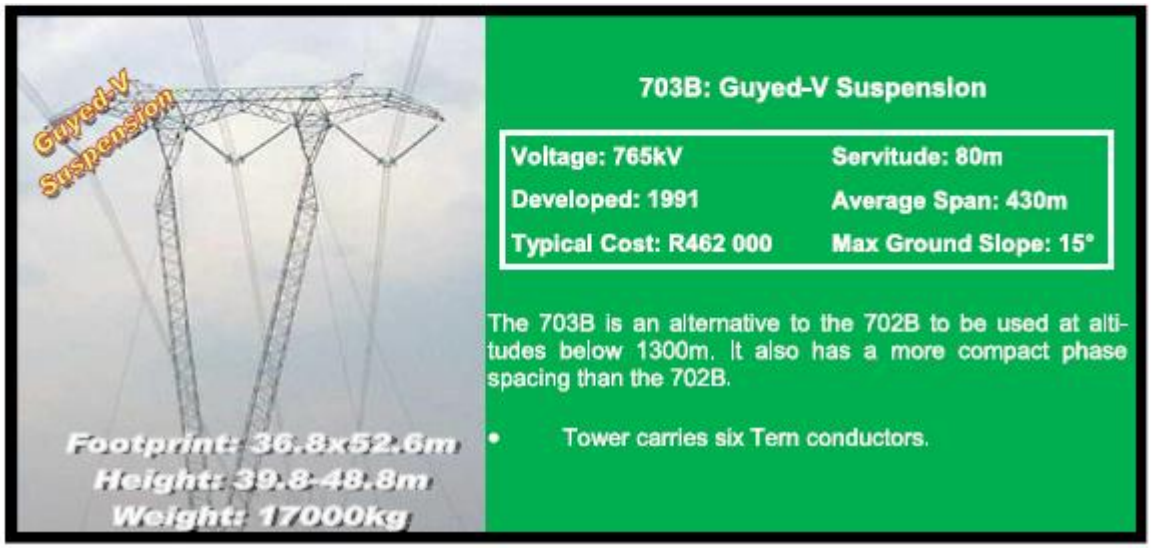


Figure 3: 703B Guyed-V Suspension Voltage: 765 kV Developed: 1991

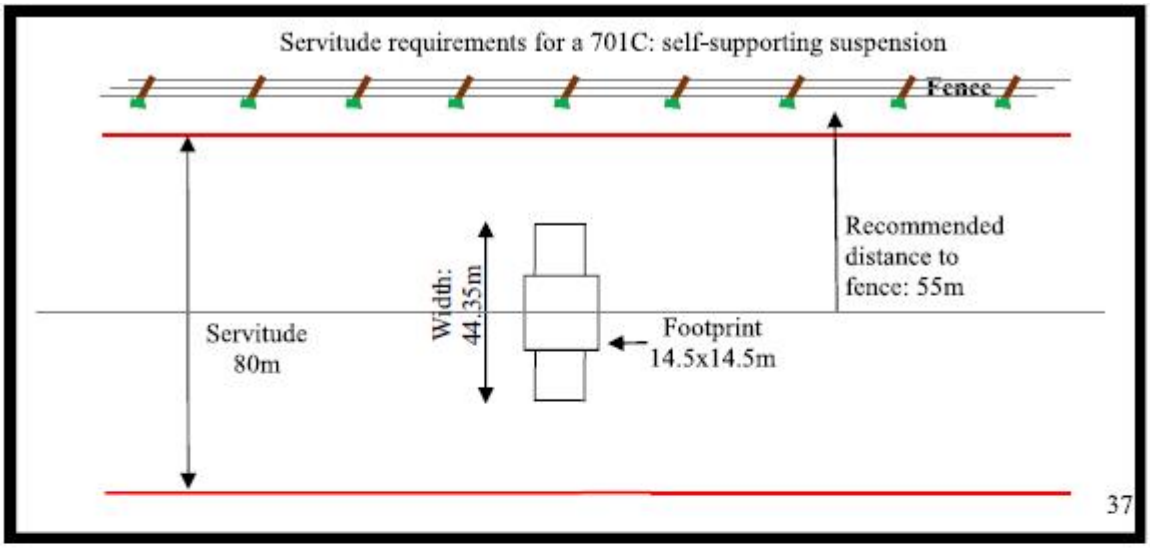
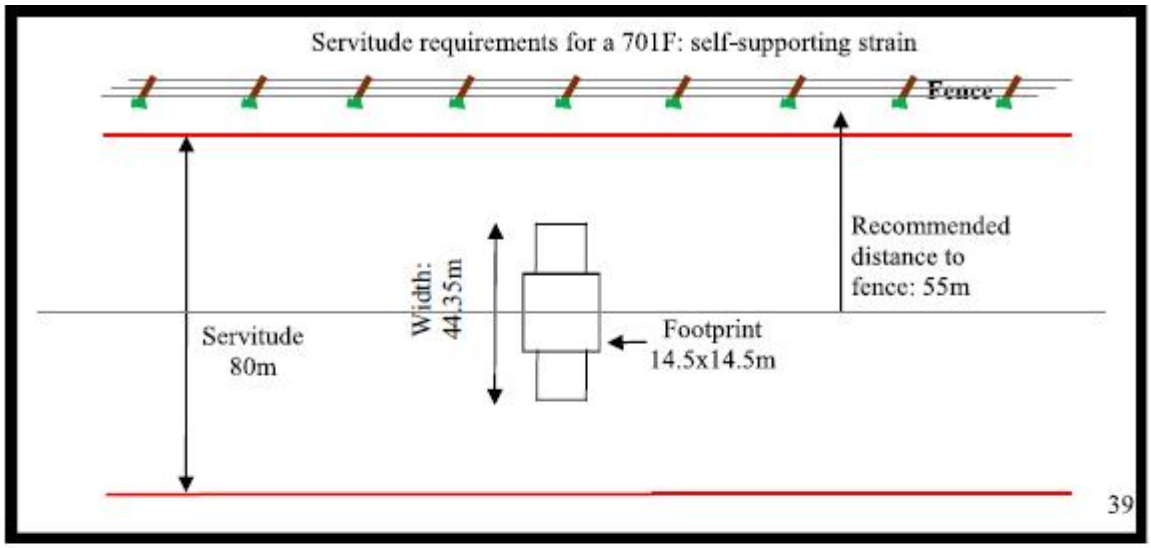


Figure 4: 701C Self - Supporting Suspension Tower Voltage: 765kV Developed: 1984



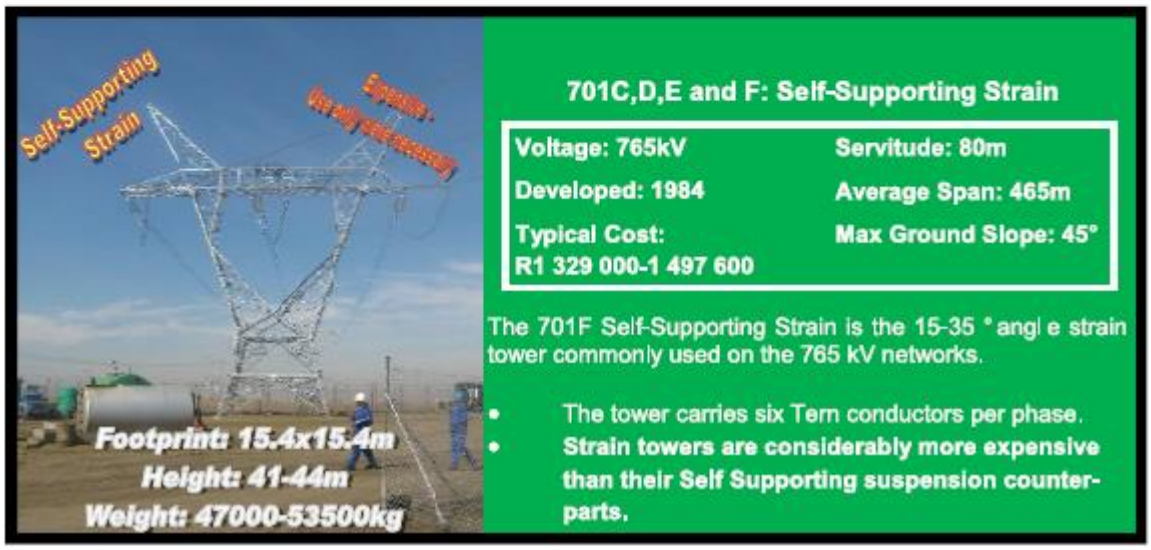


Figure 5: 701C,D,E & F Self - Supporting Suspension Strain Tower Voltage: 765kV Developed: 1984.

Avifauna & visual impact specialists have recommended maximum use of the cross rope suspension tower depicted in Figures 6 & 7 as they offer least substrate for nesting and most visual porosity.

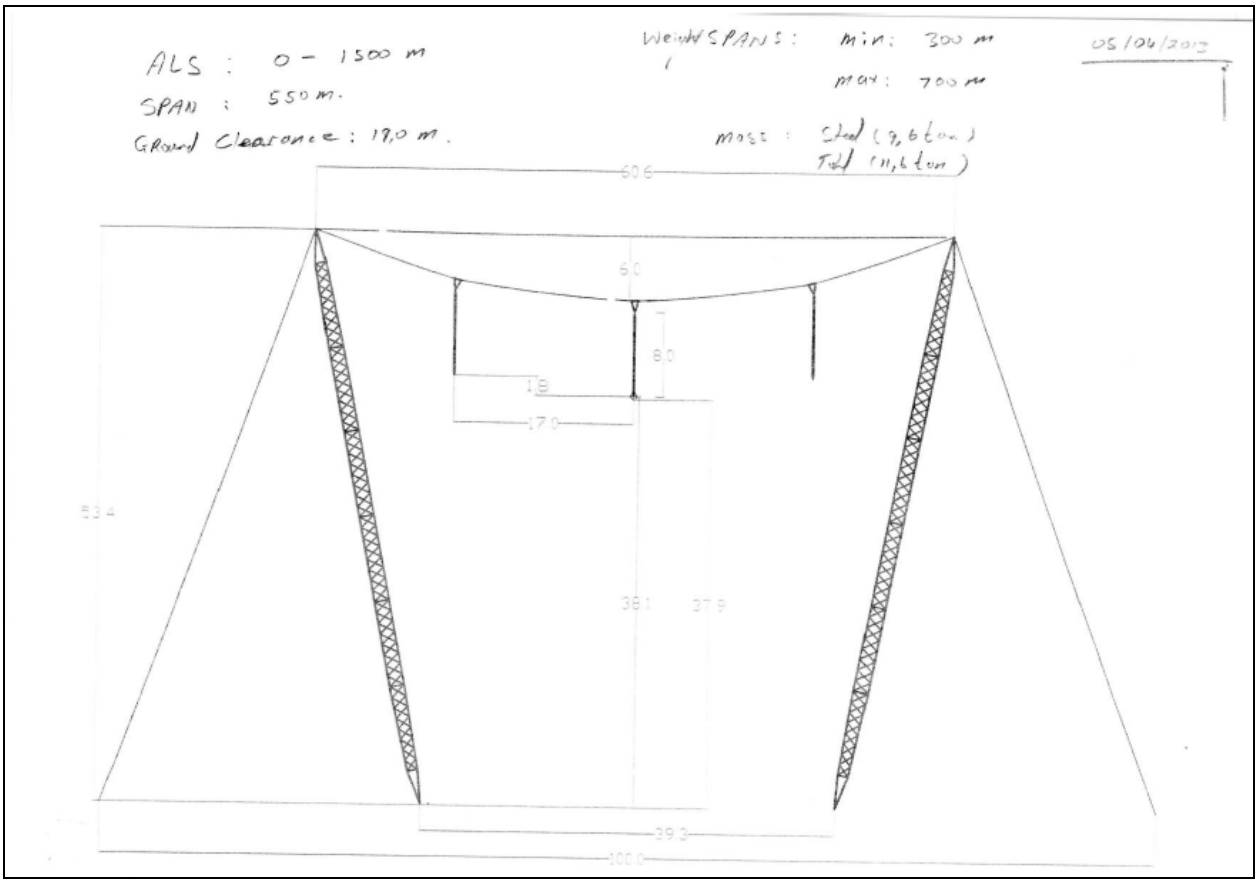


Figure 6: Crossrope Tower, Voltage: 765kV Developed: Recently

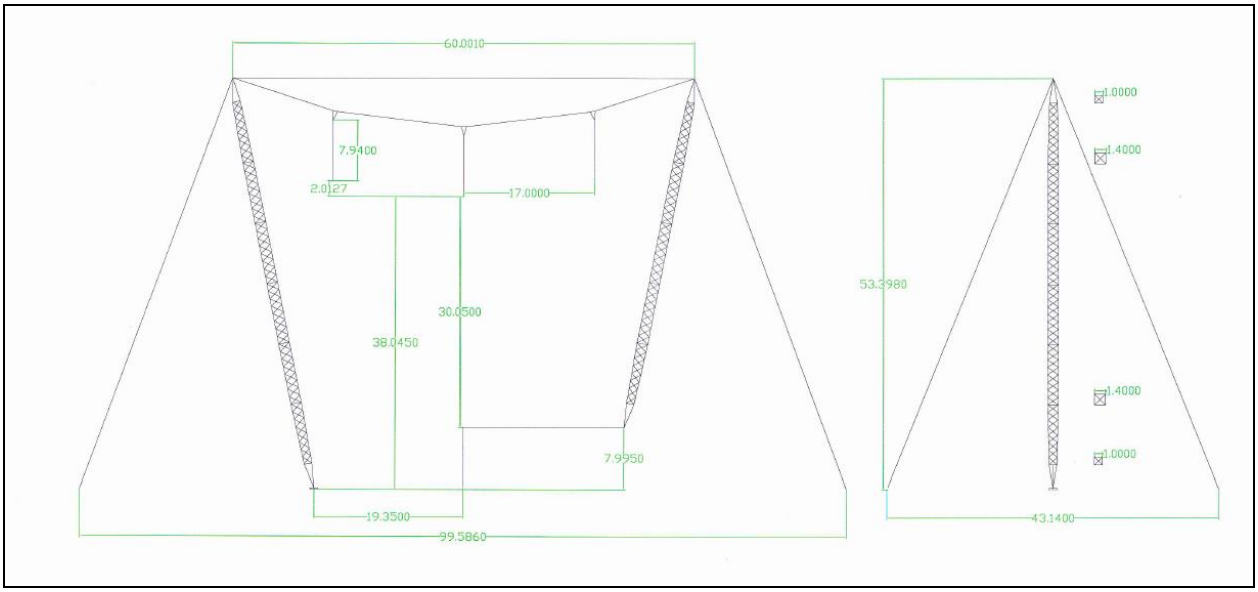


Figure 7: Crossrope Tower 705C, Voltage: 765kV

1.2.3 Servitude Requirements

Eskom will register a servitude width of 80m (40m on either side of the centre line) against the title deeds of the properties that would be traversed by the proposed transmission power line. The servitude would allow Eskom Transmission certain rights and controls that support the safe and effective construction, operation and maintenance of the power line.

For the purposes of seeking environmental authorisation, 2km wide corridors are typically investigated in detail to determine the preferred corridor to avoid any environmental sensitive features and allow for minor deviations within the corridor during the servitude acquisition negotiation process and the power line construction along the route alignment.

1.2.4 Clearances

The minimum vertical clearance to buildings, poles and structures not forming part of the 765kV power line must be 8.5m. The conductor ground clearance between the towers must be 10.4m (Figure 8). The minimum distance of a 765kV transmission power line structure from proclaimed public roads is 11.5m from the centre line of the structure to the centre line of the road. The minimum distance between any part of a tree or shrub and any bare phase conductor of a 765kV transmission power line must be 8.5m (OHSA, 1993).

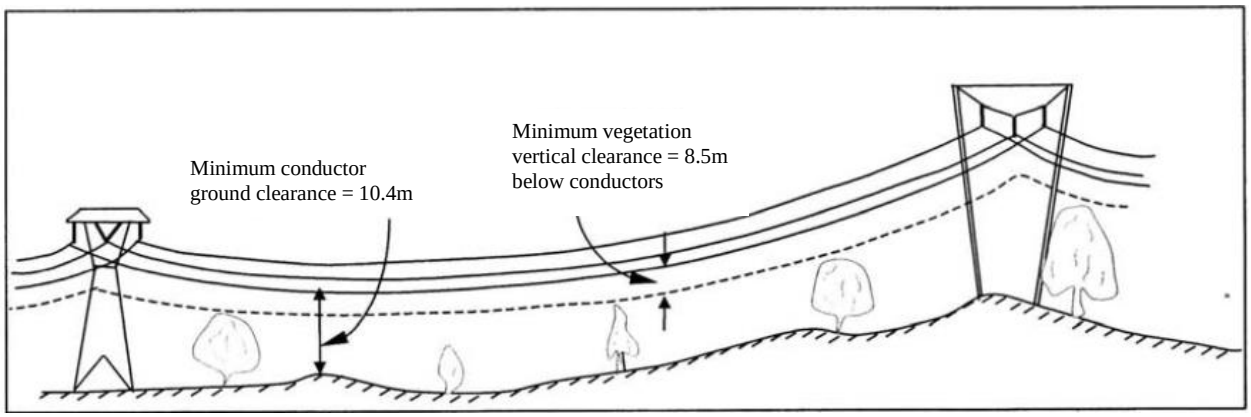


Figure 8: Servitude requirements in terms of vegetation clearing under conductors and minimum ground clearance (Source: BE, 2006)

An approximately 8m wide strip is generally required to be cleared of all trees and shrubs down the centre of transmission power line servitude for stringing purposes only. Any tree or shrub in other areas that will interfere with the operation and / or reliability of the transmission power line must be trimmed or completely cleared (CEA, 2003). More details on transmission power line vegetation management are provided in **Appendix K.**

Vegetation clearance for the proposed Kronos-Aries 765kV transmission power line 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 power line construction as listed in Table 1 (CEA, 2003) below.

Table 1: Minimum standards to be used for vegetation clearing for the construction of the proposed Kronos-Aries 765kV transmission power line (CEA, 2003)

ITEM	STANDARD	FOLLOW UP
Centre line of the proposed transmission power line	Clear to a maximum (depending on tower type and voltage) of a 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. Monitor for invasive alien plants, and eradicate.
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. Monitor for invasive alien plants, and eradicate.
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. Monitor for IAP, eradicate
Proposed tower position and proposed support/stay wire position	Clear all vegetation within proposed tower position in an area not larger than a foot print of 20 x 20m (self-supporting towers) and 40 x 40m (compact cross-rope suspension towers) around the position, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil. Allow controlled agricultural practices, where feasible.	Re-growth to be cut at ground level and treated with herbicide as necessary. Monitor for invasive alien plants, and eradicate.
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 power line.	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.

Furthermore, vegetation clearing would be required for the 2125.58m^2 working area for the tower constructions. It is likely that indigenous vegetation, some of which maybe endangered or more vulnerable than other species type would be cleared. This would require a vegetation permit. Other sensitive areas that would be impacted are watercourses. The length between each tower would approximately be 400m. Hence some towers would be constructed within 32m of a watercourse. This may require a water use permit.

The minimum safety clearances in terms of typical electric magnetic field levels in power line environments 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

The Occupational Health & Safety indicates that a distance of 5.6 metres to any building must not be encroached. However Eskom acquires 40 meter servitude from the centre line (80m total servitude width). A typical 765kV line has a 22 meter phase to phase spacing. Therefore from the nearest conductor to the edge of the servitude, the distance would be 34.4 meters (considering conductor blow out conditions) which comfortably complies with the 5.6 meters from the Occupational Health & Safety.

1.2.5 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 power line life cycle. The proposed power line would therefore require vegetation clearing for the access road of maximum 8m wide, required along the 80m wide servitude of approximately 180km in length.

In general, 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.

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

1.2.6 Storage of Transformer Oils

At Kronos and Aries substations, storage of diesel vehicle fuel and transformer oils would be required. The diesel vehicle fuel of $10m^3$ would be stores in containers (at a time) at the substations for refueling of construction vehicles. The oil collection dams would be built to collect and store the transformer oils in cases of spillages. The oil dams would be built according to the oil volume of the largest transformer in the substation plus a 20% margin. For example: The biggest transformer in a substation may contain $180m^3$ of oil. Therefore the oil dam would be built to accommodate $1.2 \times 180m^3 = 216m^3$.

Please note: The above activities as well as other services required during the construction and operational phase would be conducted in accordance with the approved Environmental Management Programme (EMPr). Furthermore, the exact location of temporary access roads for construction purposes as well as access roads for maintenance purposes may not be finalised at this stage. After the 80m servitude acquisition within the 2km corridor, subsequently a walk-down would be undertaken with the relevant specialists to guide on tower positions. During the walk-down stage, the required access roads would be assessed and included in the site specific EMPr.

2 PROJECT LOCALITY

2.1 DESCRIPTION OF THE PROPOSED KRONOS-ARIES POWER LINE

The study area of the proposed Kronos-Aries 765kV transmission power line comprised three alternative routes to be considered, each within a 2km corridor. This included affected landowners within the 2km corridor. The total length of the power line would be approximately 180km between the existing Aries and Kronos Substations.

Kronos Substation is located in the Siyathemba Local Municipality within the jurisdiction of Karoo District Municipality in the Northern Cape Province. Kronos Substation, approximately 11km south of a small settlement called Copperton and 56km south west of Prieska town

Aries Substation is located in the Kai Garib Local Municipality within the jurisdiction of Siyanda District Municipality, in the Northern Cape Province. Aries Substation is approximately 40km south west of Kenhardt town

The proposed transmission power line would be approximately 180km in length from Kronos to Aries substation.

The general topography within the study area is flat to undulating landscapes, while rocky outcrops and mountainous areas could be expected. The proposed routes cross the regional roads: R27 and R361 and some district roads as well as an existing railway line mainly transporting iron ore from Sishen mine near Kathu to Saldanha.

2.2 COORDINATES

The approximate coordinates are provided below:

Table 3: Approximate Coordinates between Kronos and Aries Substations

	Corridor 1	Corridor 2	Corridor 3
Start point at Kronos	30° 1'19.48"S	30° 1'19.48"S	30° 1'19.48"S
	22°20'18.21"E	22°20'18.21"E	22°20'18.21"E
Mid-point	29° 55' 12.35"S	29° 37' 38.14"S	29° 38' 5.42"S
	21° 29' 34.52"E	21° 11' 31.10"E	21° 38' 18.42"E
End point at Aries	29°29'33.71"S	29°29'33.71"S	29°29'33.71"S
	20°47'43.30"E	20°47'43.30"E	20°47'43.30"E

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

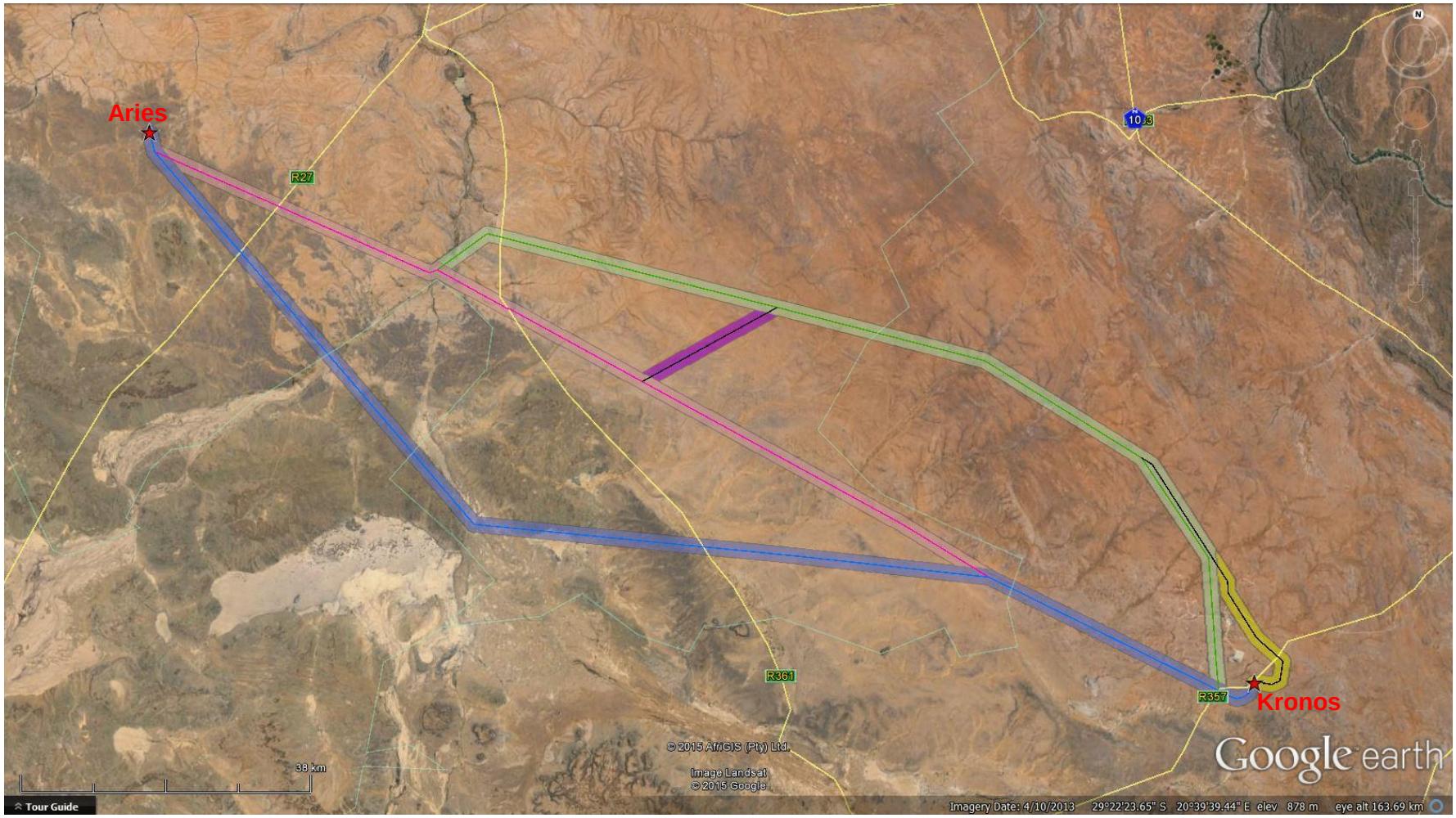


Figure 9: Aerial photo of locality area (Source: Google)

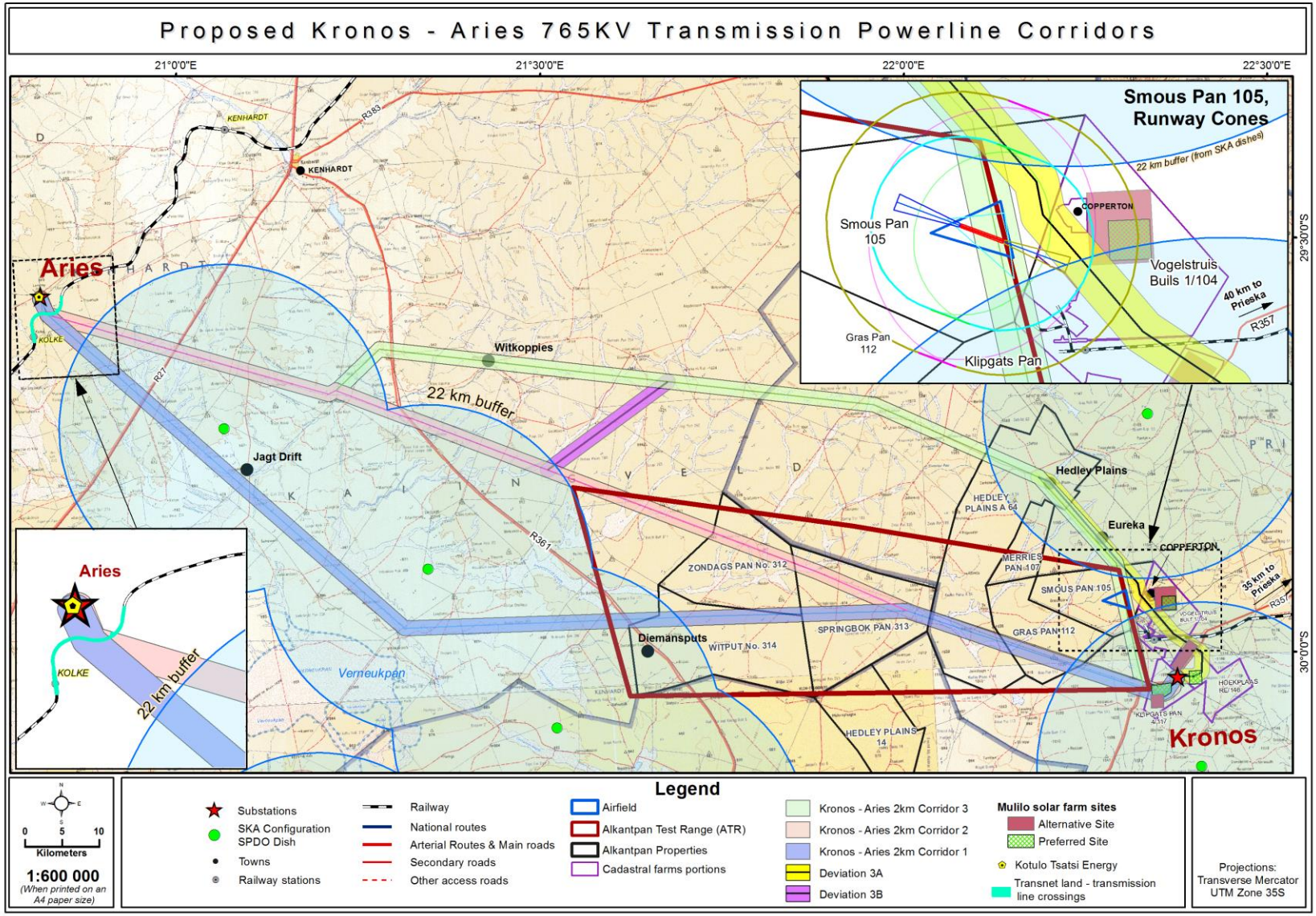


Figure 10**:** Locality map of proposed development Clearer locality map is provided in Appendix C

2.3 LAND OWNERSHIP

The proposed 765kV power line is approximately 180km linear activity that would require an 80m wide servitude over privately owned land to be secured. The servitude is to ensure the safe construction, and maintenance / operation of the line. The servitude would entitle Eskom certain rights such as access to the proposed development site. The final alignment would be located within the preferred 2km corridor so that environmentally sensitive areas and areas of high biodiversity significance may be avoided and also avoid environmental sensitivities outside the study area.

At this EIA phase, Eskom has not yet acquired servitudes and therefore would require landowners consent if any of the alternative route corridors is selected and authorised as the final route corridor.

The proposed development could affect many aspects of the environment along the course of the activity such as: crossing fences, boreholes, farm tracks, dwellings, mines, pipelines and watercourses. Landowners located within 2km of the linear activity could also be potentially affected. Affected landowners were identified and given notice of the proposed development during the Scoping and EIA process. The map depicting the proposed routes traversing the landowners' properties is provided in Appendix C.

3. IDENTIFICATION OF ALTERNATIVE SCENARIOS

In accordance with EIA Regulations No. 543 (18 June 2010), 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 would be determined after thorough assessments of all proposed alternatives corridors have been compared and recommended by the specialists as well as considering stakeholders' and I&APs' concerns.

The alternative scenarios that were investigated for this project comprise: location alternatives; process and technical alternatives; and the do nothing alternative. In terms of the location, 3 alternative route corridors were considered for the proposed transmission power line. At a later stage of the EIA process, 2 deviation routes to the preferred Corridor 3 were developed for technical reasons. See reasons below:

Deviation Lines	Technical Reasons for the Deviations
3A	This deviation was created to avoid the proposed airfield, on one of Alkantpan Testing Range properties. Civil Aviation Authority (CAA) recommended the deviation to avoid obstacles buffers. The deviation also avoids possible solar farms near Kronos substation.
3B	This deviation was created during the specialists' integrated meeting to link Corridor 3 to Corridor 2. Initially most specialists preferred Corridor 2, which is along an existing line. However part of Corridor 2 traverses Alkantpan Testing Range (ATR) "no power line zone."

3.1 LOCATION ALTERNATIVES

The figure below shows proposed alternative route corridors considered for the construction of the transmission power line. Alternative Corridors 1, 2 and 3 run the entire length of the development between Aries and Kronos Substations. Additional deviations to Corridor 3 comprise: Deviations 3A and 3B.The route corridors would traverse features such as: various types of vegetation, watercourses, roads, farms and undulating hills.

The key determinants in identifying the different route options would include: the receiving environment such as centre-pivots, terrain (certain mountainous areas are not accessible and suitable for building), mining areas, environmentally sensitive areas (wetlands, dams, pristine areas, national protected areas; etc.); game farms, existing infrastructures (roads, railways, buildings, community dwellings / households, amongst others).

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) is the route, the less expensive it is to build the proposed power line

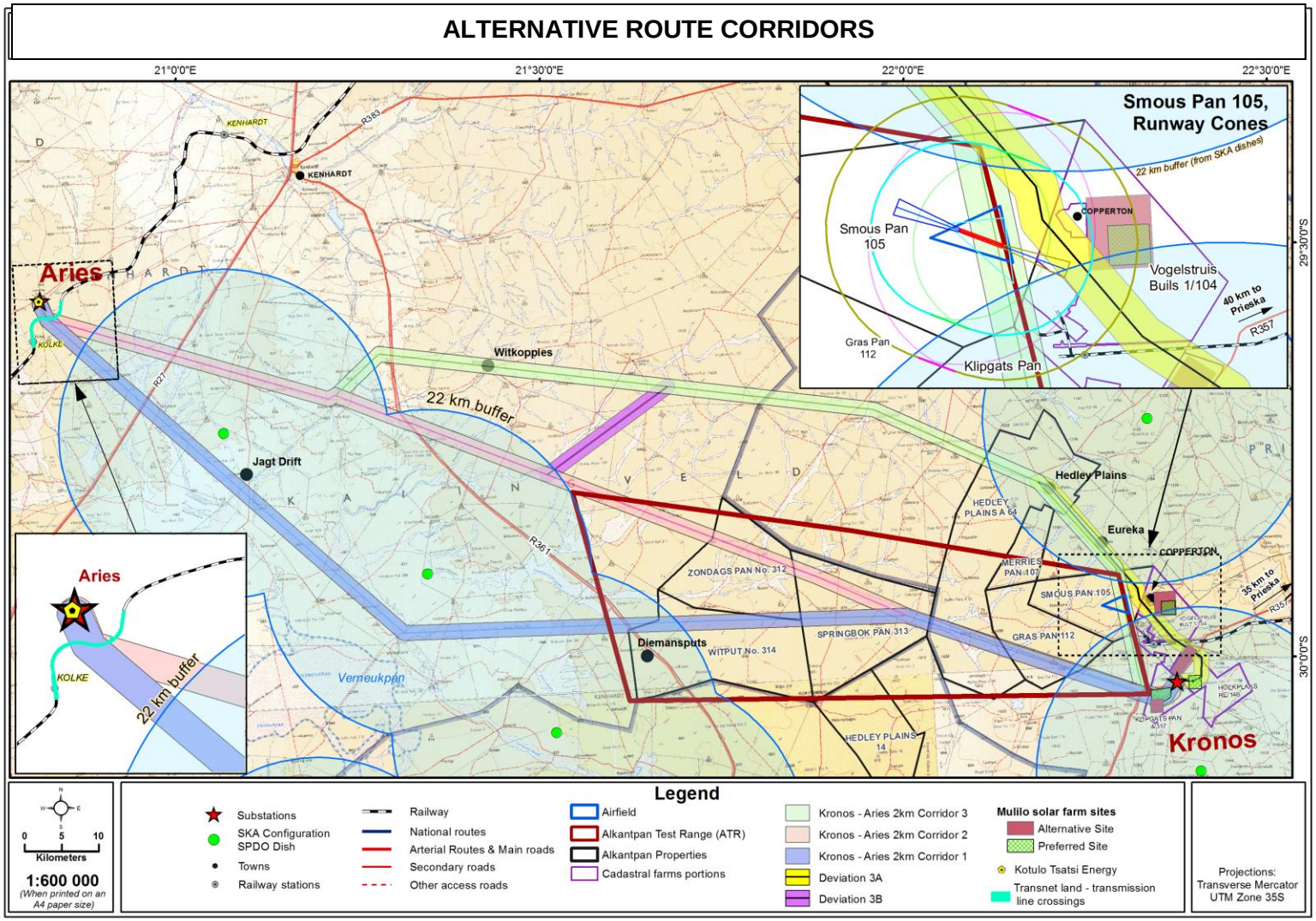


Figure 11: Proposed Alternative Route Corridors

3.1.1. CORRIDOR 1

From the Aries substation, all three corridors follow the same alignment for the first approximate 14km, where after Corridor 1 splits southwards towards the Verneukpan. From here Corridor 1 turns north-eastward to join Corridor 2 about 44km west of the Kronos substation. Where Corridor 1 joins Corridor 2 to reach Kronos substation, there is an existing transmission line (Figure 11).

3.1.2. CORRIDOR 2

From the Aries substation, all three corridors follow the same alignment for the first approximate 14km, where after Corridor 2 aligns more-or-less in a strait south-easterly direction until it reaches Kronos substation (Figure 11). The entire Corridor 2 runs along the existing 400kV transmission power line. Corridor 2 traverses Alkantpan Test Range (ATR) properties for approximately 42km from Kronos substation.

3.1.3. CORRIDOR 3 with DEVIATION 3A AND 3B

From the Aries substation, all three corridors follow the same alignment for the first approximate 14km. Corridor 3 continues for about another 30km along the same alignment as that of Corridor 2, where after Corridor 3 turns northwards and passes south of Marydale town. Approximately 8km before reaching Kronos substation Corridor 3 comes into close proximity to solar development areas. Furthermore, Corridor 3 traverses a proposed aerodrome of which the power line would have to avoid as a potential obstacle for aviation purposes. Corridor 3 then joins Corridor 1 and Corridor 2 about 16km west of the Kronos substation (Figure 11).

Deviation 3A: It includes a proposed deviation created to avoid the proposed airfield, CAA obstacles and buffers and proposed solar parks. This corridor runs from the Kronos substation using Deviation 3a and follows the remainder of Corridor 3 and the last bit of Corridor 2 to the Aries substation.

Deviation 3B: Corridor 3B is a deviation which links Corridor 3 to Corridor 2 which serves to avoid the “no power line zone” at Alkantpan Testing Range located in Corridor 2.

3.2 PROCESS AND TECHNICAL ALTERNATIVES

There are two technical alternatives relevant for a 765kV power line other than the “Do-Nothing” Alternative.

3.2.1 765kV Alternating Current (AC)

In AC voltage, the flow of electric charge periodically reverses direction, whereas in HVDC the flow of electric charge is in one direction. The line length for an AC system is only viable for a line length of approximately 450km. Therefore, for this power line, which would be about 180km in length, an AC system could be used and Eskom would need to install transformers in different

substations along the route. Furthermore other local generated renewable energy would be able to be collected along the route.

3.2.2 High Voltage Direct Current (HVDC)

HVDC system uses direct current for the bulk transmission of electricity, compared to the more common AC system. For long distance transmission of more than 1000km, HVDC would be more appropriate provided transformation would not be required along the line route. The HVDC converter stations are expensive and only viable if the line length is very long (>1000km). Therefore considering the length of the entire proposed power line from Western Cape to Gauteng, an HVDC system would be less costly than an AC system.

3.2.3 Advantages of HVDC over AC

- The most common reason for choosing HVDC over AC transmission is that HVDC is more economic than AC for transmitting large amounts of power point-to-point over long distances.
- Even though HVDC conversion equipment at the terminal stations is costly, overall savings in capital cost may arise because of significantly reduced transmission line costs over long distance routes.
- HVDC needs fewer conductors than an AC line, as there is no need to support three phases.
- Also, larger conductors can be used since HVDC does not suffer from the skin effect[1]. These factors can lead to large reductions in transmission line cost for a long distance HVDC scheme.
- Depending on voltage level and construction details, HVDC transmission losses are quoted as about 3.5% per 1,000 km, which is less than typical losses in an AC transmission system.
- HVDC transmission may also be selected because of other technical benefits that it provides for the power system. HVDC schemes can transfer power between separate AC networks. HVDC power flow between separate AC systems can be automatically controlled to provide support for either network during transient conditions, but without the risk that a major power system collapse in one network will lead to a collapse in the second.

3.2.4 Disadvantages of HVDC

- The disadvantages of HVDC are in conversion, switching, control, availability and maintenance.
- HVDC is less reliable and has lower availability than AC systems, mainly due to the extra conversion equipment.

[1] Skin effect is the tendency of an AC to become distributed within a conductor such that the current density is largest near the surface of the conductor, and decreases with greater depths in the conductor.

- The required converter stations are expensive and have limited overload capacity. At smaller transmission distances, the losses in the converter stations may be bigger than in an AC transmission line for the same distance.
- Operating a HVDC scheme requires many spare parts to be kept, often exclusively for one system, as HVDC systems are less standardized than AC systems and technology changes faster.
- In contrast to AC systems, realizing multiterminal systems is complex (especially with line commutated converters), as is expanding existing schemes to multiterminal systems. Controlling power flow in a multiterminal DC system requires good communication between all the terminals; power flow must be actively regulated by the converter control system instead of the inherent impedance and phase angle properties of the transmission line.
- The increasing size of the conductor to reduce power loss in transmission is expensive and will have a significant visual contrast.

The following table outlines the comparisons between a 765kV AC and HVDC:

Table 4: HVDC vs AC

	AC	**HVDC**
Current	AC	DC
Maximum line length	+- 450km	> 1000km
Towers & Conductor	3 phase bigger foot print	1 phase smaller foot print
Transformation	Possible at different substations	Not possible, loose the advantage of the network
Substations	Feeder bay every 450km	Only two converter stations needed

Please note: Even though both options (765kV HVDC and 765kV AC) are regarded viable alternatives for point-to-point long distance transmission of more than 1000km, the 765kV AC alternative is preferred for this project due to the following reasons:

- The distance between the substations / point-to-point is approximately 880km for the entire Northern Alignment (Perseus to Juno), which is less than 1000km distance for HVDC projects;
- The transformers are to be installed at the following substations: (Perseus and Kronos), (Kronos and Aries), (Aries and Helios), and (Helios and Juno) to enable the collection of other renewable energy along the proposed entire line route (*i.e.* from Juno to Perseus substations);
- The cost of DC conversion equipment is much higher as compared to an AC system at the terminal stations or substations;
- However, should a need arise for Eskom after the Environmental Authorisation has been granted to convert from AC to HVDC, the EAP is of the opinion that there will be no need for any further assessments provided there is no deviation from the authorised route because HVDC has lesser environmental impact (*i.e.* less tower footprint, servitude width and conductors).

3.3 DO NOTHING ALTERNATIVE

The “do nothing” alternative is the option of not undertaking the proposed development, which implies that the 765kV overhead line would not be constructed. Retention of the status quo would mean that it would not be possible to meet the growing electricity demands in the area and other surrounding towns and large power consumers such as mines fed by the substations nor would it be possible to efficiently evacuate increasing renewable power generated in the Northern and Western Cape to the rest of the country.

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 power line there is an increasing possibility that outages could occur, resulting in economic losses that could run into millions of rands, particularly for the various industries in the area.

The “do nothing” alternative would also have the inability to meet future demand which would cap economic development at current levels leading to failure to meet provincial and national growth targets.

The do nothing scenario puts the national grid at risk, particularly between Perseus and Sterrekus, due to the high number of transmission lines in the power corridor/spine. Flash overs & fires would result in significant outages whereas this Northern Alignment allows for continuous power supply via alternative substations.

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 in force at that time will apply.

4.1 LEGISLATION RELATED TO PROPOSED PROJECT

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."

National Environmental Management Act (No 107 of 1998, as amended)

NEMA (Act No. 107 of 1998) emphasizes the involvement of sustainable development, which requires the integration of social, economic and environmental aspects in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations.

To maintain the practice of sustainable development, NEMA EIA Regulations identify listed activities that need to apply to the EIA process by involving: social aspects, which comprise the public participation process; the economic factors through identifying the need and desirability of the proposed activities and the benefits on the communities and/or country at large; and by

identifying and assessing alternative activities that would pose the least negative impacts on the environment and biodiversity in the study areas.

In terms of NEMA (Act No. 107 of 1998) this proposed development is identified in Government Notice No. R543 of 18 June 2010 as part of listed activities that must apply to the EIA process. Other listed activities associated with the proposed development are outlined in Table 5 of this report. As identified listed activities in GN R544, 545, and 546, the proposed development will require the submission of a Scoping Report and an Environmental Impact Assessment Report to the relevant authorities as part of the environmental authorization process.

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.

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).

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).

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.

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 ECA, there is no need to undertake a separate application in terms of the National Heritage Resources Act (NHRA).

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, for instance, 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.

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

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. In terms of the proposed project, Section 106 (3) provides exemption from the Act. "Only where the organ of state has obtained formal exemption from the Minister, the organ of state has to:

- make formal application for exemption;
- notice of the exemption has to be gazetted by the Minister; and
- the organ of state has to compile an EMP per borrow pit and submit these to DMR for approval" (DME, 2002).

In this case, an EMP would be appropriate for approval.

Expropriation Act (No. 63 of 1975)

The Expropriation Act is used to acquire land from unwilling sellers (South Africa, 1975). If necessary, Eskom would need to acquire additional land for this development. This would have to take place during the pre-construction and post-authorisation phase of the development.

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

Provisions of this Act which are relevant to this study include the guiding principles relating to threatened and protected ecosystems and species, species and organisms posing a threat to biodiversity, permits relating to listed threatened and protected species, alien species or invasive species. 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.

National Environmental Management: Waste Act (No. 59 of 2008)

In terms of section 16 (1) of the Act, duty of care is applicable to (DEAT, 2008b):

- Avoid the generation of waste and where such generation cannot be avoided, to minimize the toxicity and amounts of waste that are generated;
- Reduce, re-use, recycle and recover waste;
- Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
- Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
- Prevent any employee or any person under the proponent's supervision from contravening this Act; and
- Prevent the waste from being used for an unauthorised purpose.

Conservation of Agricultural Resources Act (No 43 of 1983)

In terms of GN 1048 of 1984 and GN 2485 of 1999, the Act provides management principles relating to weeds and invaders and also categories of weeds and invaders (DOA, 1983).

National Water Act (No 36 of 1998)

The National Water Act states that duty of care to remedy the effects of pollution to water resources needs to be taken into consideration in all circumstances (section 19). The Act also stipulates procedures to be followed in the event of an emergency incident which may impact on a water resource (Section 20) as well as governing water use licences (Section 21) if required for construction purposes (DWAF, 1998).

National Forests Act, (No 84 of 1998

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister".

Promotion of Administrative Justice Act (PAJA) (No 3 of 2000)

The Promotion of Administrative Justice Act aims to give effect to the right to administrative action that is lawful, reasonable and procedurally fair, and to the right to written reasons for administrative action as contemplated in Section 33 of the constitution of the Republic of South Africa 1996 and provides for matters incidental thereto (PAJA, 2000). In particular, the proposed development was considered in accordance with this Act in terms of the following (PAJA, 2000:4):

An administrator undertaking procedurally fair administrative action must give adequate notice of the nature and purpose of the proposed administrative action:

- a reasonable opportunity to make representations;
- a clear statement of the administrative action;
- adequate notice of any right of review or internal appeal, where applicable; and
- adequate notice of the right to request reasons if they were not provided

In cases where an administrative action affects the rights of the public, an administrator, must decide whether to hold a public inquiry and therefore conduct the public inquiry or appoint a suitably qualified person to do so and determine the procedure for the public inquiry, which must:

- include a public hearing and comply with the procedures to be followed in connection with public inquiries;
- conduct the inquiry in accordance with that procedure; and
- compile a written report on the inquiry and give reasons for any administrative action taken or recommended

If an administrator decides to follow a notice and comment procedure, the administrator must:

- take appropriate steps to communicate the administrative action to those likely to be materially and adversely affected by it and call for comments from them;

- consider any comments received; and
- comply with the procedures to be followed in connection with notice; and
- comment procedures

Any person whose rights have been materially and adversely affected by administrative action and who has not been given reasons for the action may, within 90 days after the date on which that person became aware of the action, request that the administrator concerned furnish written reasons for the action. The administrator to whom the request is made must, within 90 days after receiving the request, give that person adequate reason in writing for the administrative action.

National Environmental Management: Protected Areas Act (No 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.

The proposed development would traverse environmentally sensitive areas (to be identified by biodiversity specialists during field work). Nonetheless, 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 2010 promulgated in terms of NEMA under Government Notice (GN) No. R544, 545 and 546 outline the activities for which Environmental Authorisation must be obtained following either a Basic Assessment or EIA process.

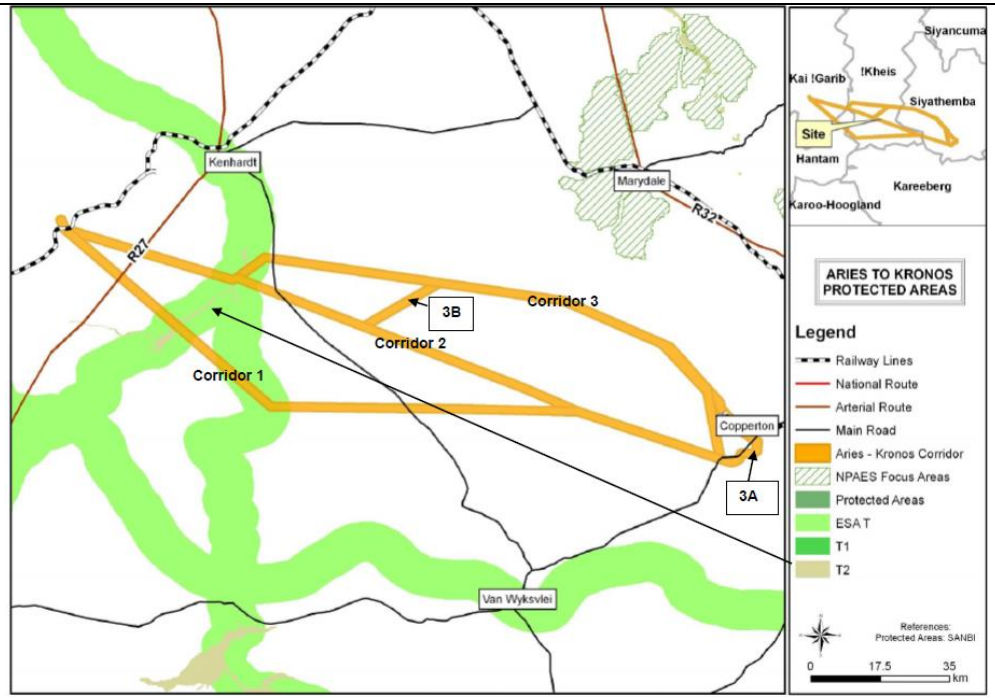
Developments which trigger activities within GN R544 and R546 require a Basic Assessment and those that trigger GN R545 activities require a full EIA. Due to the length and capacity of the proposed transmission line and substations upgrades, a full EIA is being conducted for the proposed power line and associated works.

The following listed activities are relevant to this project:

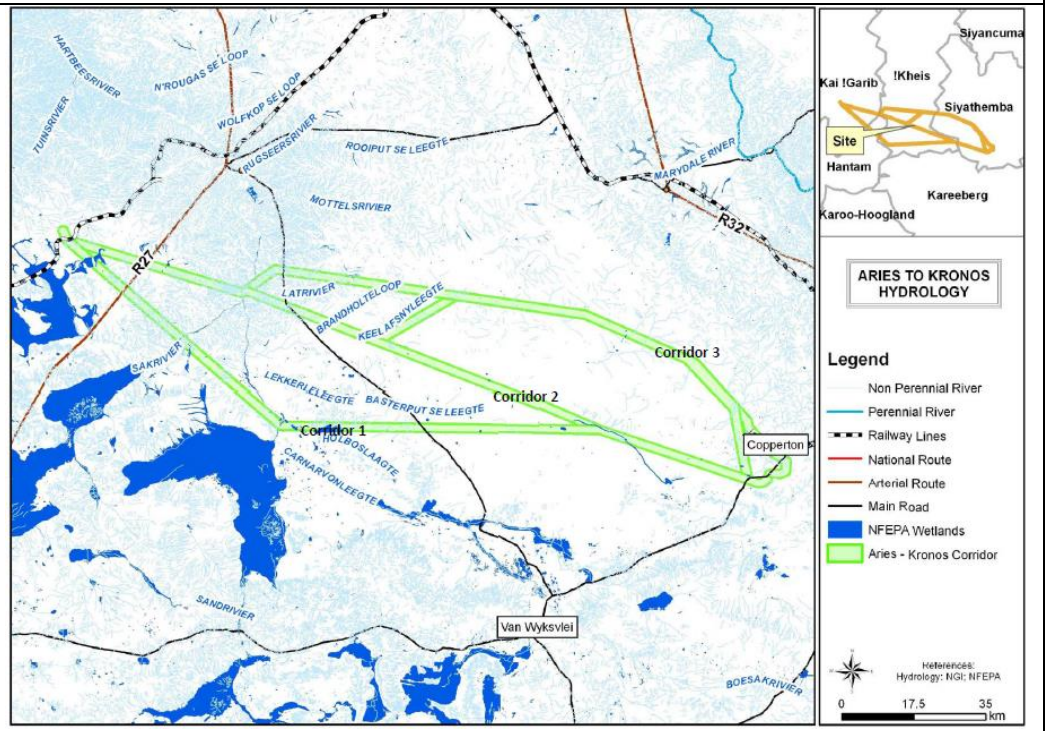
Table 5: Activities listed within Government Notice No. R544, R545 and R546 applicable to this project (as per numbering in the Government Notice)

Activity Number	**Description of each listed activity as per the project description**	**Reasons For Listed Activities Triggered**
GN R544		
11(xi)	*The construction of:* *(xi) Infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.*	The footprint working area for each of the tower structures to be constructed would range from approximately 210.25m^2 to 2 125.68m^2. These area footprints exceed the threshold of 50m^2. Some of the tower structures will be constructed within 32m of a watercourse. The watercourses will be impacted during the construction phase of the project and rehabilitation will be undertaken prior to the operational phase.
13	*The construction of facilities or infrastructure for the storage, or for the storage and handling of dangerous goods, where such storage occurs in containers with a combined capacity of 80m^3 but not exceeding 500m^3*	Oil collection dams will be built to collect and store transformer oils in cases of spillages at the substations. The biggest transformer in a substation could contain up to 180m^3 of oil. The oil dams will be built to accommodate a capacity of 216m^3 of transformer oil. Therefore the capacity of the oil dams would exceed the threshold of 80m^3 but less than 500m^3.
22(ii)	*The construction of a road outside an urban area:* *(ii) Where no reserve exists, where the road is wider than 8m*	Construction heavy vehicles will require access along the final route alignment from Kronos to Aries substation to transport towers and other associated structures. Temporary access roads will be constructed during construction phase of the project and the roads will be rehabilitated prior to operational phase of the project. The access roads wider than 8m where no reserve exists will be determined

Activity Number	Description of each listed activity as per the project description	Reasons For Listed Activities Triggered
		along the chosen route alignment prior to construction phase of the project.
38	*The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kV and the development footprint will increase.*	Both Kronos and Aries substations will entail an upgrade of the capacity and expansion of the development footprint to accommodate the 765kV transmission capacity.
GN R545		
8	*The construction 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.*	The proposed project involves the construction of a 765kV transmission power line from the Kronos substation near Copperton and Prieska to Aries substation near Kenhardt in the Northern Cape Province. The length of the power line would be approximately 180km, however, depending on the final route alignment.
GN R546		
12 (b)	*The clearance of an area of 300m^2 or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.* *(b)Within CBA identified in bioregional plans*	Each working area for tower construction will range from approximately 210.25m^2 to 2 125.68m^2. These working area footprints will require vegetation clearance where 75% or more of the vegetation cover constitutes indigenous vegetation. The tower working footprints of approximately 2 125.68m^2 will exceed the threshold clearance area (*the clearance of an area of 300m^2 or more but less than 1ha of vegetation…)* The proposed Kronos-Aries power line corridors will traverse over small sections of CBAs (ranked as T2) and may thus have an impact thereon. In addition, the corridors traverse an ESA. Both the CBA and the ESA are associated with the Hartbees River, catchments of the Bushmanland Vloere (pans) and Lower Gariep Broken Veld (koppies/mountains). The Gariep focus area is situated approximately 20km north of the proposed development, around the town of Marydale town. See figure a below.

Activity Number	Description of each listed activity as per the project description	Reasons For Listed Activities Triggered
		 Figure a: NPAES, CBAs, and ESAs along the proposed development. (Source: Eyssell, 2015 – Kronos-Aries Vegetation Report).
16 (iv) (a) ii (bb) (ff)	*The construction of:* *(xi) Infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur*	The footprint working area for each of the tower structures to be constructed would range from approximately 210.25m^2 to 2 125.68m^2, which exceeds the threshold of 10m^2. Some of the tower structures will be constructed within 32m of a watercourse. The proposed power line routes will cross numerous perennial and non-perennial rivers and drainage lines including the Hartbees River and catchments of the Bushmanland Vloere (pans). The watercourses that will be

Activity Number	Description of each listed activity as per the project description	Reasons For Listed Activities Triggered
	behind the development setback line. ***(a) In Northern Cape Province:*** *ii. Outside urban areas, in:* *(bb) National Protected Area Expansion Strategy Focus areas; and* *(ff) Critical Biodiversity Area… as identified in bioregional plans.*	affected will be determined along the chosen route alignment prior to construction phase of the project. The watercourses will be impacted on during the construction phase of the project and rehabilitation will be undertaken prior to the operational phase. <u>Geographical areas:</u> As indicated in Figure a above, the proposed Kronos-Aries power line corridors will traverse over small sections of CBAs (ranked as T2) and may thus have an impact thereon. In addition, the corridors traverse an ESA. Both the CBA and the ESA are associated with the Hartbees River, catchments of the Bushmanland Vloere (pans) and Lower Gariep Broken Veld (koppies/mountains). The Gariep focus area is situated approximately 20km north of the proposed development, around the town of Marydale town.
24 d (a) (ii) (bb) (ee)	*The expansion of:* *(xi) Infrastructure, where the Infrastructure will be expanded 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.* ***(a) In Northern Cape Province:*** *ii. Outside urban areas, in:* *(bb) National Protected Area Expansion*	Both Kronos and Aries substations will entail an upgrade of the capacity and expansion of the development footprint to accommodate the 765kV transmission capacity. The expansion footprint area will occur within 32 metres of a watercourse, measured from the edge of a watercourse. Figure b below illustrates watercourses and water bodies along the proposed development.

Activity Number	Description of each listed activity as per the project description	Reasons For Listed Activities Triggered
	Strategy Focus areas; and (ee) Critical Biodiversity Area…as identified in bioregional plans.	 Figure b: Watercourses and water bodies along the proposed route alignments (Source: Bootsma, 2015 – Kronos-Aries Wetland Report)

5. APPOINTMENT OF ENVIRONMENTAL CONSULTANTS

Mokgope Consulting CC has been appointed by Eskom to undertake an Environmental Impact Assessment (EIA) for a linear activity of the proposed Kronos-Aries 765kV Transmission Power line and Substations Upgrade. The proposed power line development is identified as an activity that may have significant detrimental effects on the environment, as defined by the EIA Regulations of 2010.

The 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 Government Notice No. R543 of 2010, considering Government Notice No. R544, R545 and R546 of 2010, of application for Environmental Authorisation in terms of a Scoping and full EIA process. The application has been submitted for authorisation to the National Department of Environmental Affairs and is registered under the NEAS Reference: DEA/EIA/0001557/2012; and DEA Reference: 14/12/16/3/3/2/440.

5.1. THE ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

(a) Name of EAP: Mpho Nenweli

Description: 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). 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, amongst others, 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 5 years relevant experience, and has been involved in undertaking a

number of EIAs associated with Eskom power line 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 Certificated Natural Scientist (Environmental Science), Registration number 300019/14.

The Environmental Assessment Practitioner has signed as independent consultants in front of a commissioner of oaths. The declaration of independence from the EAP is provided in Appendix B. The EAPs' Curriculum Vitae (CV) are also provided in Appendix B.

5.2 EAP COMPANY BACKGROUND

Mokgope is an independent black-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 within 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:

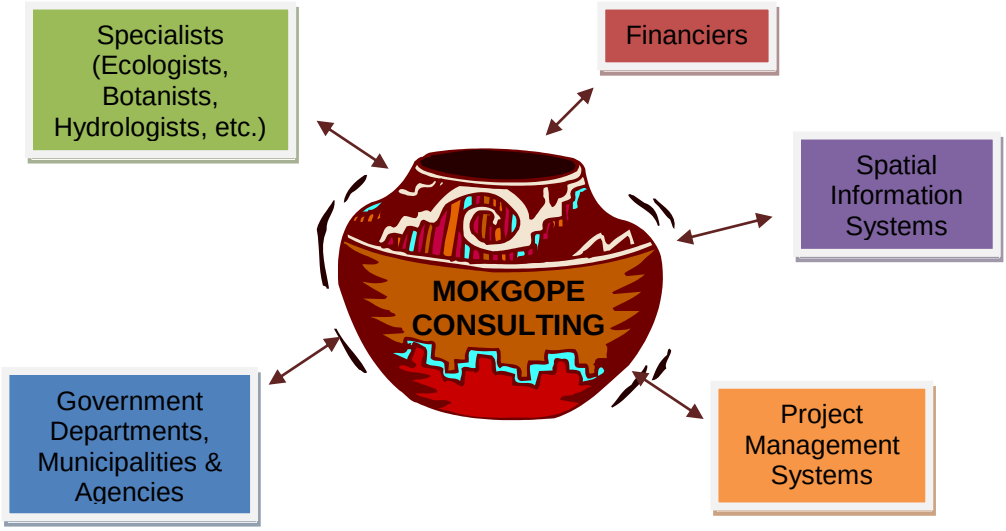


Figure 12: Network of strategic partners

This network has provided alternatives that give the company a strong 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.

The following core professionals are involved in the running and execution of the EIA for the proposed Kronos-Aries 765kV transmission power line project. Table 7 includes the specialists that were involved in the environmental assessment as well.

Table 6: Core EIA Project Team for Kronos-Aries project

TEAM MEMBER MOKGOPE CONSULTING	FUNCTION
Mpho Nenweli	Project Director: Responsible for managing the project, reviewing of specialist reports, Scoping, EIA and EMP reports. Also involved in the appointment of the project team and their management thereof.
Judith Fasheun	EIA Process: Responsible for compiling the Scoping and EIA 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.
Bruce Sebolai	Afrikaans Translator for Public Participation: Coordination of key stakeholder groups (farmers unions), Community liaison and appraisal of local municipalities.

Table 7: 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 mainly a vegetation assessor with more than 7 years' experience.	To conduct studies on the impact of the proposed transmission line and substations on local vegetation and ecosystems.
Fauna	James Harvey	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. 13 years of experience conducting avifaunal specialist studies for	To conduct studies on the impact of the proposed development on birds.

FIELD	NAME	EXPERIENCE	FUNCTION
		electrical infrastructure. SACNASP accredited	
Wetland	Antoinette Bootsma (Limosella Consulting)	BSc Hons (Botany, 2005), Currently registered for MSc, (Ecology). Short courses: (wetland delineation, legislation and rehabilitation, 2007); & (wetland soils, Terrasoil Science, 2009). Member: (SACNASP 400222-09). Wetland scientist - 5 years experience.	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)	Masters (Soil science), University of Pretoria in 1998. He is currently working as a senior soil scientist as the ARC- Institute for soil, climate and water. His specialty includes 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.	To conduct an agriculture impact assessment on the impact of the proposed development on the existing area.
Visual	Gerhard Griesel (Axis Landscape Architecture)	BSc Hons (Landscape Architecture, 2002). ML(Prof), 2003. (Cand. SACLAP – 20161). Years of experience: 2004 - current.	Undertaking the aesthetic impacts of the proposed transmission line and substations.
Ecotourism	Dereck Milburn (Integrated Ecotourism Solutions)	Dereck has been actively involved in the Ecotourism Industry for the last 10 years. He is an accredited assessor with the Tourism Grading Council and is an accredited Consultant with the Tourism Enterprise Partnership. He specializes in ecotourism planning and management on all levels and holds a N.Dip in Ecotourism Management along with industry qualifications required to be an effective Ecotourism Consultant.	To identify the economic and tourism impacts associated with the project, whether positive or negative

FIELD	NAME	EXPERIENCE	FUNCTION
Heritage	J. A. van Schalkwyk	Masters (Anthropology, 1985). D. Litt. et Phil (Anthropology, 1996). Member: Association for Southern African Professional Archaeologists, Anthropology Southern Africa and African Studies Association.	To conduct a heritage impact assessment on the proposed transmission line and substations.
Social	Golden Chalunda (African Development Economic Consultants)	MA (Economics), B.Soc.Sc (Economics & Computer Science). Economic Consultant specialising in Sector Analyses, Urban Economics, Trade & Investment and Economic Development. Golden Chalunda will carry out all background research, and analyse and forecast the socio-economic impacts of the proposed Eskom project on business, settlements, tourism, agriculture, agriculture industry and other land uses.	To conduct a social impact assessment on the social environment affected by the proposed development

For more information on the specialists please refer to their CV and or company profiles provided in Appendix B.

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 Appendix M, to inform the description of the various specialist assessments within the proposed power line 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. Within the area studied, much of the proposed routes are situated in areas that receive late summer or early autumn rainfall. Temperatures can reach 40°C in summer, while frost and temperatures below 0°C are recorded in winter. Whirl winds are common on hot days.

The Province comprise mainly of flat to undulating landscapes, while rocky outcrops and mountainous areas could be expected, especially within the Lower Gariep Broken Veld vegetation type (Mucina & Rutherford, 2006).

6.1.2 Geology and Soils

The power line corridors are for their greatest extent underlain by tillite and sedimentary rock, with some shale along Corridor 1 and Gneiss and Quartzite along Corridor 2 and 3 (Figure 13).

The soil class along the majority of the power line corridors is S2 which is shallow, free draining and highly erodible (Figure 14). Soil class S16 is also present but limited and corresponds greatly to the Lower Gariep Broken Veld vegetation type that comprise ultrametamorphic koppies (locally called black hills) with shallow soil forms including Mispah and Glenrosa (Mucina & Rutherford, 2006). Soils are mostly free draining.

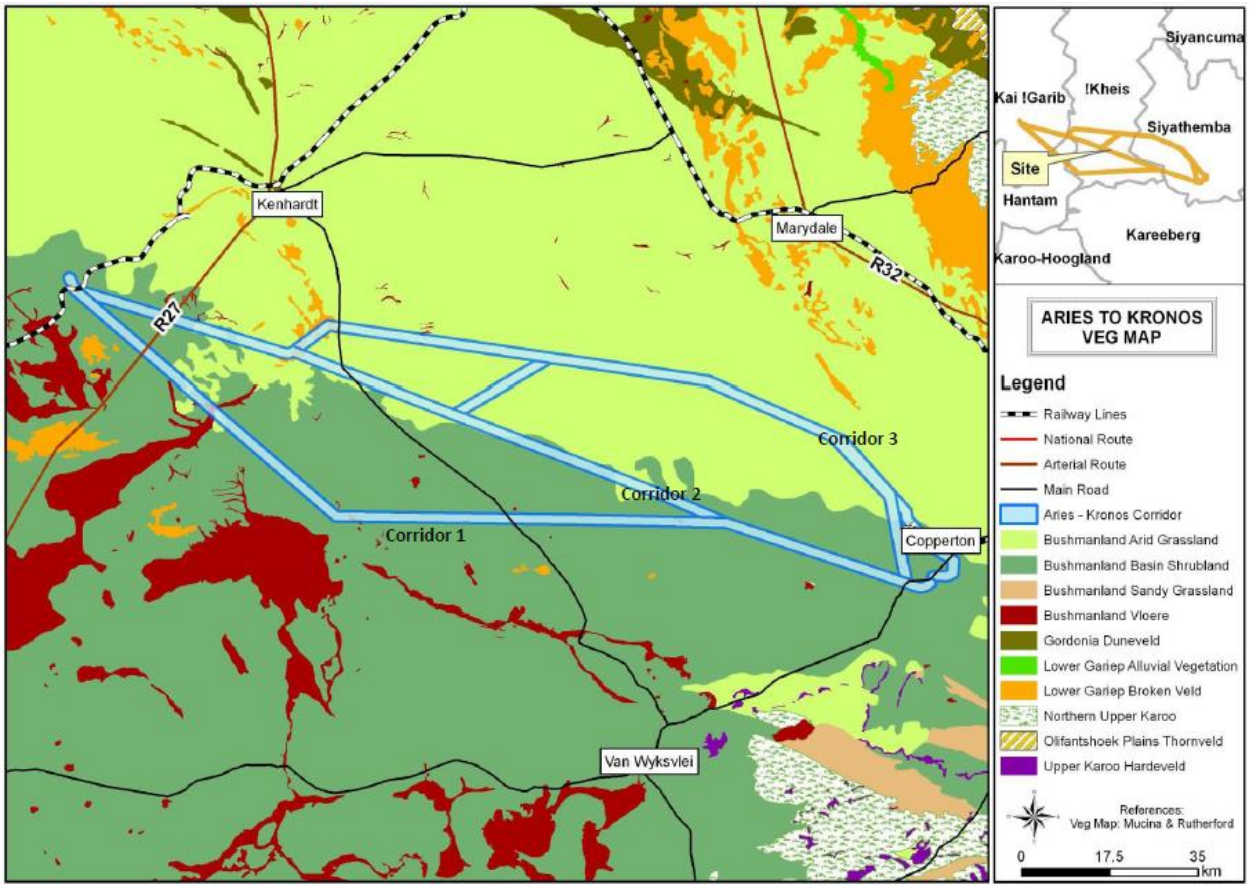


Figure 13: Geology underlying the proposed power line routes

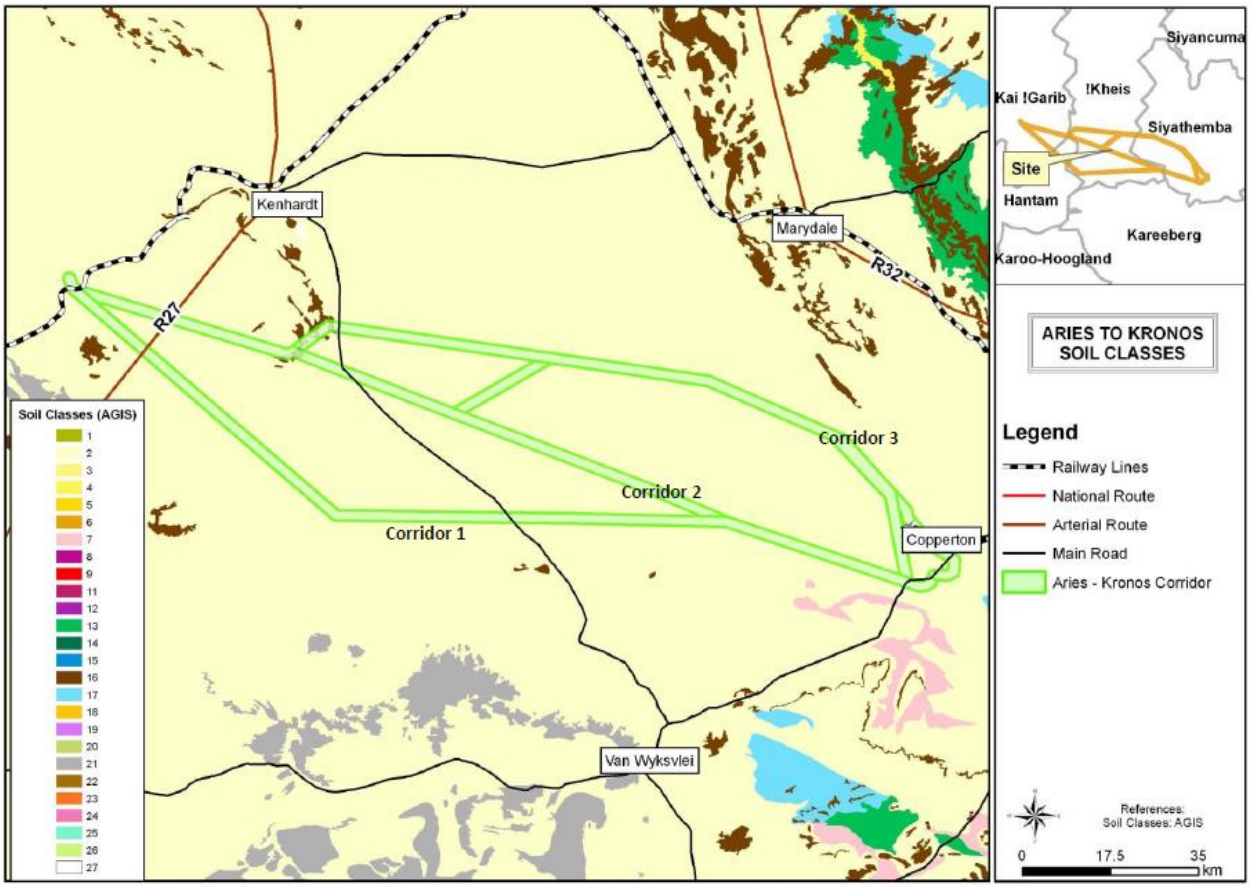


Figure 14: Soil classes underlying the proposed power line route alternatives

6.1.3 Watercourses

Surface water spatial layers such as the National Freshwater Ecosystems Priority Areas (NFEPA) Wetland Types for South Africa (SANBI, 2010) reflected the presence of several pans/wetlands and perennial and non-perennial rivers within the proposed power line corridors (Figure 15).

The pans are typically endorheic (inward draining) salt pans (also called “vloere”) occurring within the Bushmanland Basin as well as the broad riverbeds of the non-perennial Sak River (Mucina & Rutherford, 2006). The salt pans are characterised by depressions in the landscape containing temporary to permanent (less often) water. The pans could be dry for years between temporary flooding (Davies & Day 1986). This is mainly due to a high evaporation rate and a low precipitation rate in these parts of the country. The pan bottoms are usually formed by shales of the Ecca group which gives rise to vertic clays. Erosion in some places can be considerable. Corridor 2 will be in close proximity to the larger of these salt pans (i.e. Verneukpan).

Perennial and non-perennial rivers increase towards the western portions of the proposed corridors where extensive systems of intermittent river channels are evident (Figure 15). Main rivers include the Sak River, Lat River, Holboslaagte Brandholteloop and Keelafsnyleegte.

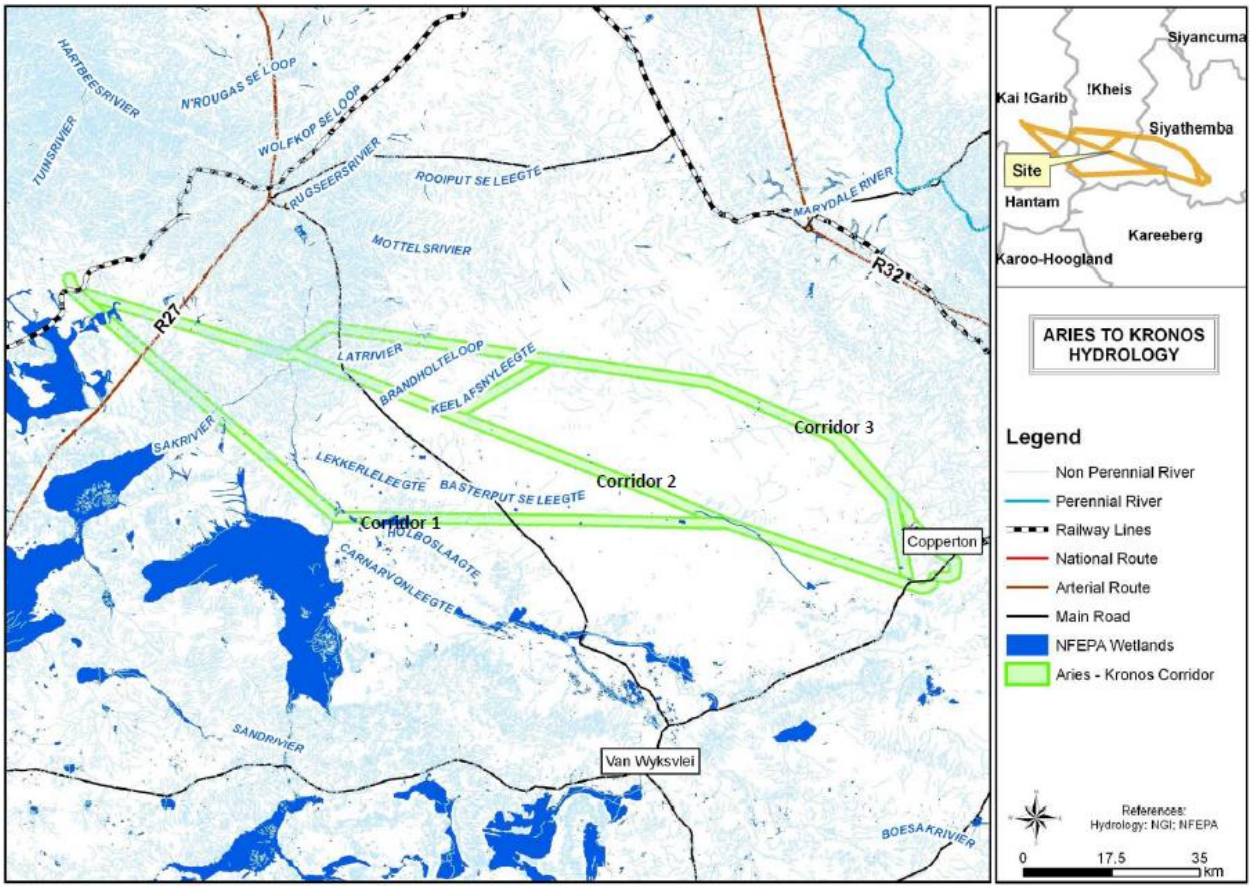


Figure 15: Water courses and water bodies along the proposed route alignments

Quaternary catchment

The power line corridors stretch over four (4) Quaternary Catchments (Table 8). As per Macfarlane *et al*, (2009) one of the most important aspects of climate affecting a wetland's vulnerability to altered water inputs is the ratio of Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET) (i.e. the average rainfall compared to the water lost due to the evapotranspiration that would potentially take place if sufficient water was available). As per Table 8, the ratio of Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET) in the catchments are very low and signifies that wetlands within this quaternary catchment are more dependent on water from their upstream catchment than on direct precipitation (Macfarlane, *et al*, 2009). Consequently, the wetlands are sensitive to changes in regional hydrology, particularly where their catchment becomes transformed and the water available to sustain them becomes redirected.

Table 8: Characteristics of the Quaternary Catchments relevant to the assessment of wetland health (Adapted from Schultze [1997])

Catchment	Mean Annual Precipitation MAP (mm)	Potential Evaporation PET (mm)	MAP: PET
D54D	168.0	2731.9	0.06
D54G	167.6	2755.9	0.06
D53A	151.1	2786.6	0.05
D57E	143.0	2767.1	0.05

6.2 BIODIVERSITY ENVIRONMENT

6.2.1 Vegetation

Biomes

The study area falls within the Nama-Karoo Biome of South Africa. The Nama-Karoo Biome comprises an arid-to semi-arid region characterized by summer rainfall that varies between 100 and 520mm per year. The majority of this Biome is covered by a lime-rich, weakly developed soil over rock and although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing and other disturbances that impact on the natural vegetation occurs (Mucina and Rutherford, 2006).

The dominant vegetation is a grassy, dwarf shrubland wherein grasses tend to be more common in depressions and grazing rapidly increases the relative abundance of shrubs. This Biome is subjected to alien invasive species such as *Opuntia aurantiaca* (Prickly Pear) and *Prosopis glandulosa* (Honey-Mesquite). Most of the land is used for grazing and under conditions of overgrazing, some indigenous species may proliferate and even result in bush encroachment e.g. *Rhigozum trichotomum* (Threethorn), *Chrysocoma ciliata* (Bitterbos) and *Acacia karroo* (Sweet Thorn).

The Nama-Karoo has a relatively low floristic diversity (Mucina & Rutherford, 2006) and a limited number of rare or threatened plant species are expected to occur.

The Nama-Karoo comprise a complex of plains dominated by low shrubs, mixed with grasses, succulents, geophytes (e.g. bulbs) and annual forbs (Mucina & Rutherford, 2006). Indigenous trees are mostly restricted to drainage lines or rocky outcrops.

Vegetation Types

A biome is made up of various vegetation Types, based largely on soil, topography and climate variations within the biomes. The proposed power line routes could impact on at least four vegetation types as geographically presented in Figure 16 (Mucina & Rutherford, 2006). None of these vegetation types are considered to be endangered as the remaining extent of natural vegetation (> 90%) is more than the conservation target (between 21% and 24%) for these vegetation unit.

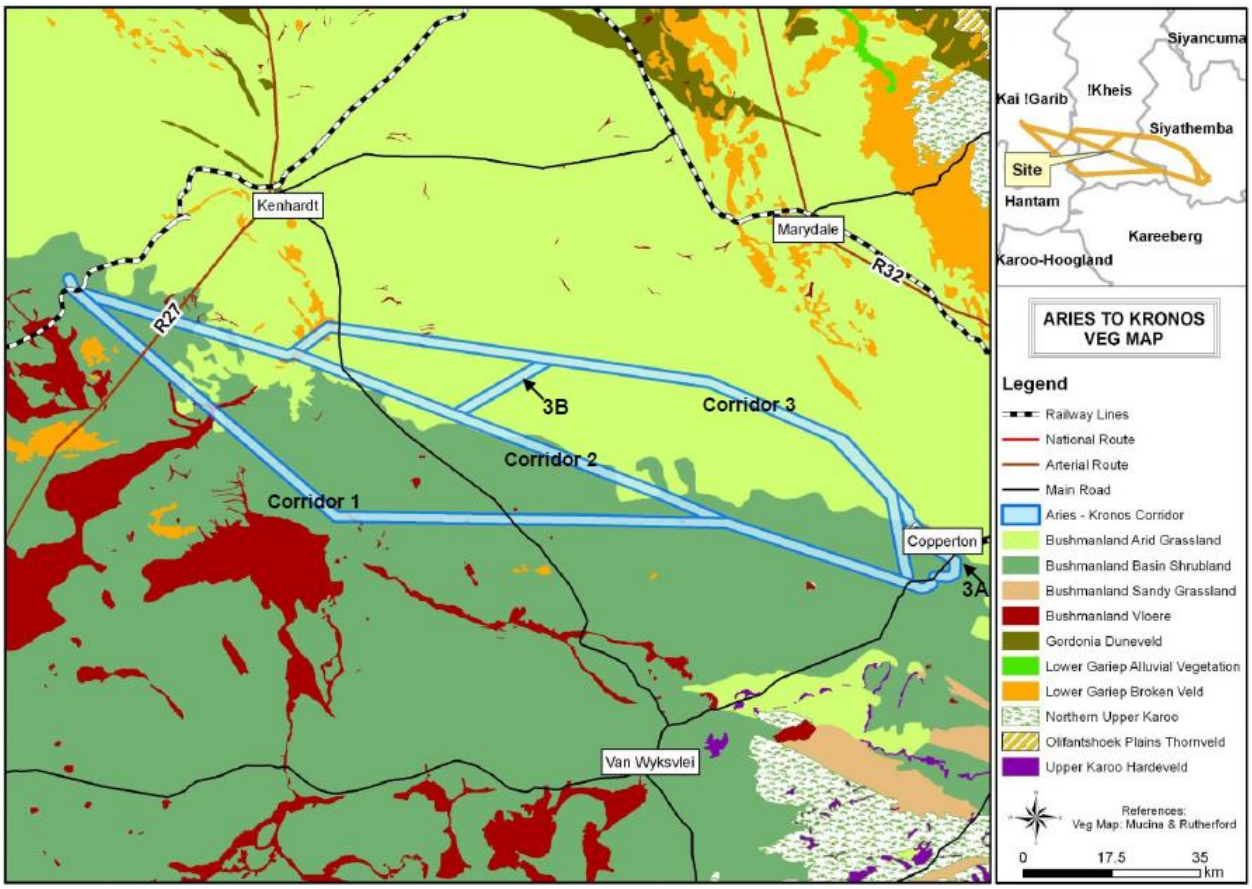


Figure 16: Vegetation types occurring along the proposed Kronos-Aries route alignments

Namakwa District Biodiversity Plan

Much of the area studied for the Kronos-Aries proposed power line route alternatives was situated within the Namakwa District. The Namakwa District Municipality (NDM) compiled a Biodiversity Sector Plan (Bioregional plan) in which areas of biodiversity concerns are mapped 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 biodiversity map indicates where Critical Biodiversity Areas (CBA's) occur. CBA's 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). 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
- CBA2 (including T2 and A2) which are near natural landscapes with limited disturbances which has intermediate irreplaceability with regards to reaching conservation targets

In addition, Ecological Support Areas (ESA's) that support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors) in the landscape are also mapped. ESA's are functional landscapes that are moderately disturbed but maintain basic functionality and connect CBA's.

The proposed Kronos-Aries power line route alternatives are in proximity to and could impact on CBA's (T2 – near natural landscapes) and traverse an ESA that is associated with the Sakrivier (Figure 17).

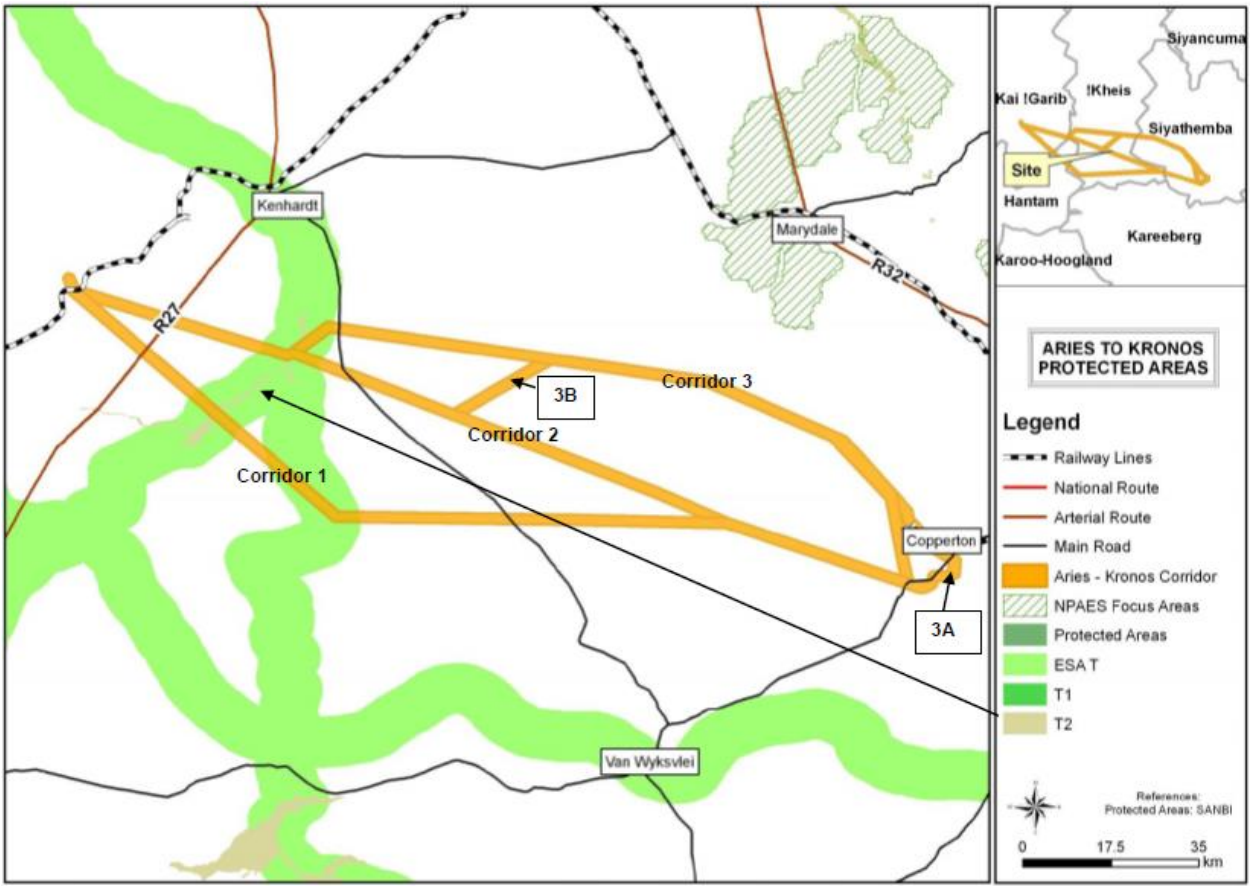


Figure 17: CBA's and ESA's along the proposed Kronos-Aries power line routes

- CBA's 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. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (e.g. tourism., game farming)
- ESA's are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

Table 9 below indicate land uses that are compatible within CBA's and ESA's as well as those that are not and those that can be undertaken with restrictions. As per Table 9, linear developments such as the proposed power line are restricted to compulsory.

Table 9: The Namakwa District matrix of recommended land-use activities in relations to the different CBA categories for the Namaqua District (adapted from Ferrar & Lotter 2007).

Type of Land Use	Protected Area or Conservation Area (PA/CA)	Critical Biodiversity Area 1 (CBA1)	Critical Biodiversity Area 2 (CBA2)	Ecological Support Areas (ESA)	Other Natural Areas (ONA)
Conservation Management	Y	Y	Y	Y	Y
Extensive Game Farming	Y	Y	Y	Y	Y
Extensive Livestock Production	R	Y	Y	Y	Y
Rural Recreational Development	R	N	R	R	Y
Rural (Communal) Settlement	N	N	N	R	Y
Dryland Crop Cultivation	N	N	N	R	Y
Intensive Animal Farming (e.g. Dairy, piggery's)	N	N	N	R	Y
Irrigated Crop Cultivation	N	N	N	R	Y
Urban & Business Development	N	N	N	N	R
Major/Extensive Development Projects	N	N	N	R	R
Linear Engineering Structures	N	**R**	**R**	**R**	R
Water Projects & Transfers	N	N	R	R	R
Underground Mining	N	N	R	R	Y
Surface Mining, Dumping & Dredging	N	N	N	R	R

Notes:
Y = YES, permitted and actively encouraged activity; N = NO, not permitted, actively discouraged activity; and, R = **R**ESTRICTED to compulsory, site-specific conditions & controls when unavoidable, not usually permitted.

6.2.2 Fauna

The broader study area is likely to support a moderate diversity of terrestrial vertebrate fauna. This includes a small number of mammals of conservation importance (Friedmann & Daly 2004). The fauna and vegetation studies that have been conducted have helped in identifying the species present in greater detail. They assessed the effect of the proposed development on ecological communities (especially sensitive species) and provided recommendations, including mitigation measures, where necessary (Fauna Report, Appendix M).

6.2.3 Avifauna

The possible impacts of the proposed power line on avifauna include the following: collision of birds (predominantly large terrestrial species) with overhead cables; destruction or alteration of bird habitat during construction and maintenance; disturbance of birds (particularly those breeding) during construction and maintenance of the power line; nesting of birds on the tower structures; and electrical faulting caused by birds perching, nesting or roosting on towers.

Collision of birds with overhead cables, in particular earth wires

Large terrestrial bird species likely to be found in this area include Ludwig's Bustard *Neotis ludwigii*, Secretary bird *Sagittarius serpentarius*, Kori Bustard *Ardeotis kori*, Northern Black Korhaan *Afrotis afraoides*, and Karoo Korhaan *Eupodotis vigorsii*. Of these species, conservation concern is greatest for the bustards, which are classified as 'Vulnerable' by Barnes (2000), and the Secretary bird (Near-threatened, Barnes 2000). These species are well known to be susceptible to collisions with power lines and the existing power lines in the broader area already cause significant numbers of bird collisions of these species. The specialist highlighted the necessity of day-night markings on the power lines.

Habitat destruction

This route will traverse an arid area, with low vegetation and open landscapes. Although there appear to be no protected areas, Important Bird Areas (BirdLife South Africa 2012) or large open water sources or rivers requiring special concern along this route, this type of open landscape is prime habitat for large terrestrial birds and raptors. Fortunately this habitat type is likely to be fairly uniform in the broader landscape and so the impact of the proposed power line through habitat destruction is anticipated to be low.

Disturbance of birds

Whether disturbance of birds occurs or not will need to be confirmed during the walk down of the selected route within the authorised corridor, but it could be a concern for large eagles breeding on the existing transmission lines (or natural substrate) in the area.

Electrical faulting caused by birds

For this interaction to occur requires either large birds such as eagles and vultures or large numbers of smaller birds regularly perching or roosting on the towers. The likelihood of this will be assessed in more detail during the EIA phase but at this stage it is considered unlikely to be a significant impact. The probability of electrical faulting caused by birds is low on a 765kV power line due to the large clearances between hardware, but is also dependant on the exact tower structure used and will be assessed further in the EIA phase.

Nesting of birds on tower structures

Of the large raptors, White-backed Vulture *Gyps africanus* could possibly visit the area occasionally, as could Lappet-faced Vulture *Torgos tracheliotos*. White-backed Vulture have been recorded nesting on transmission towers previously. Verreaux's Eagle *Aquila verreauxii* and Martial Eagle *Polemaetus bellicosus* are also likely to occur here and have proven elsewhere that they readily use power lines to perch and nest on.

Of the medium sized raptors, Black-chested Snake-Eagle *Circaetus pectoralis*, African Marsh-Harrier *Circus ranivorus,* Black Harrier *Circus maurus*, Southern Pale Chanting Goshawk *Melierax canorus*, Steppe Buzzard *Buteo vulpinus*, Jackal Buzzard *Buteo rufofuscus*, Booted Eagle *Aquila pennatus*, and Lanner Falcon *Falco biarmicus* are also likely to be recorded in the area. Certain of these species could nest on the power line.

Nesting of birds on the proposed power line could be viewed as a positive interaction since the power line provides nesting substrate in an area otherwise devoid of substrate (few trees). However it is likely that there are also negative consequences of birds breeding on power lines, such as increased exposure to collision with cables, and possible exposure to electromagnetic fields created by the electricity. There is also the consequence of nest management (trimming, relocation, removal) by Eskom staff being necessary if the birds choose to nest in the wrong areas on the towers.

6.2.4 Tourism and Land use

Tourism in the Study Area is limited to through-traffic between Cape Town and the northern parts of South Africa, as well as hunting and farm stays. Tourist attractions are centred in the towns. There are no statistics available about visitor numbers to this specific area, but given the low numbers for the Northern Cape in total, it is not expected to be substantial.

There are a number of bed and breakfast establishments, guesthouses and hunting lodges in the area. The establishments in town mostly attract overnight business visitors, while the farm and hunting lodges outside town mostly attract leisure visitors.

The hunting season runs from May to August, and this is the busiest time of the year for hunting lodges, however many hunting outfits have extended licenses that allow year-round hunting. School holidays are also busy periods because of an increase in through traffic between the Western Cape and other parts of the country.

Ecotourism in the Northern Cape is an increasing segment in the tourism industry. More and more tourists are being exposed to the hidden treasures which the province has to offer. A major attribute of the province is the solitude and open spaces which have not been impacted on by human development.

Potential Impacts on the tourism industry identified at this stage of the project include the following:

- Impacts on existing ecotourism products which have been developed based on an pristine natural environment;
- Impacts on management activities in proclaimed Protected Areas;
- Visual Impacts on visitors travelling along roads to their respective destinations;
- Impacts on sense of place for tourists;
- Potential lighting impacts on the experience of visitors. Especially bright lights of construction camps and nocturnal bird markers on the cables in the view shed of existing lodges in the area;
- Dust/noise pollution on tourism products during the construction phase; and

- Poaching of animals from hunting properties could increase during the construction phase.

These impacts were verified and assessed through site visits and interviews as the primary tools for gathering related information. Recommendations were provided accordingly in the Ecotourism Report, Appendix M.

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; and
- 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 18 below provides a summary illustration of the Initiation and Scoping Phase.

The EIA process has followed the framework outlined in Figure 19 below.

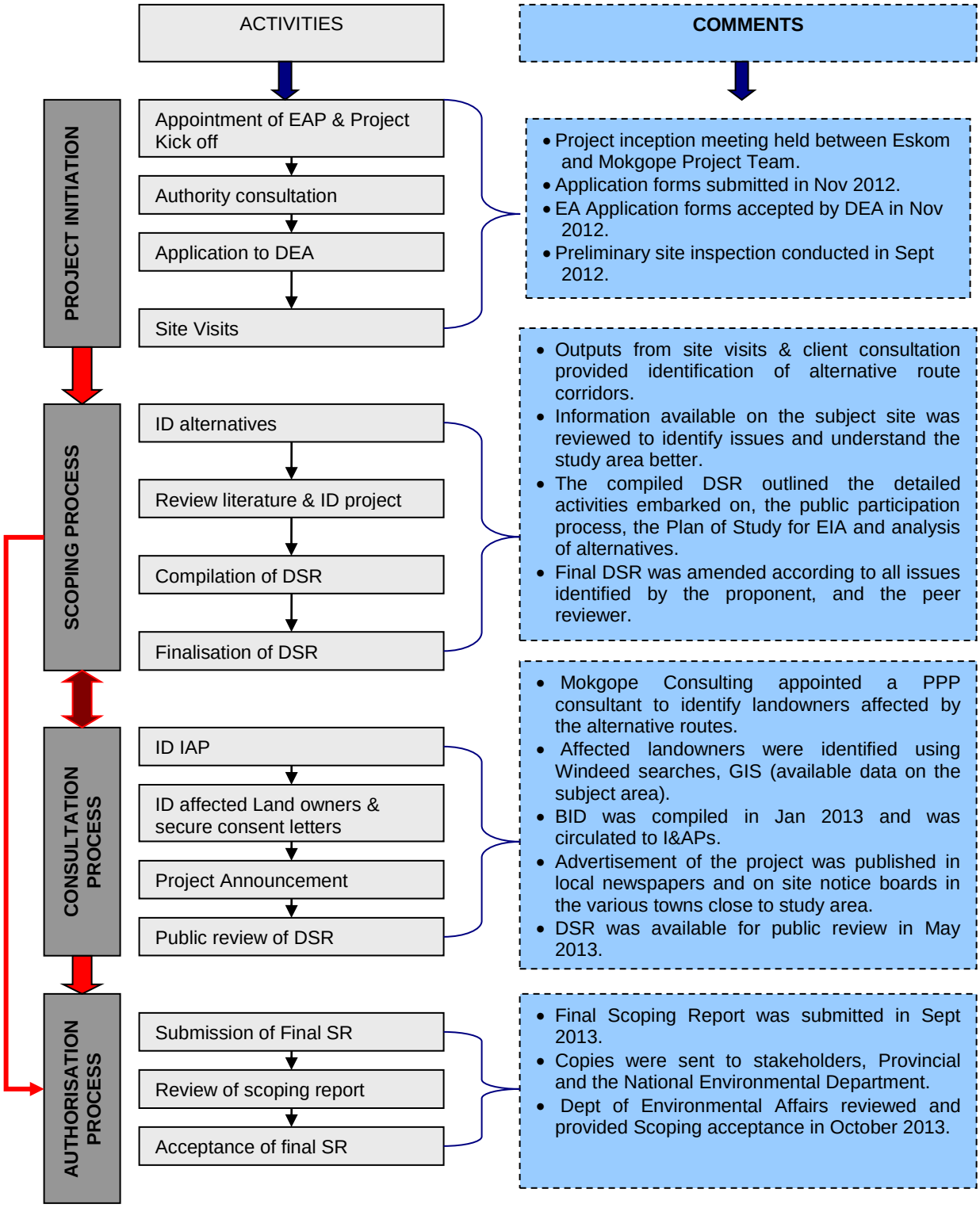


Figure 18: Initiation and Scoping Stage flow chart

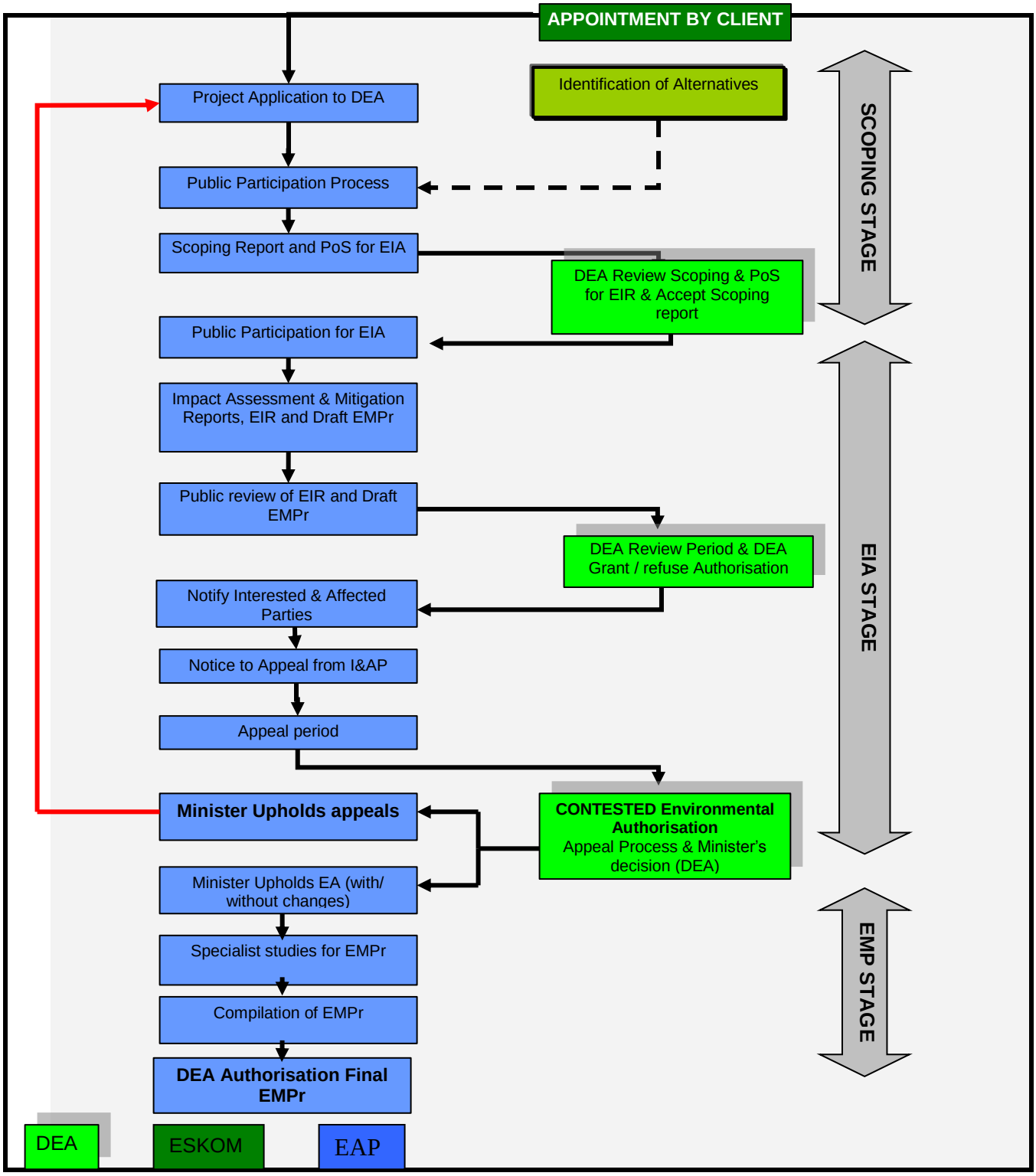


Figure 19: Outline of the EIA process flow

7.2 TECHNICAL PROCESS

For the Scoping phase, the following technical process was followed:

7.2.1 Pre-consultation meeting with client

On notification and receipt of the appointment letter from Eskom, a project inception meeting was held on 11 September 2012 between Eskom and Mokgope Consulting. During the 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 power line route corridors and substations upgrade.

7.2.2. Application for Authorisation in terms of GN No 543 of 2010

Application to undertake an EIA was submitted to DEA in November 2012. DEA acknowledged receipt and acceptance of the application by providing the project reference numbers.
NEAS Ref: DEA/EIA/0001557/2012 and DEA Ref: 14/12/16/3/3/2/440.

Northern Cape Department of Environment and Nature Conservation and Development (DENC) is regarded as the key commenting authority on this project and has been included on the list of Key stakeholders.

To secure approval for Scoping report from the authorities, Mokgope Consulting embarked on the following activities:

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

7.2.3 Landowner Consent

Eskom currently does not own any properties where the proposed transmission power line would be constructed. Therefore, registration of servitudes and land owners consent are required.

7.2.4 Site Inspection

Mokgope Consulting and Eskom undertook a preliminary flyover site inspection between the 18 and 20 September 2012. Site inspection photographs are provided in Appendix E.

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. This would require negotiations with the landowners for the construction of the transmission line;
- Identify alternatives for the power line 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 advertise the proposed transmission power line.

7.2.5 Identification of issues

To compile the Final Scoping Report, issues identified from I&APs, local municipalities, field visits and consultations with Eskom were considered. This information made it possible to identify additional specialist studies required. The studies were used in the assessment of potential impacts from the proposed development as well as identifying sensitive areas. The following specialist studies were conducted during the EIA phase:

Table 10: Specialist Studies and requirements

Specialist Studies	Requirements
Flora and Fauna	• Provide status of habitat and identification of all ecologically sensitive areas. • Identify 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 corridor 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 corridor to be assessed and the substations to be upgraded. • Provide recommendations for clearing of plants and acceptable heights. • Recommendation of the best alternative route corridor and technology to be used.
Avifauna	• Provide status of bird habitats in the area and any endangered species including their migration patterns. • Identify areas where bird interactions may play a major role. • Classify potential bird impacts, 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 corridor and technology to be used.
Wetland	• Identify wetlands and river crossings.

Specialist Studies	Requirements
Assessment	• 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 Assessment	• Identify agricultural activities taking place in the area and the significance to the local economy and livelihoods. • Identify 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. • Identify potential impacts of the proposed power line on the agricultural sector in the area. • Recommendation of the best alternative route corridor and technology.
Heritage Impact Assessment	• 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.
Visual Impact Assessment	• Identification and location of visual impact that may affect no-go areas. • Development of mitigation measures. • Recommendation of the best alternative routes and technology.
Socio-economic Impact Assessment	• 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 amongst others). • 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 corridor and technology.

Specialist Studies	Requirements
Ecotourism Assessment	• Identify pristine and relatively undisturbed natural areas. • Provide insight into the impact of human beings on the environment, and to foster a greater appreciation of our natural habitats. • Outline principles that minimize the negative aspects of conventional tourism on the environment and enhance the cultural integrity of local people.
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 EIR. 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.

The studies would also identify the potential positive impacts of the proposed development such as skills transfer to local communities and employment opportunities particularly during the construction phase.

7.2.6 Collection of Information

Mokgope Consulting gathered information on the potential impacts of the project from various stakeholders, registered Interested and Affected Parties (I&APs), local authorities and Eskom. Basic information was gathered from existing literature on the study area with inputs from various specialists. Information gathered was used to compile the DSR which was circulated back to the stakeholders for review before being submitted to the DEA for final review and acceptance.

7.2 7. Review of DSR

The DSR was prepared on the basis of information and issues identified during the Scoping Phase of EIA process. The DSR was amended based on public review and comments obtained from the I&APs (including the commenting authority and the Provincial Environmental Departments).

Findings of the assessments of the specialist studies were compiled during the EIR phase.

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 encourages 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 Appendix D.

7.3.2 Registration as Interested and Affected Parties

All I&APs were notified of the project through: site notice posters; telephonic conversations; fax; post; and or e-mailed, as well as advertising in regional and local newspapers. The following methodology was utilised to identify all major stakeholders and interested and affected parties:

- GIS data available;
- Deeds searches;
- Researching relevant local, provincial and / or national stakeholders; and
- Random identifications (such as farmers' associations) during site visits and public meetings.

7.3.3 Identification of I&APs

Criteria used to identify I&APs affected is as follows:

- Landowners within the 2km corridors of the proposed transmission line construction and substations upgrade;
- 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 were recorded on the I&AP Register. The first contact with these I&APs was in the form of a written notice accompanied by a BID. Notices were sent to all identified I&APs. The register of identified I&APs has been provided in Appendix F.

Please note that the I&APs Register was updated continuously at each stage of the EIA process.

7.3.4 Newspaper Adverts

Adverts were published in the following newspapers in English and Afrikaans:

- Noordkaap;
- Oewernuus;
- Gemsbok; and
- Volksblad.

These advertisements called for registration of I&APs on the project register and announced the public meetings that were held end of May 2013. The proof of advertisements is provided in Appendix H.

All respondents were registered and confirmation of registration was sent to them in their preferred medium of communication. For all I&APs who responded to the advert, a written acknowledgement letter accompanied by a BID was sent to them as confirmation of registration on the project database.

7.3.5 Site Notices

Site notices were posted early May 2013 at various focal points in the towns that are in close proximity to the proposed development. The site notice photographs are provided in Appendix G.

7.3.6 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 were included in the I&APs database and received project correspondence. Written notification of the project together with a BID was sent to the relevant stakeholders. Identified key stakeholders are registered in the I&APs Register provided in Appendix F.

7.3.7 Public Meetings

Public meetings were held in the areas that were convenient for affected parties and landowners to travel to. During the public participation meetings, presentations were conducted in English and translated in Afrikaans. The notification of the public meetings was advertised in local and regional newspapers.

The purpose of the meetings comprised the following:

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

The minutes and attendance registers of the public meetings are provided in Appendix I.

7.3.8 Public review of Draft Scoping Report

All stakeholders were given the opportunity to review and comment on the Draft Scoping Report (DSR) in accordance with Environmental Regulation 56. The report was placed in the Kenhardt library and Prieska library. Written notices were sent to stakeholders to inform them of the availability of the report. In addition, advertisements in English and Afrikaans were published in

the relevant newspapers. Copies of the Scoping Report were made available on www.mokgope.co.za.

All key stakeholders and I&APs were afforded 40 days to comment on the DSR. All I&APs were given an opportunity to forward their written comments, objections, inputs and queries within that period. This was done in order to assess and provide stakeholders and I&APs an opportunity to comment on the alternative route corridors to be recommended during the EIR Phase. All comments received from stakeholders and I&APs were acknowledged and contained in the "Comments and Response Report", which is provided in Appendix J. Stakeholders and I&APs were required to make all their comments to Mokgope Consulting.

The DSR was amended to include all issues and concerns raised by the public during the commenting period (May to June 2013). Some of the constraints identified during the public meetings were overlaid in the locality map. The amended Scoping Report was published as a Final Scoping Report and submitted to DEA for final review in September 2013. The Scoping Report was approved in October 2013 and formed the basis for further studies conducted during the EIA phase.

8. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

This section gives a brief outline of the process Mokgope Consulting followed when conducting the EIA process for the proposed 765kV transmission line and substations upgrade in the Northern Cape Province. During this phase, specialist studies were undertaken to assess all potential impacts that are significant. This process was also informed by the findings from the Scoping Phase.

8.1 PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

The EIA phase provides stakeholders and I&APs the opportunity to verify 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 were undertaken in the EIA phase. The specialist studies assessed impacts on both the social and the biophysical environment and identified ways that could mitigate the anticipated impacts.

The purpose of this EIR is therefore, to:

- Outline the manner in which the biophysical and socio-economic aspects of the environment may be affected by the proposed activity;
- 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 activity and identified alternatives;
- Recommend the least impacting alternative route corridor to DEA for final authorisation regarding the proposed project;
- Provide mitigation measures for all identified impacts on the feasible option; and
- Provide the I&APs with an opportunity to comment on the information provided in the report prior to final submission to the DEA.

8.2 PUBLIC PARTICIPATION

All stakeholders and registered I&APs were given the opportunity to review the draft EIR in accordance with the Environmental Regulation R543. The report was placed in public places that include amongst others the Kenhardt and Prieska libraries, as well as at municipal offices. Advertising in English and Afrikaans on the availability of the report at public places was done to inform stakeholders and registered I&APs. In addition, stakeholders and registered I&APs were informed of the availability of the report through letters and / or telephonically where necessary.

A 40 day commenting period was afforded to all stakeholders and I&APs, who were given an opportunity to forward their written comments, objections, inputs and queries within that period. This was done in order to assess and provide I&APs an opportunity to comment on the specialist studies, alternatives routes investigated, recommendations and conclusions.

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

8.2.1 Public Meetings

Public meetings were held during the EIA phase in July 2014. Similar to the Scoping phase meetings, the EIA public participation meetings were conducted in English and Afrikaans. Public participation meeting venues and dates were scheduled with considerations of the I&APs' convenience. These meetings provided local communities with an opportunity to critique, analyse and engage with the consultants on the outcome of the studies and proposed recommendations. Minutes of the meetings were compiled and circulated to all interested and affected people.

The public participation meetings were advertised in the local and regional newspapers (Noordkaap; Oewernuus; Gemsbok; and Volksblad) in English and Afrikaans to ensure that local stakeholders and I&APs were informed beforehand. Other forms of public notification were through site notices, which were posted at public areas in Kenhardt and Prieska.

8.3 AUTHORITY REVIEW OF THE ENVIRONMENTAL IMPACT REPORT

After comments from the public on the Amendment of this Draft EIR have been received and incorporated into the report, the final EIR will be submitted to the DEA for consideration. In addition, prior to submission to the authorities, the I&APs and stakeholders would be afforded at least 21 days to comment on the final EIR.

8.4 EIA TIMEFRAMES

The following work programme has been 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 11: Proposed Project Schedule

ACTIVITY	TIME FRAME	STATUS
Submit Application form to DEA	November 2012	**Complete**
Preliminary Site Visit – Site notice posting	March/April 2013	**Complete**
PPP for Scoping process	January-May 2013	**Complete**
Circulation of Draft Scoping Report	May/June 2013	**Complete**
SUBMISSION OF SCOPING REPORT TO DEA	September 2013	**Complete**
Approval of Scoping Report	October 2013	**Complete**
Circulation of draft EIR	June/July 2014	**Complete**
PPP for EIR phase	July 2014	**Complete**
Circulation of Amended draft EIR	Oct 2015	**In Progress**
SUBMISSION OF FINAL EIR TO DEA	December 2015	Pending
Anticipated Environmental Authorisation	February 2016	Pending
APPEAL PERIOD	March/April 2016	Pending
SITE WALK-DOWN & EMPR	Aug – Oct 2017	Pending

8.5 TERMS OF REFERENCE FOR SPECIALIST STUDIES

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

Please note: In July 2015, specialists were requested to conduct desktop assessments of the new deviations corridors. Therefore the specialists' reports were amended to include the deviations.

ToR: Fauna

A faunal assessment was done with the following aims:

- Review existing information;
- Conduct a site visit to visually assess the state of the site and determine potential impacts, with special emphasis on threatened and/or endangered species;
- Identify mitigation measures for any 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: Vegetation

A flora impact assessment was conducted with the following aims:

- Review existing literature and identification of red data species;
- Conduct a site visit to visually 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: Avifauna

The Avifauna study was done with the following aims:

- Review of existing literature;
- Conduct site visit to visually 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: Socio-economic Impacts

A socio-economic impact assessment was conducted with the following aims:

- Review existing literature on the study area;
- Conduct a desk top assessment of the study area and identify potential impacts (social and economic) and develop mitigation measures;
- 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, 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 site visit to visually assess the site and identify potential impacts (social and economic) and develop mitigation measures;
- 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, 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 visually 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 sensitive and/or no-go areas.

ToR: GIS

The GIS specialist compiled and / or amended maps required by the project team during the assessment process. This included providing all relevant and up to date metadata sets.

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 environment;
- 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 visually 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: Ecotourism

- Identification Tourism Status Quo;
- Identification of potential impacts;
- Significance Rating of Impacts;
- Identification of mitigation measures; and
- Compile a report indicating all findings, fatal flaws, recommendations and maps indicating sensitive and/or no-go areas.

8.6 METHODOLOGY FOR THE ASSESSMENT OF POTENTIAL IMPACTS

All impacts identified during Scoping and EIA stages of the study were classified in terms of their significance. The broad significance categories are as follows:

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

- **Mitigation level:** The degree to which the impact could be mitigated.

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

- The **Magnitude** of the impact: This was quantified as:
  - 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:** described the likelihood of impact occurring and was rated as follows:
  - Extremely remote: Which indicates that the impact will probably not happen;
  - Can Occur: there is a possibility of occurrence;
  - Unusual but Possible: Distinct 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 was 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 to which the impact is **reversible or the lost resource can be replaced.**

To determine the significance ranking, the following ranking (or similar) was applied to each impact identified:

The Significance of the impact is calculated as follows:

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

Table 12: Significance ranking (Savahanna Environmental, 2008)

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

RANKING	100-65	64-36	35-16	15-5	4-1
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

9. ENVIRONMENTAL IMPACT ASSESSMENTS AND MITIGATION MEASURES

The information provided in this section summarises findings of specialist reports. Please note that in July 2015 amendments to the specialist reports were produced to include new deviations to Corridor 3. The deviations were proposed to avoid ecologically sensitive areas and proposed / existing infrastructures where possible. The detailed amended reports of the various specialist assessments are provided in **Appendix M.**

9.1 VEGETATION ASSESSMENT

9.1.1 Key Findings

The vegetation within the proposed corridors comprised mostly of the Bushmanland Basin Shrubland and Bushmanland Arid Grassland (Mucina and Rutherford, 2006) (Figure 20). These vegetation types are similar with the dominant vegetation comprising arid grassland that varied from dense to sparse grassland to dwarf shrubveld (Botha and Becker, 2010). It was noted that overgrazing and other disturbance lead to bush encroachment by *Eriocephalus* and *Rhigozum* species. Due to the arid nature of much of the surveyed area, the vegetation was found to be mainly used for grazing. Where the veld was not overgrazed, the natural species composition was observed to still be largely intact and as expected based on the literature review. The proposed corridors were also observed to cross dry pans, “vloere”, perennial and non-perennial rivers as well as rocky outcrops and ridges with characteristic vegetation.

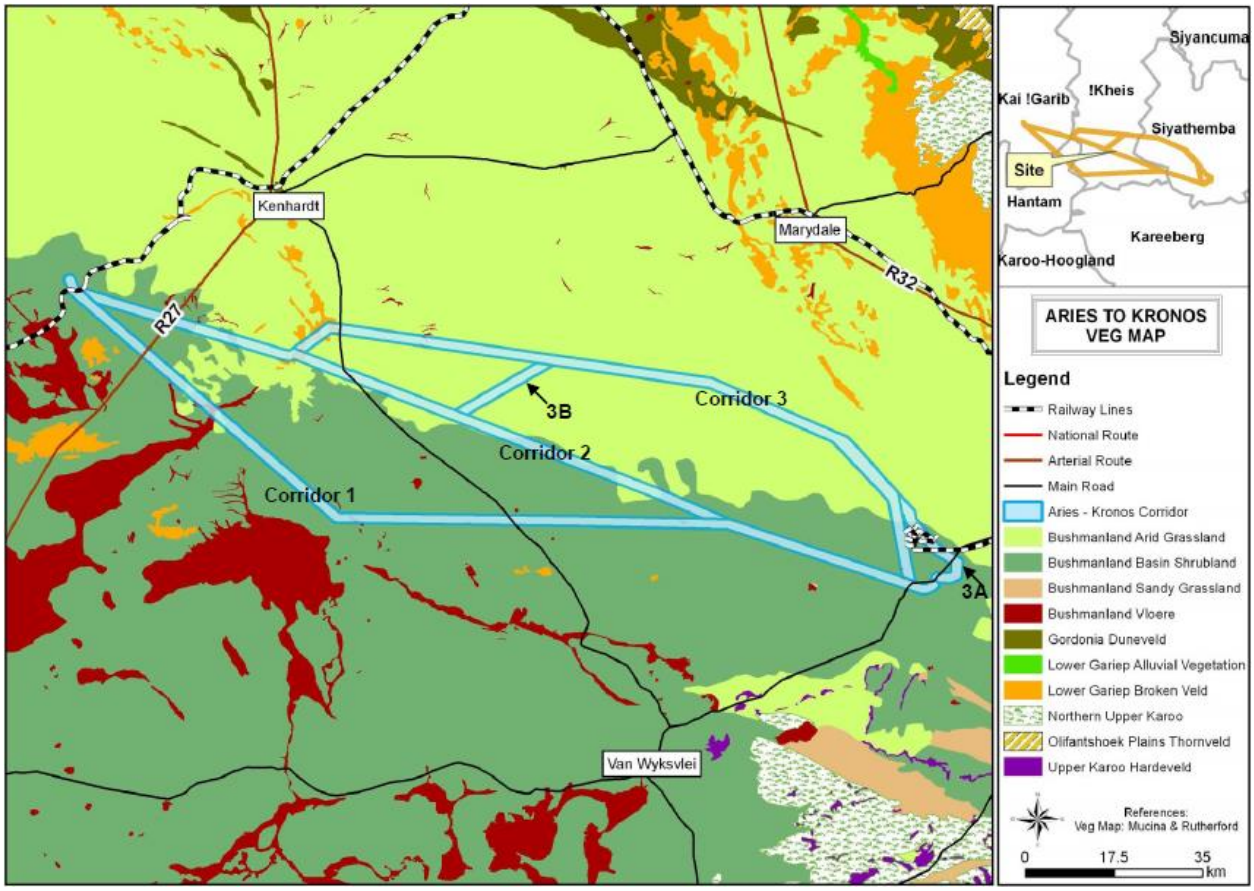


Figure 20: Vegetation types present along the proposed Kronos-Aries route corridors (Eyssell, 2015)

<u>Broad Vegetation Groupings</u>

The bulk of the vegetation along the proposed power line corridors and deviations was observed to be in a mostly natural state and was grouped as follows:

1. Mixed-Karoo vegetation;
2. Vegetation on hills (rocky outcrops and ridges);
3. Riparian vegetation (perennial and non-perennial); and
4. Salt pans and associated vegetation.

The vegetation groupings are discussed in the Vegetation Report provided in Appendix M and geographically represented below.

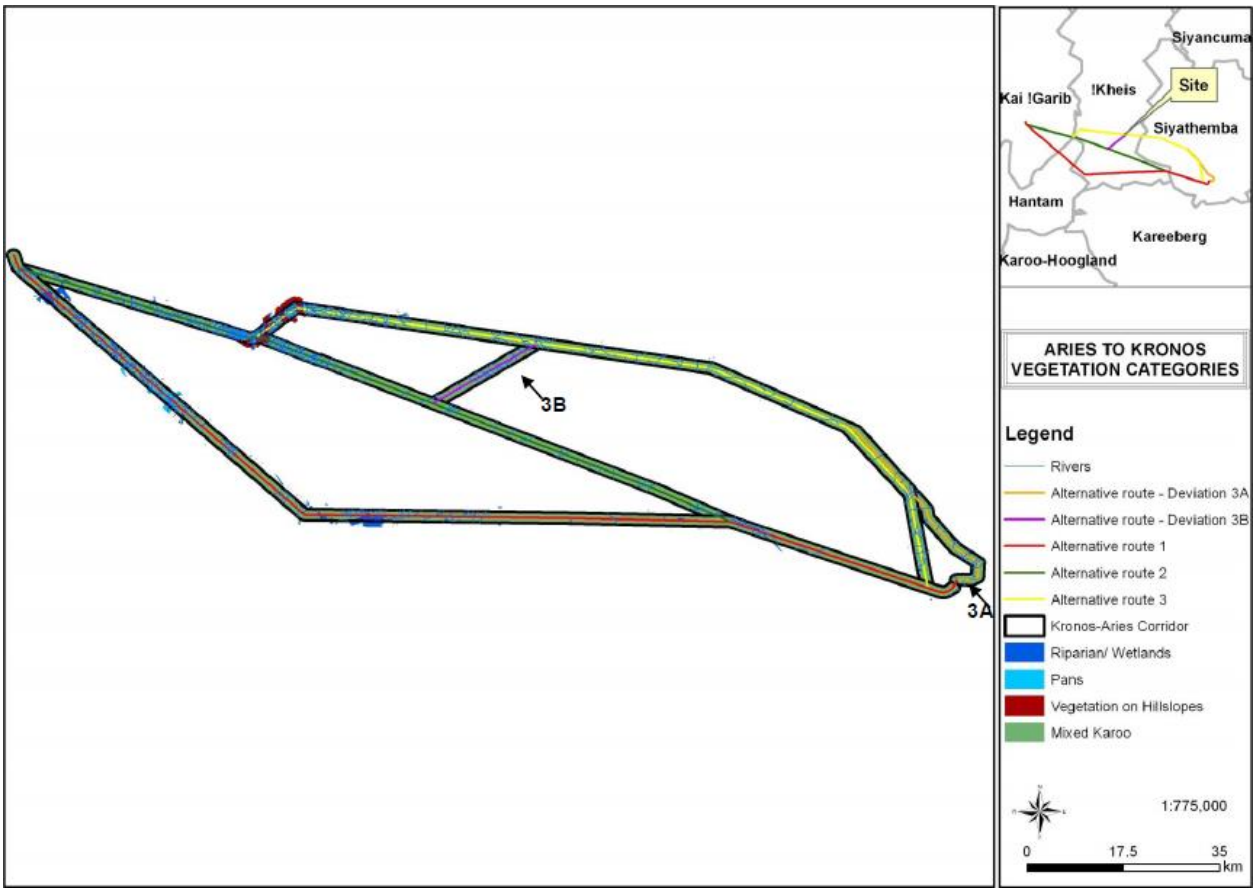


Figure 21: Broad Vegetation Groupings within the proposed Kronos-Aries Corridors (Eyssell, 2015)

Plants of Conservation Importance

At least 11 plant species of conservation concern could occur within the proposed corridors and their likelihood of occurring are given in Appendix D in the Vegetation Report. Of these plants, one vulnerable species (*Aloe dichotoma*) was confirmed to occur within the western extent of the corridors, while *Hoodia gordonii* was observed within Corridor 1 and therefore likely occurs within the others corridors too. In addition, a likelihood exist that at least 5 of the 11 species shortlisted, could occur within the corridors (see Appendix D provided in the Vegetation Report, Appendix M in this report).

Provincially Protected Plants

Provincially, a number of plants are protected by Schedule 1 and Schedule 2 of the Northern Cape Nature Conservation Act No.9 of 2009. The removal, destruction or pruning of these plants will require a permit from the relevant Provincial Conservation Authority.

Table 13 lists provincially protected species that were confirmed to occur or could likely occur along the power line corridors. The species identified at the time of the field survey are printed in **bold.** However, it is thought that during favourable conditions, more protected plant species may be identified to occur along the power line route alternatives. Table 13 indicates that the

most protected plant species that could potentially occur within the corridors is expected to occur on the rocky outcrops and ridges and within the Mixed-Karoo vegetation.

Table 13: List of protected plants that could potentially occur and suitable habitat

Specie	Mixed Karoo	Hills	Riparian	Pans
Acacia erioloba*				
All Aloe's	x	x		
• ***Aloe dichotoma***	x			
Anacampseros species	x	x		
Ammocharis coranica	x			
Androcymbium albomarginatum x		x		
Avonia ustulata and all other species	x			
Apocynaceae family, incl stapeliads	x	x		
Boscia albitrunca*	x	x		
Boscia foetida	x			
Crassula barbata subsp *broomii*		x		
All *Colchicum* species	x	x		
Commiphora species		x		
• ***Commiphora gracilifrontdosa***		x		
Crinum bulbispermum			x	
***Delosperma* species**	x	x		
All *Diascia* species				
All *Euphorbia* species				
• ***Euphorbia avasmontana***		x		
Gnaphalium simii				x
Gymnosporia szylowiczii	x			
Gnidia leipoldtii		x		
All Haemanthus species				
Harpagophytum procumbens	x	x		
***Harveya* species**	x			
Hoodia gordonii				
All *Jamesbrittenia* species				
Lachenalia auriolae	x			
Lithops aucampiae				
Lithops hookeri	x			
***Ledebouria* species**	x			
Manulea deserticola	x			
Mestoklema tuberosum	x			
Moraea species	x			
Nymandia capensis		x		
All *Nemesia* species				
All *Ornithogalum* species		x		
All *Oxalis* species				
Ruschia intricata	x			
Sutherlandia fructescens	x			
Tritonia laxifolia	x			
* Trees also protected nationally				
	21	**16**	**1**	**1**

Also a nationally protected tree

Alien Invasive Plants

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 be controlled and eradicated by means of an eradication and monitoring programme.

Below is a brief explanation of the three categories of problem plants in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the study site is listed in Appendix C in the Vegetation Report, Appendix M in this report.

The main invasive species identified in the study area were:

- *Prosopsis glandulosa* (Honey Mesquite) within drainage lines and riparian areas. This tree is currently a Category 2 but proposed Category 1b in the NEMBA[2] list.
- *Tamarix* species, which is proposed Category 1 and 1b invasive weeds, also occurred in drainage lines and in the Mixed-Karoo vegetation.
- Category 1 and 2 species should be removed and re-infestation monitored as part of an alien invasive monitoring plan for the implemented route alternative.

Vegetation Sensitivity

The vegetation sensitivity assessment aimed to identify whether the broad vegetation groupings within the area studied is of conservation concern and thus sensitive to linear infrastructure development.

To determine the sensitivity of the vegetation observed along the proposed power line corridors, weighting scores as listed in Table 14 below were applied (also see the vegetation sensitivity rating in Appendix B, in the Vegetation Report, Appendix M in this report). The vegetation with

[2] This was a draft NEMBA list at the time of the initial studies.

the lowest score represents the vegetation that has the least / limited sensitivity to the development of a power line.

Table 14: Weighting Scores

Scoring	13-18	7-12	0-6
Sensitivity	High	Medium	Low

The sensitivity analysis results of the above assessment were classified as per Table 15 below.

Table 15: Scoring of vegetation that occurred within the study area (Eyssell, 2013)

Broad vegetation community	Conservation Status of regional Vegetation	Predominant state	Legislated protection	Plants of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18	Sensitivity
Mixed-Karoo	0	2	0	3'	2	2	9	medium
Vegetation on hills	0	3	2*	3	3	3	14	high
Riparian vegetation	0	2	3	2	3	3	13	high
Pan / "Vloer" vegetation	0	2	3~	2	3	3	13	high

' Presence of *A dichotoma*
*as per Gauteng provincial guidelines used here as best practise
~ pans are classified as wetlands which is nationally protected

From Table 15, it is deduced that the hydrological features (pans, potential wetlands and riparian areas) as well as hills within the proposed power line corridors are the most sensitive to development, followed by the Mixed-Karoo vegetation. The resultant vegetation sensitivities are geographically represented in Figure 22.

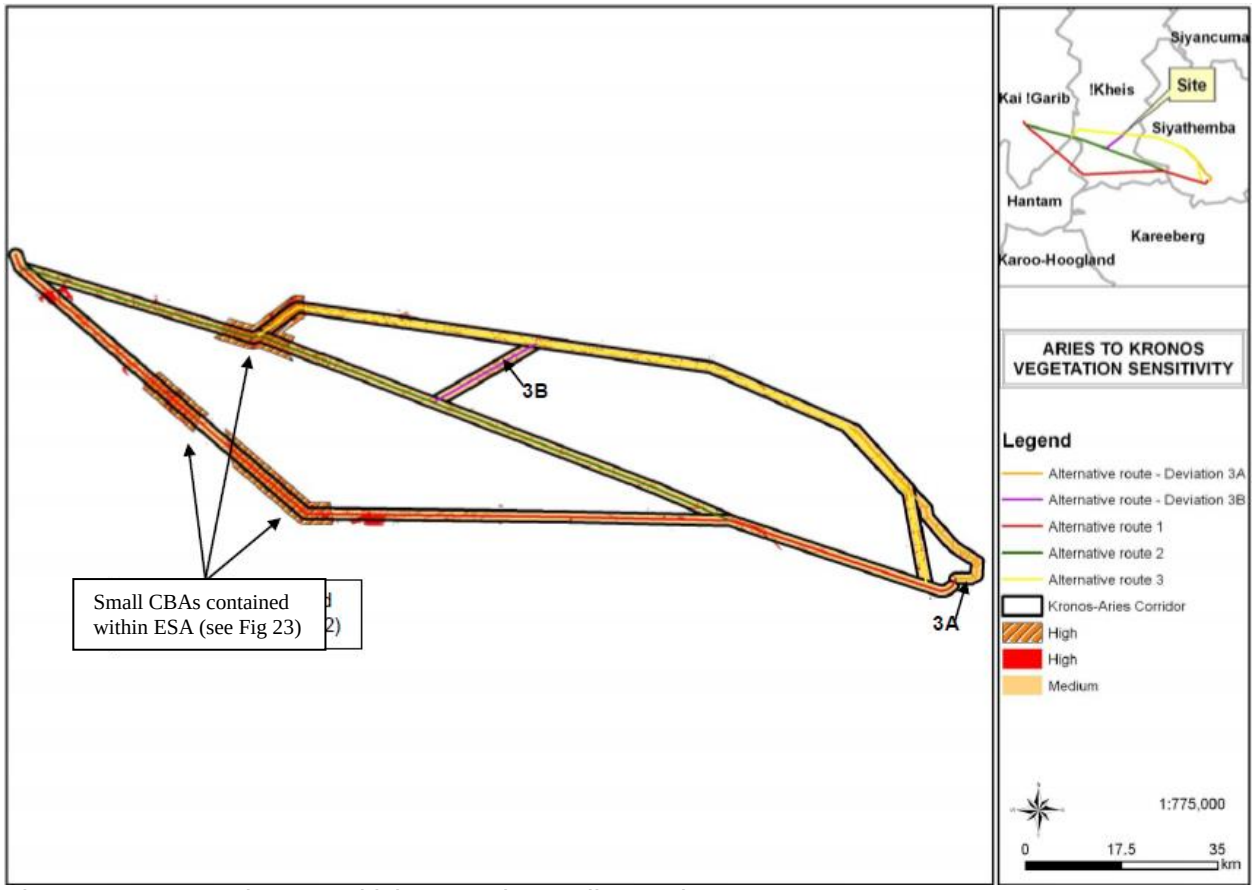


Figure 22: Vegetation Sensitivity Map (Eyssell, 2013)

Namakwa CBAs and ESAs

The focus areas for the protected areas expansion project, was classified as being of high sensitivity to power line developments. In addition, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) as per the Namakwa Biodiversity Sector Plan, were also highlighted as sensitive. Although ESA's are not essential for meeting biodiversity representation thresholds, they nevertheless play an important role in supporting the ecological functioning of CBA's and in delivering ecosystem services (Desmet & Marsh, 2007). In addition, linear infrastructure is not a supported land use in an ESA or CBA, but could be allowed to proceed with specific measures in place.

All three of the proposed Kronos-Aries power line corridors (excluding the Deviations 3A and 3B) will traverse over small sections of Critically Biodiversity Areas (CBAs) (ranked as T2)[3] and may thus have an impact thereon. In addition, the corridors traverse an Ecological Support

[3] 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
- CBA2 (including T2 and A2) which are near natural landscapes with limited disturbances which has intermediate irreplaceability with regards to reaching conservation targets

Areas (ESA)[4]. Both the CBA and the ESA are associated with the Hartbees River, catchments of the Bushmanland Vloere (pans) and Lower Gariep Broken Veld (koppies/mountains) (Figure 23).

No NPAES focus areas are situated along or in close proximity to the proposed Kronos-Aries powerline corridor alternatives. However, a Gariep focus area is situated approximately 20km north of the proposed route, around the town of Marydale (Figure 23).

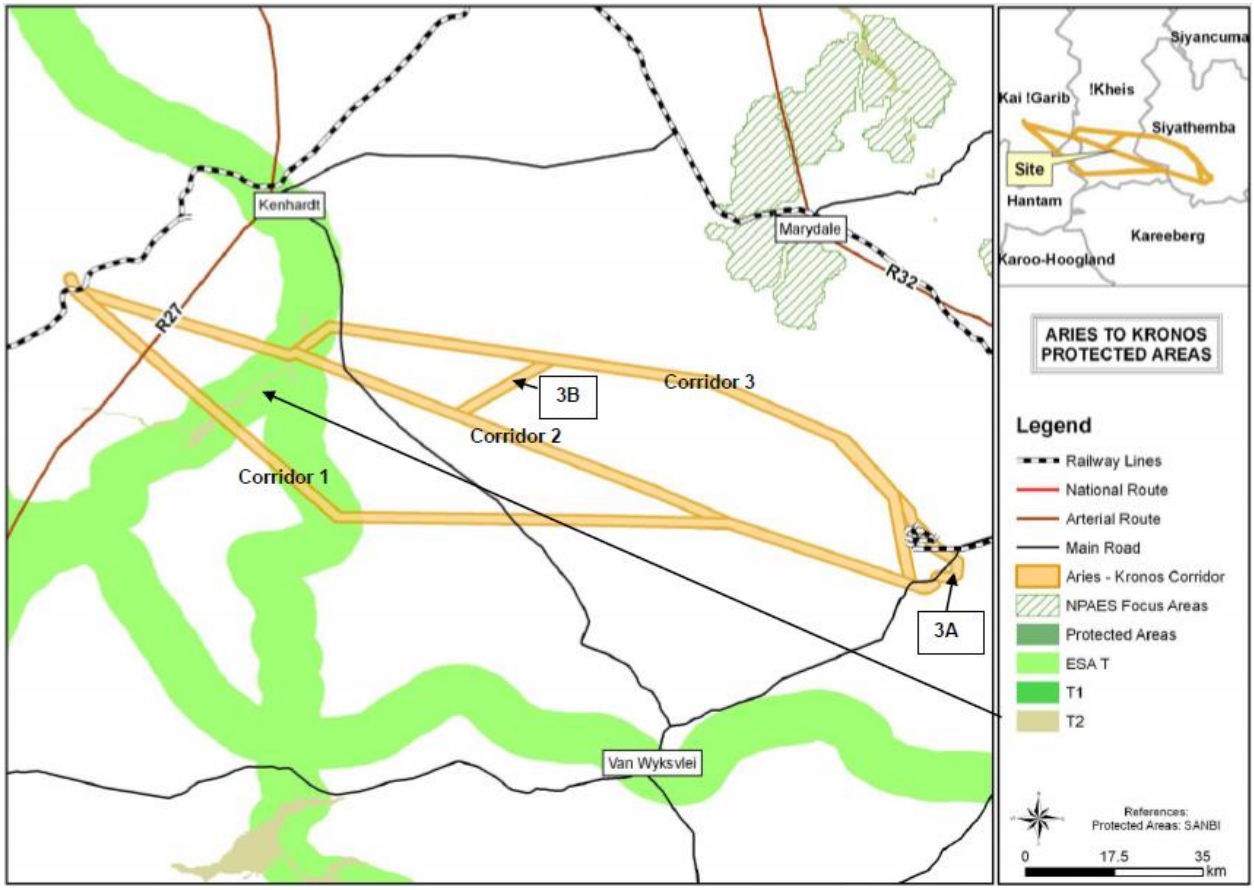


Figure 23: CBAs and ESA along the proposed Kronos-Aries route corridors (Eyssell, 2015)

Preferred Corridors

The corridors were found to be similar in the distribution of high sensitivity vegetation along the routes. However, Corridor 2 and the initial 40km of Corridor 3 from Aries substation include an existing distribution line and thus access roads. All three corridors include sensitive vegetation as well as have *Aloe dichotoma* (Vulnerable) and *Hoodia gordonii* (DD) present. Also, all three corridors will traverse through an ESA as set out in the Namakwa Biodiversity Sector Plan, as well as impact on a small area of a CBA (ranked T1). However, Corridor 1 will impact on the largest extent of ESAs.

[4] Support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors) in the landscape.

The deviations proposed in July 2015 were note ground-truthed and therefore not included in this rating system. The site preference rating concluded that the corridors are similar in their sensitivities towards the development. However, Corridor 2 already contains an existing powerline and it is thus assumed that this route will require the minimum disturbances to vegetation as access roads already exist. If Corridor 3 is amended to link to Corridor 2 as proposed by *deviation 3B,* then Corridor 3 will make more use of the existing line and access roads, which increases its suitability from a vegetation perspective. Deviation 3A will lengthen the Corridor and thus likely increase the potential impacts. All three corridors (except the deviations) traverse an ESA area, as well as small CBA areas. However, Corridor 1 traverses the largest section of CBAs (Table 16).

From the calculations in Table 16, Corridor 2 was confirmed to have the least number of sensitivities per hectare of corridor, especially if taking into account that a power line already exists along this corridor. Deviation 3B enables corridor 3 to traverse a smaller section of ESAs and CBAs and less hilly areas and therefore reduces the overall percentage of sensitivity. Therefore, Corridor 3, including all the proposed deviations (3A and 3B), and Corridor 3 with only Deviation 3B, provide feasible second options.

Table 16: Percentage (in hectare) of a corridor that comprises of high sensitivity

	Corridor 1	**Corridor 2**	**Corridor 3**	**Corridor 3 with ALL deviations**	**Deviation 3A, plus rest of 3**	**Deviation 3B, plus rest of 3**
% High sensitivity (Ha)	5880.84	5985.95	7981.12	7154.59	8066.99	7086.48
CBA (not included in % calculation)	6249.49	2316.12	3157.23	2316.12	3157.23	2316.12
Corridor size (Ha)	33679.87	31847.69	33476.11	35697.12	34758.34	35110.83
% of corridor within high sensitivity	**17.46**	**18.80**	**23.84**	**20.04**	**23.21**	**20.18**
% of corridor within CBA	**18.55**	**7.27**	**9.43**	**6.49**	**9.08**	**6.60**
TOTAL of %Sens	36.01	**26.07**	33.27	**26.53**	32.29	**26.78**

Table 17 below indicates the preferred corridor and summary of findings that influenced the route preference.

Table 17: Route Corridor Comparisons and Preference (Eyssell, 2015)

Route	Sensitive Vegetation	Order Of Preference
Corridor 1	• The topography along most of the corridor is flat. However, in the western extent, more hills were observed • This corridor does not impact on protected areas or focus areas for protected areas expansion • The drainage line(s) in this corridor north of Verneukpan plays a role in the health and functioning of this pan • The Vulnerable *Aloe dichotoma* was confirmed to occur in the western extent of this corridor (south of Kenhardt towards the Aries substation) • Confirmed occurrence of a nationally protected tree, within this route corridor (*Boscia albitrunca)* • Confirmed occurrence of *Hoodia gordonii* • Traverse a number of inselbergs, koppies and outcrops • Traverse through two ESA's as well as a T1 CBA (Figure 23)	**Third option**
Corridor 2	• An existing distribution line is situated within this corridor • The topography along most of the corridor is flat. However, in the western extent, more hills were observed • This corridor does not impact on protected areas or focus areas for protected areas expansion • The Vulnerable *Aloe dichotoma* was confirmed to occur in the western extent of this corridor (south of Kenhardt towards the Aries substation) • Confirmed occurrence of a nationally protected tree, within this route corridor (*Boscia albitrunca)* • Confirmed occurrence of *Hoodia gordonii* • Traverse a number of inselbergs, koppies and outcrops • Traverse through two ESA's as well as a T1 CBA (Figure 23)	**First option**
Corridor 3	• For the first approximate 40km from Aries, this corridor includes an existing distribution line • The topography along most of the corridor is flat. However, in the western extent, more hills were observed • This corridor does not impact on protected areas or focus areas for protected areas expansion • The Vulnerable *Aloe dichotoma* was confirmed to	Corridor 3 with all deviations or Corridor 3 with Deviation 3B **Second option**

Route	Sensitive Vegetation	Order Of Preference
	occur in the western extent of this corridor (south of Kenhardt towards the Aries substation) • Confirmed occurrence of a nationally protected tree, within this route corridor (*Boscia albitrunca)* • Highly likely that *Hoodia gordonii* occurs within this corridor • Traverse the Lower Gariep Broken Veld Vegetation as well as a number of other smaller inselbergs, koppies and ridges • Traverse through an ESA's as well as a T1 CBA (Figure 23)	

9.1.2 Vegetation Impacts and Mitigations

Any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. To limit these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

The possible impacts, as described below, were assessed based on the Significance Rating Matrix provided in **Section 8.6** of this report.

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 18: Analysis of the Significance of Potential Vegetation Impacts (Kronos to Aries – for all corridors and deviations) (Eyssell,2013)

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
CONSTRUCTION PHASE	Destruction of natural vegetation	• Clearing of vegetation for tower erection, access roads, and construction camps • Damage to vegetation in access roads and construction area • Illegal disposal and dumping of construction material such as cement or oil as well as maintenance materials during construction; • Storage of metal structures within vegetation	3 2	3 3	2 1	2 2	5 4	50 32	High	Moderate
	Exposure of the soil to erosion and subsequent sedimentation of perennial and nonperennial rivers	• Removal of vegetation without proper rehabilitation	3 2	3 3	2 2	2 2	3 2 (if rehabilitated asap)	30 27	Moderate	Moderate
	Possible destruction of plants of conservation concern	• Construction activity where these plants potentially occur	3 2 (if all species can be avoided or removed & used for rehabilitation)	3 3	2 2	2 2	3 3	30 27	Moderate	Moderate
	Spread of alien	• Contaminated construction	3	3	3	3	3	36	High	Moderate

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	invasive vegetation	vehicles and tools; and • Alien invasive species spread from current infestation into disturbed soils	2	3	2	2	3	27		
	Positive impact by removing alien invasive plants from the substation and power line route footprint, although care must be taken not to remove all vegetation at once, especially within the rainy season (could result in soil erosion and soil loss).	• Removing of existing invasive alien vegetation in areas proposed for the development and within servitudes	0	0	0	0	0	0	Positive impact	
	Disturbance to nonperennial and perennial rivers and loss of stabilising vegetation	• Construction activities within the buffer areas linear development such as access roads through the non-perennial rivers	3 2	3 3	2 2	3 2	3 3	33 27	Moderate	Moderate
	Soil compaction	• The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation and inhibit re-vegetation.	3 2	3 3	2 2	3 3	4 2	44 20	High	Moderate
OPERATIONAL PHASE	Bush encroachment which will reduce species diversity	• • Removal of vegetation from servitudes, access roads, the footprint of alignment, as well as for substation upgrades could lead to bush encroachment by trees such as *Acacia melifera* and the	3 2	3 3	2 1 (if timeous action is	2 2 if timeous action is taken)	3 3	30 24	Moderate	Moderate

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
		shrub *Rhigozum trichotomum*			taken)					
	Destruction of natural vegetation	• Maintenance vehicles driving within natural vegetation • Altered fire regime-natural fire prevented.	3 2	3 3	2 1	2 2	3 3	30 24	Moderate	Moderate
	Possible increase in exotic vegetation	• Alien vegetation spreading from existing infestation into disturbed soil, especially in the absence of successful rehabilitation.	3 2	3 3	3 2	3 2	3 3	36 27	High	Moderate

Table 19: Mitigation Measures (Vegetation)

Impact	Mitigation Measures
Construction Phase	
Destruction of natural vegetation: The construction of the power line route would inevitably require the removal of vegetation for the purpose of access roads, servitudes and the pylon footprint. Areas where structures are stored would flatten vegetation that could be detrimental to the persistence of the vegetation. In addition, the illegal disposal of construction material such as oil, cement etc. could destroy natural vegetation. Where vegetation was removed, salt tends to build up on the soil surface through evapo-transpiration of rainwater. Saltiness, dryness and the rapid movement of water over the soil will result in erosion as well as mineral capping (brittle crust of fine clay that forms on the surface of bare, pulverised soils)	• Corridor 2 coincides with an existing power line and this corridor would thus concentrate the impact, instead of spreading it our over the landscape. In addition, Corridor 2 is likely to be able to make use of the existing servitude and access roads, minimising the impact on natural vegetation; • At the time of the field survey, the R27 road between Kenhardt and Brandvlei was being upgraded. Road construction camps were noted in proximity to the Corridors and could be re-used for the construction of the power line, in order to reduce impact on natural vegetation; • Sensitive areas / vegetation such as CBAs, hills, pans and riparian areas within the final corridor should be avoided by the actual route alignment. In most corridors, there is enough space to circumvent hills and to span pans and riparian areas. Where this cannot be done in a corridor, another one of the alternative corridors should be investigated.
Exposure to Erosion Much of the soils within the corridors comprise fine	• The route impacting mostly on disturbed areas should take preference; • Do not allow erosion to develop on a large scale before taking action;

Impact	Mitigation Measures
sand and clay and the area is prone to erosion in the event of good rainfall. Furthermore, the removal of surface vegetation will expose the soils, which in rainy events could cause sedimentation of watercourses. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive plants, or unpalatable shrubs that reduce grazing capacity, can spread easily into these eroded soil. Raindrops on bare soils disperses the clay fraction in the soil that settles into or block the soil pores on the surface, sealing it so that water cannot penetrate (Esler, *et al,* 2006).	• No construction / activities should be undertaken within moist soils / watercourses / pans and their associated buffers until a Water Use License was granted by the Department of Water Affairs (DWA); • Make use of existing roads and tracks, rather than creating new routes through naturally vegetated areas; • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005); • 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. However, refrain from using *Atriplex nummularia* (Old Man Salt bush). This Australian shrub tends to delay the re-establishment of indigenous plant species and makes the soil surface brak. Seeds can also be purchased from the Worcester Veld Reserve, Agricultural Institute (Esler *et al,* 2006); • 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.

Impact	Mitigation Measures
Removal / Destruction of protected plants and plants of conservation concern: The construction of the power line could result in the removal 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 populations.	• Where possible, construction activities must be restricted to previously disturbed areas; • A suitably qualified person (botanist / horticulturist) should survey the final route alignment and pylon footprints within the growing season of the plants, in order to confirm whether these plants will be impacted upon, prior to the commencement of construction; • Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activity, 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); • 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; • It is recommended that the construction crew 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 that house the protected plant species and the plants of conservation concern and protect from construction activities and vehicles; • Slight deviations of access road / tower alignments must be permitted, so as to avoid plant populations of conservation concern (DWAF, 2005).
Potential increase in invasive vegetation: The seed of alien invasive plant species that occur on and in the vicinity of the construction areas could spread into the disturbed and stockpiled soil. Also, the construction vehicles and equipment were likely	• Alien invasive species that were identified within the study area and in specific along the final route alignment should be removed prior to construction-related soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation;

Impact	Mitigation Measures
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.
Positive impact by removing alien invasive plants: By removing alien vegetation along the route alignment, within corridors and construction camps, the numbers of alien species, as well as the potential for these plants to spread into disturbed soil are reduced, provided that rehabilitation was successful.	• Compile and implement an alien invasive monitoring plan to remove alien invasive plant species along the chosen route alignments, prior to construction; • Rehabilitate all areas cleared of invasive plants as soon as practically possible, utilising specified methods and species; • Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. Monitoring should continue for at least two years after construction is complete and form part of the maintenance activities; • Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc; • Ensure that only properly trained people handle and make use of chemicals; • Dispose of the eradicated plant material at an approved solid waste disposal site; • Only indigenous plant species naturally occurring in the area should be used during the rehabilitation of the areas affected by the construction activities.
Disturbance to non-perennial and perennial rivers: Removal of vegetation surrounding drainage lines and within riparian areas could result in a disturbance and potential loss of faunal habitat associated with the stream as well as loss of mature trees which could destabilise soil conditions. In	• No construction / activities can be 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

Impact	Mitigation Measures
addition, all watercourses (including nonperennial rivers) 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 (non-perennial rivers and natural channels included) are subject to authorisation by the Department of Water Affairs (DWA) by means of a Water Use License.	minimise the destruction of the drainage bed; • 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; • Linear infrastructure should span across the rivers. Where it is unavoidable to place the pylon footprint within the protective buffer zones, the construction activities must be restricted to as small a footprint possible and rehabilitation undertaken as soon as construction is complete; • It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.
Soil compaction: The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation and inhibit revegetation. 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 maintenance) vehicles may not veer from the dedicated roads; • 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; • It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.
Operational Phase	
Deterioration of natural vegetation and bush encroachment The vegetation occurring along the constructed power line could degrade over time if suitable rehabilitation of the disturbed soils does not take place. Furthermore, maintenance work and vehicles could damage the vegetation along the route 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. • Monitor rehabilitation and do not allow grazing to take place until such time that revegetation was found to be successful. • 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.

Impact	Mitigation Measures
Rhigozum trichotomum (Driedoring) occurs abundantly within the studied. This specie in large numbers and dominant stands is known as an indicator species of bush encroachment. Bush encroachment is the process which transforms in this case the Mixed-Karoo vegetation into a woody species-dominated one. This is recognised as a very serious problem throughout Sub-Saharan Africa, as it means that large areas of grazing lands are lost (or reduced in capacity), and it transforms habitats and reduces species diversity.	• Monitor rehabilitation and ensure that bush encroachers and 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. • 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.
Destruction of natural vegetation: During the operational phase, maintenance vehicles could impact on rehabilitated and natural vegetation. In addition, the cleared servitudes could alter the fire regime.	• 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; • Maintenance vehicles must not veer from dedicated access roads and activities should be restricted to the previously disturbed footprint; • It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas;
Possible increase in exotic vegetation: If rehabilitation of the indigenous vegetation along the new power line route is unsuccessful or is not enforced, exotic and invasive vegetation may increase.	• 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 of the power line are regularly removed and re-infestation monitored.

9.1.3 Conclusion and Recommendations

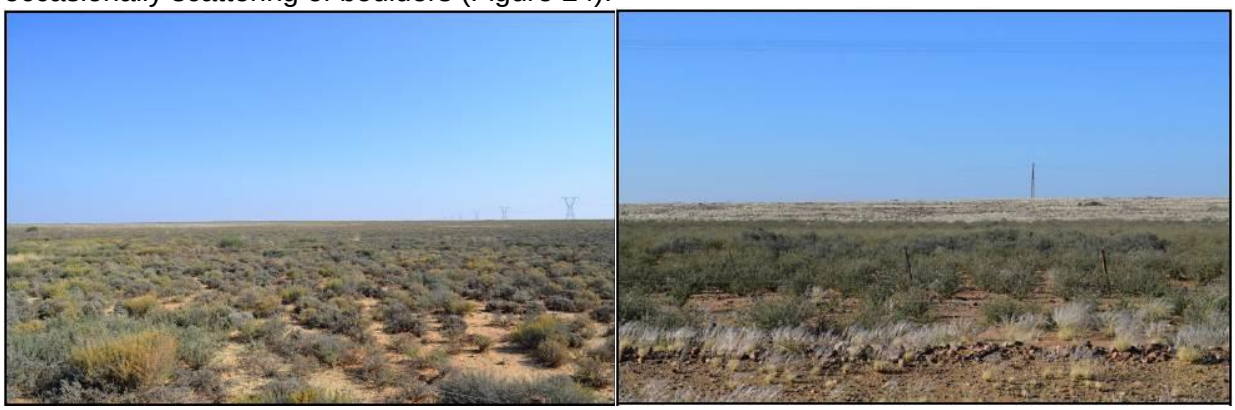
The vegetation that could be impacted on by the power line corridors were classified into four broad vegetation communities. Of these, the riparian vegetation, vegetation in and around salt pans and vegetation of rocky outcrops, ridges and inselbergs were regarded as sensitive. In addition, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) situated within the corridors, were also mapped as sensitive.

Both substations are situated in vegetation groupings of medium sensitivity. The route alternatives do not differ significantly as to their sensitivity towards the proposed power line development. However, a distribution line already exists in Corridor 2, while Corridor 3 is the only corridor that traverses significant areas of hills vegetation. Deviation 3B will ensure that these hilly areas are avoided. The preferred route was determined as Corridor 2, with Corridor 3 including deviation 3A and B or just 3B as the second options.

9.2 FAUNA ASSESSMENT

9.2.1 Key Findings

Much of the study area appears to be under relatively low intensive landuse, such as livestock, and is in natural to semi-natural condition. In terms of fauna, the habitat is fairly homogenous, primarily consisting of open sandy plains with clumps of Karoo vegetation, consisting of grass and / or shrubby vegetation of varying density and height (but mostly under 60cm) and occasionally scattering of boulders (Figure 24).



a b

Figure 24: Examples of Habitat within the study area. Short, open Karoo shrub vegetation near the eastern edge of the study area, 54km south west of Prieska, and slightly taller shrubby vegetation with grassy areas in the background, near the western edge of the study area 30km south-west of Kenhardt (Harvey, 2013).

<u>Rare and Threatened Mammal Species</u>

Four species of conservation importance are known to occur in the broader region (Friedmann & Daly 2004; Monadjem et al. 2010), and are expected to occur within portions of the study area (Table 20). Three 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 (Honey Badger and Brown Hyena) (Skinner & Chimimba 2010) and, if present, any portion of the study area is likely to form a relatively small proportion of the area they routinely utilise.

Table 20: 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) (Harvey, 2013)

Common Name	Scientific Name	Conservation Status	Comment	Occurrence within the study area
Black-footed Cat	*Felis nigripes*	RD – VU	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, grassy and karoid habitats.
Honey Badger	*Mellivora capensis*	RD – NT	Wide habitat use but occurs at low densities. Threatened by human	May occur widely but sparsely in areas of natural vegetation.

Common Name	Scientific Name	Conservation Status	Comment	Occurrence within the study area
			persecution.	
Brown Hyena	*Parahyaena brunnea*	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, typically in the form of clumps of dense vegetation. Rare in the region.
Littledales' Whistling Rat	*Parotomys littledalei*	RD - NT	Widely but apparently patchily distributed, and may be threatened by stochastic events e.g. disease	May occur widely in areas with denser vegetation.

Rare and Threatened Amphibian Species

The study area falls within an area that supports very low amphibian species diversity relative to other areas of the country, with a low number of endemics and no range-restricted species will be present.

No rare or threatened amphibian species are known or expected to occur within the study area.

Rare and Threatened Reptile Species

Recorded reptile diversity is fairly low, with 20 species recorded in the study area and an additional 14 species recorded in surrounding areas and expected to be present, giving a total of 34 species in the area. Although some species are widespread, most species are largely confined to the dry west of the country albeit widely distributed there. Only a single endemic species is present within the study area, the Marico Gecko *Pachydactylus mariquensis.*

No rare or threatened reptiles are known or expected from the study area.

9.2.2 Potential Fauna Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 21: Analysis of the Significance of Potential Fauna Impacts (Kronos-Aries – for all Corridors and Deviations) (Harvey, 2013)

	Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
CONSTRUCTION PHASE	Disturbance	2 1	2 1	2 1	1 0	5 4	35 12	Moderate	Low
	Habitat loss	2 1	2 1	2 1	5 2	4 3	44 15	High	Low
	Alien Invasive Plant Spread	3 1	3 1	3 1	4 2	3 2	39 10	High	Low
	Pollution During and Following Construction	1 0	3 0	1 0	2 0	3 1	21 0	Moderate	Minor

Table 22: Mitigation Measures (Fauna)

Impact	Mitigation Measures
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.	• Keep footprint areas to a minimum size and reduce noisy activities where possible.
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 power lines themselves will be supported by the towers and will have no impact on terrestrial fauna. Although some clearance of taller	• Restrict foot print areas to the minimum size required • Avoid disturbance to and destruction of rocky outcrop habitats as far as possible • Utilise existing infrastructure where possible

Impact	Mitigation Measures
vegetation may be required along the route, in general, vegetation clearance is expected to be minimal, given that much of the vegetation is low.	
Alien Invasive Plant Spread There is potential for alien invasive plants to increase as a result of disturbance associated with construction activities, particularly at tower installation sites and new road construction sites and close to rivers.	• Monitor construction sites (or at least a subsample thereof) to assess if alien plants establish • If alien plants begin to establish, design and implement an alien plant control and monitoring programme
Pollution During and Following Construction There is potential for waste products to be dumped into adjacent areas, following completion of the construction phase.	• Ensure that all waste products are removed following completion of construction phase

9.2.3 Conclusions and Recommendations

The fauna assessment determined that the study area is generally of medium value for terrestrial vertebrate biodiversity, and terrestrial vertebrate fauna is unlikely to be substantially negatively affected by this development.

The following recommendations are made:

- All three Corridors and Deviations are considered equally acceptable.
- All attempts to minimise unnecessary disturbance and habitat loss during the construction phase should be employed.
- 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.
- An alien plant control programme (including monitoring) should be designed and implemented for tower footprint areas and any new access roads created during the construction phase, to prevent the disturbance associated with construction from encouraging the proliferation of alien plants.
- Any alien plant clearance programmes should rely preferably on mechanical removal; if the use of chemicals is necessary, the chemicals used must be confirmed to have no negative effects of any indigenous biodiversity by an appropriate expert prior to their use.

9.3 AVIFAUNA ASSESSMENT

9.3.1 Key Findings

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 250 bird species across the broad study area. This does not mean that all of these species do occur on the alignments of the proposed power line, but it does give an indication of what could occur in the area. The full species list is shown in Appendix 2 provided in the Avifauna Report.

Table 23 is an extract of the species thought to be most important for this study, including Red-listed species and additional non Red-listed species which are believed are relevant to this study because of their propensity to interact with overhead transmission lines. A total of 67 species are included in Table 23, with 10 listed as regionally Vulnerable, 9 as regionally Near-threatened (Barnes 2000), and 2 protected under the Bonn Convention

For each species the preferred micro-habitat, likelihood of occurring on site and relative importance of site have been assessed. An indication of the ways in which the species could interact with the proposed power line has also been supplied. This is a large number of species to deal with, so in order to narrow the focus the really heavily impacted species for which this study area is important have been shaded in grey in Table 23. These species are discussed in more detail in the Avifauna Report provided in Appendix M. The species cannot afford to face additional collision threats due to new power lines, making it essential that this impact is carefully managed for this project. In addition to these, other species worthy of mention include Lappet-faced Vultures and Blue Cranes (which might be present occasionally, although this is a marginal area for them), Black, White and Abdim's Storks, and medium-sized raptors which may perch or nest on towers including kestrels, Black-chested Snake Eagles, Black Harriers, Southern Pale Chanting Goshawks, Steppe and Jackal Buzzards, Booted Eagles and Lanner Falcons

Table 23: Summary of priority bird species associated with the proposed Kronos-Aries 765 kV power line (most important species highlighted in grey) (Smallie, 2013)

Common name	Scientific name	SABAP 1	SABAP 2	Regional conservation status	Preferred micro habitat in this study area	Likelihood of occurring on site	Relative importance of site for national population of species	Likely interactions with proposed power line
Bustard, Kori	*Ardeotis kori*	X	X	VU	Open Karoo and *Acacia* watercourses	Definite	High	C, HD, D
Bustard, Ludwig's	*Neotis ludwigii*	X	X	VU	Open Karoo	Definite	High	C, HD, D
Buzzard, Jackal	*Buteo rufofuscus*	X	X		Any	Probable	Medium	C, HD, D, N, P
Buzzard, Steppe	*Buteo vulpinus*	X			Any	Definite	Medium	C, HD, D, N, P
Cormorant, White-breasted	*Phalacrocorax carbo*	X			Any close to water	Possible	Low	C, D, N, P
Crane, Blue	*Anthropoides paradiseus*	X		VU	Open Karoo, pans	Possible	Low	C
Crow, Cape	*Corvus capensis*		X		Open Karoo	Definite	Low	C, HD, D, N, P
Crow, Pied	*Corvus albus*	X	X		Open Karoo	Definite	Low	C, HD, D, N, P
Duck, African Black	*Anas sparsa*	X			Pans	Possible	Low	C
Duck, Maccoa	*Oxyura maccoa*	X			Pans	Unlikely		
Duck, Yellow-billed	*Anas undulata*	X			Pans	Probable	Low	C
Eagle, Booted	*Aquila pennatus*	X			Open Karoo	Probable	Medium	C, HD, D, P
Eagle, Martial	*Polemaetus bellicosus*	X	X	VU	Open Karoo	Definite	High	C, HD, D, N, P
Eagle, Tawny	*Aquila rapax*			VU	Open Karoo	Possible	Low	C, HD, D, N, P
Eagle, Verreaux's	*Aquila verreauxii*	X	X		Open Karoo	Probable	Medium	C, HD, D, N, P
Eagle-Owl, Spotted	*Bubo africanus*	X	X		Any	Probable	Medium	C, HD, D, P
Eagle-Owl, Verreaux's	*Bubo lacteus*	X			Open Karoo	Probable	Medium	C, HD, D, P
Falcon, Lanner	*Falco biarmicus*	X	X	NT	Open Karoo	Definite	Medium	C, HD, D, N, P
Falcon, Pygmy	*Polihierax semitorquatus*	X	X		Open Karoo	Possible	Low	C, D, P

Fish-Eagle, African	*Haliaeetus vocifer*	X			Any close to water	Unlikely		
Flamingo, Greater	*Phoenicopterus ruber*	X		NT	Pans	Possible	Medium	C, D
Flamingo, Lesser	*Phoenicopterus minor*			NT	Pans	Possible	Medium	C, D
Goose, Egyptian	*Alopochen aegyptiacus*	X	X		Any close to water	Definite	Medium	C, D, N, P
Goose, Spur-winged	*Plectropterus gambensis*	X	X		Any close to water	Probable	Low	C, D
Goshawk, Southern Pale Chanting	*Melierax canorus*	X	X		Any	Definite	Medium	C, HD, D, N, P
Grebe, Black-necked	*Podiceps nigricollis*	X			Pans	Possible	Low	C
Grebe, Little	*Tachybaptus ruficollis*	X			Pans	Possible	Low	C
Guineafowl, Helmeted	*Numida meleagris*	X	X		Any	Definite	Medium	C, HD, D, P
Harrier, Black	*Circus maurus*	X	X	NT	Any	Possible	Medium	C, HD, D, P
Harrier-Hawk, African	*Polyboroides typus*	X			None	Unlikely		
Heron, Black-headed	*Ardea melanocephala*	X			Any close to water	Probable	Medium	C
Heron, Goliath	*Ardea goliath*	X			Any close to water	Unlikely		
Heron, Grey	*Ardea cinerea*	X			Any close to water	Probable	Medium	C
Ibis, African Sacred	*Threskiornis aethiopicus*	X			Any close to water	Probable	Medium	C, P
Ibis, Glossy	*Plegadis falcinellus*	X			Any close to water	Probable	Medium	C, P
Ibis, Hadeda	*Bostrychia hagedash*	X	X		Any	Probable	Medium	C, P
Kestrel, Greater	*Falco rupicoloides*	X	X		Open Karoo	Definite	Medium	C, HD, D, N, P
Kestrel, Lesser	*Falco naumanni*	X		VU	Open Karoo	Probable	Medium	C, HD, D, P
Kestrel, Rock	*Falco rupicolus*	X	X		Open Karoo	Probable	Medium	C, HD, D, P
Kite, Black	*Milvus migrans*	X			Any	Possible	Low	P
Kite, Black-shouldered	*Elanus caeruleus*	X			Any	Probable	Low	P
Kite, Yellow-billed	*Milvus aegyptius*	X			Any	Probable	Low	P
Korhaan, Karoo	*Eupodotis vigorsii*	X	X		Open Karoo	Definite	High	C, HD, D
Korhaan, Northern Black	*Afrotis afraoides*		X		Open Karoo	Definite	High	C, HD, D

Korhaan, Red-crested	*Lophotis ruficrista*	X	X		Open Karoo	Possible	Low	C, HD, D
Lark, Red	*Calendulauda burra*	X	X	VU	Open Karoo	Probable	Medium to high	HD, D
Lark, Sclater's	*Spizocorys sclateri*	X	X	NT	Open Karoo	Probable	Medium to high	HD, D
Marsh-harrier, African	*Circus ranivorus*			VU	Any close to water	Possible	Low	C, HD, D
Owl, Barn	*Tyto alba*	X	X		Any	Probable	Medium	C, D, P
Painted-snipe, Greater	*Rostratula benghalensis*	X		NT	Any close to water	Unlikely		
Plover, Chestnut-banded	*Charadrius pallidus*	X		NT	Pans	Possible	Low to medium	C, D
Pochard, Southern	*Netta erythrophthalma*	X			Pans	Possible	Low	C
Sandgrouse, Namaqua	*Pterocles namaqua*	X	X		Open Karoo	Definite	Medium to high	C, HD, D
Secretarybird	*Sagittarius serpentarius*	X	X	NT	Open Karoo	Definite	Medium to high	C, HD, D
Shelduck, South African	*Tadorna cana*	X	X		Any close to water	Probable	Medium	C
Shoveler, Cape	*Anas smithii*	X			Any close to water	Possible	Low	C
Snake-Eagle, Black-chested	*Circaetus pectoralis*	X	X		Open Karoo	Definite	Medium	C, HD, D, P
Spoonbill, African	*Platalea alba*	X			Pans	Possible	Medium	C
Stork, Abdim's	*Ciconia abdimii*	X		Bonn	Any close to water	Possible	Low	C, P
Stork, Black	*Ciconia nigra*	X		NT	Any close to water	Possible	Low	C, P
Stork, White	*Ciconia ciconia*	X		Bonn	Any close to water	Possible	Low	C, P
Teal, Cape	*Anas capensis*	X			Pans	Possible	Low	C
Teal, Red-billed	*Anas erythrorhyncha*	X			Pans	Possible	Low	C
Thick-knee, Spotted	*Burhinus capensis*	X	X		Open Karoo	Definite	High	C, HD, D
Vulture, Lappet-faced	*Torgos tracheliotos*			VU	Open Karoo	Possible	Low	C, HD, D, P
Vulture, White-backed	*Gyps africanus*			VU	Open Karoo	Definite	Medium	C, HD, D, P
Weaver, Sociable	*Philetairus socius*	X	X		Any	Definite	Medium	HD, D, P, N

VU = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species. C = Collision with overhead cables; HD = Habitat destruction; D = Disturbance of birds during construction; N = Nesting on towers; P = Perching on power line towers.

Bird sightings in the study area

Priority species seen during field work were recorded and can be seen in Figure 25. Care should be taken not to place too much emphasis on the exact locations of the sightings, as birds in this arid environment are highly mobile, and react to very localised rainfall which can occur in this region. In addition, the field work was not representative of variation in conditions on site, and time was not apportioned evenly across the study area.

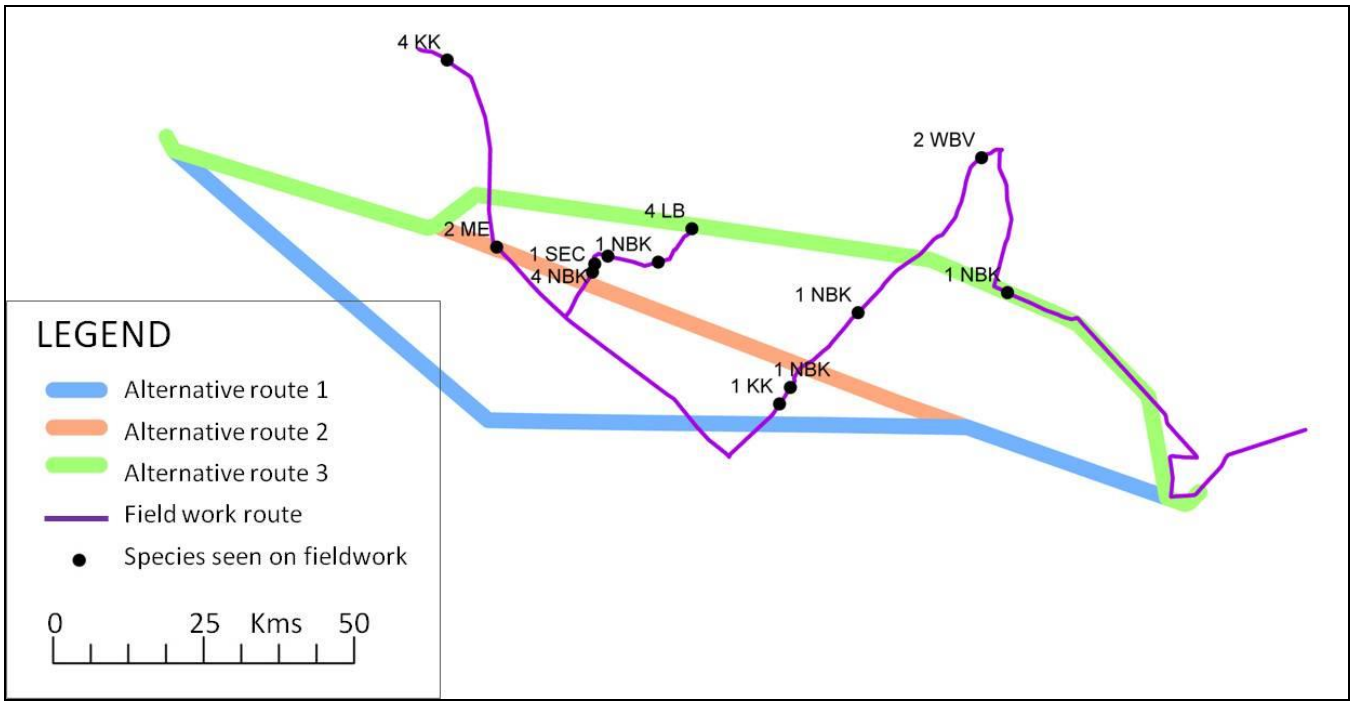


Figure 25: Priority bird species recorded during field work and census counts in the study area

(KK=Karoo Korhaan, LB=Ludwig's Bustard, SEC=Secretarybird, NBK=Northern Black Korhaan, ME=Martial Eagle, WBV=White-backed Vulture)

Deviations 3A to 3B were not investigated during field work.

More broadly, good numbers of the species identified in Figure 25, as well as Kori Bustards, were seen in the Bushmanland bioregion during a large terrestrial bird road census which was conducted four times across the Karoo from May 2010-April 2011 (Shaw 2013). Since 2010, a satellite tagged Ludwig's Bustard has also spent much of his year in close proximity (roughly 12 km north-east) to Corridor 3, potentially highlighting an important area for this species since these birds are rarely alone. All of this data provides confirmation of the presence of several key species in the vicinity of the proposed power line.

Power line mortality surveys on existing Kronos-Aries 400kV and Hydra-Kronos 400kV

Of specific interest to this study are mortality data from two unmarked sections of existing 400kV lines in the area; 52 kilometres of Kronos-Aries which lies 44 kilometres to the south-west of the proposed line at the closest point, and 55 kilometres of Hydra-Kronos which lies 27 kilometres

to the south-east. These sections lie either side of the proposed line, and were surveyed quarterly for two full years (April 2010-April 2012) for power line mortalities as part of a wider study on the impact of power line collisions on Ludwig's Bustard (Shaw 2013). Results from this study indicated that at least 15 species are impacted by transmission power lines in this area (Table 24), six of which are priority species. As expected, bustards were most affected, with high numbers of Ludwig's and Kori Bustards killed.

Power line surveys will underestimate mortality rates, because of scavenger removals, habitat and observer biases (Bevanger 1999). Experiments in the Calvinia region of the Karoo have demonstrated that less than half of the dead birds present under power lines are likely to be located (Schutgens *et al.* in review, Shaw *et al.* in prep.). Therefore, an averaged minimum estimate of 0.29 Ludwig's Bustards.km^{-1}.yr^{-1} are killed on these unmarked 400 kV lines, but a more realistic estimate adjusted for dead birds missed on surveys is 0.63 Ludwig's Bustards.km^{-1}.yr^{-1}. Environmental conditions and therefore the number of birds present in this area vary greatly depending on rainfall, so rates could increase dramatically if large numbers of birds were in the area. While there are no data available for collision rates on 765 kV lines, if they are at least similar to the 400kV lines in this area it is likely that the proposed line will kill over 100 Ludwig's Bustards and 16 Kori Bustards annually, unless marked. Relative to their population sizes and given the other issues discussed above, this is unacceptable.

Table 24: Number of bird collisions recovered from sections of the Hydra-Kronos and Kronos-Aries 400kV lines (2010-2012) by species (data from Shaw 2013). Recent collisions are those that died in the two year study period, and total collisions include historic remains.

	Hydra-Kronos 400 kV		**Kronos-Aries 400 kV**	
Species	**Recent collisions**	**Total collisions**	**Recent collisions**	**Total collisions**
Ludwig's Bustard	42	95	20	28
Kori Bustard	8	22	7	13
Karoo Korhaan	2	7	3	3
Northern Black Korhaan	4	6	0	0
Pied Crow	1	2	1	1
Secretary Bird	1	3	0	0
Cape Shoveller	0	0	0	1
Crow	0	1	0	0
Egyptian Goose	0	0	1	1
Feral Pigeon	1	1	0	0
Martial Eagle	0	0	1	1
Red-knobbed Coot	0	1	0	0
Sacred Ibis	0	0	0	1
Spotted Thick-knee	0	0	1	1
White Stork	0	1	0	0
Unidentified bird	0	1	1	1

Preferred Corridors

Table 25: Assessment of avifaunal factors for each corridor route

Factor	Corridor 1	Corridor 2	Corridor 3	Deviation 3A	Deviation 3B
Length of line adjacent to existing high voltage lines (defined as within 1 km or so, but with potential to be placed within 150 m between outer conductors)	39 km	163 km	49 km	43 km	79 km
Length of line	172 km	163 km	179 km	180 km	184 km
Key avifaunal features crossed or close to alignment	None	None	None	None	None
Length of line within protected areas or IBAs	None	None	None	None	None
Final ranking	**5**	**1**	**3**	**4**	**2**

Corridor 2 is the preferred, and really the only viable route from an avifaunal perspective. This is because the line can be placed adjacent to an existing line for its entire route, an option not possible with the other alternatives. The second most preferred route would be Corridor 3 with Deviation 3B. Corridor 1 is the least suitable, being closest to the highest number of water sources and running along other linear features for the least distance.

It is strongly recommended that the option of upgrading or recycling this existing 400 kV line be fully examined first. Failing that option, the power line must be built adjacent to existing lines. This is essential to restrict the number of power line corridors in this area and to provide mitigation for bird collision (in addition to the line marking recommended).

9.3.2 Potential Avifauna Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 26: Analysis of the Significance of Potential Avifauna Impacts (Kronos-Aries – for all three corridors and deviations) (Smallie, 2013)

Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
Collision	Collision of birds with earth wires and conductors – key species being Ludwig's Bustard, Kori Bustard, Secretarybird, Greater and Lesser Flamingo	4 3	5 5	4 4	4 4	4 2	68 32	Very High	Moderate
Habitat Destruction	Destruction of bird habitat during construction of the power line, and to a lesser extent maintenance	2 2	3 3	1 1	4 4	4 4	40 40	Moderate	Moderate
Disturbance	Disturbance of birds, during construction and to a lesser extent maintenance	3 3	2 2	2 1	2 2	3 2	27 16	Moderate	Low
Nesting	Nesting on Towers	2 2	0 0	1 1	3 3	2 2	12 12	Low	Low
Electrical Faulting	Electrical faulting on lines, caused by birds	3 2	1 1	1 1	4 4	3 2	27 16	Moderate	Low

Table 27: Mitigation Measures (Avifauna)

Impact	Mitigation Measures
Collision	It is essential that the option of upgrading or recycling the existing 400 kV line to produce the necessary 765 kV capacity be examined fully before a new line is considered further. This is of critical importance in ensuring that no new kilometres of line be added to the network unless absolutely necessary. Part of this exercise should be to evaluate the long-term need for transmission lines in this corridor to the Northern Cape and ensure that we do not keep adding lines without excellent justification, and without exhausting all other alternatives. Failing this, it will be essential that the new line be built adjacent to (not more than 150 m between outer conductors) the existing 400 kV line in Corridor 1, which will hopefully provide partial mitigation for the impact of collision. In addition, the below must be conducted. With our current inability to accurately predict what constitutes a high risk section of line (Shaw *et al.* 2010, Shaw 2013), the most effective anti-collision markers available at the time must be installed along the entire length of the power line, with 100% of each span marked. 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 power line. 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 power line. In addition, a site specific EMP (avifaunal walk through) must be conducted to identify high risk sections of this power line near water sources for birds which fly at night, and these sections must be installed with the most effective nocturnal anti-collision markers available at the time. It is also Eskom's responsibility to monitor the impacts of this power line and the effectiveness of the mitigation measures installed. It is therefore recommended that sample sections of this power line be monitored systematically by the Eskom-EWT Strategic Partnership. This should include patrols at least every three months along sample sections of line according to the methodology used previously by the Partnership.
Habitat destruction	A construction EMPr (avifaunal walk through) must be conducted to identify particularly sensitive habitat and environmental best practice must be followed during construction and maintenance

Impact	Mitigation Measures
	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.
Disturbance	A site specific avifaunal walk through for the construction EMPr must be conducted and environmental best practice must be followed during construction and maintenance activities. An on-site ECO must be responsible for ensuring compliance and minimising disturbance during construction. If any breeding raptors or other Red-listed bird species are identified during the site-specific EMPr, case-specific management measures must be developed by an avifaunal specialist. If the line is placed close to existing lines they must be searched for eagle nests during the avifaunal walk through.
Nesting	Impacts cannot necessarily be mitigated – but note that any intervention with nesting once line is operational must be subject to national and provincial legislation and Eskom nest management guidelines. We suggest using a cross rope suspension configuration to minimise the chances of nests being built.
Electrical faulting	Fit Bird Guards on self-support towers as per Eskom transmission guidelines, and use a cross rope suspension configuration.

9.3.3 Conclusions and Recommendations

It is strongly recommended that the option of upgrading or recycling this existing 400kV line be fully examined first. Failing that option, it is concluded that Corridor 2 is the preferred route from an avifaunal perspective. This is because the line can be placed adjacent to an existing line for its entire route, an option not possible with the other alternatives. The second most preferred route would be Corridor 3 with Deviation 3B.

In order to mitigate for the Avifaunal impacts, the following recommendations need to be implemented:

- The option of recycling or upgrading the existing 400 kV line instead of building a new line should first be fully examined, and the findings of that exercise be made available to the specialists and all concerned.
- All ephemeral pans and a buffer around them of at least 100m should be avoided by the alignment.
- Given our current inability to accurately predict which sections of line pose a high collision risk, a suitable anti-bird collision line marking device must to be fitted on earth wires from pylon to pylon for the entire length of the power line. It is extremely important that Eskom identify an effective and durable marking device and installation method by the time this line is constructed. This includes the need to have a suitable and approved nocturnal device for those sections of line close to pans likely to hold flamingos. On previous projects of this nature, Eskom have argued that no approved nocturnal device exists at the time of construction with the result that no such devices were installed. This is not an acceptable excuse. It is Eskom's responsibility to ensure that such a device exists in time for construction of this line.
- It is essential that an avifaunal walk through is conducted during the development of the site specific Environmental Management Plan for the line, and is particularly important that Eskom allows sufficient time and budget for this study to be thorough. This is critical to identify and mitigate for large eagle nests on the existing line and elsewhere on site, and to develop management recommendations to ensure that as far as possible these birds are not disturbed during the construction of the new line. The walk through will also identify sections of line that pose a high collision risk for birds which fly at night so that they can be marked with nocturnal devices.
- It will be Eskom's responsibility to ensure that the line marking devices remain in working order or are replaced timeously throughout the lifespan of the power line.
- It will be essential that a sample of the line is monitored at least every three months during the first three years of its operation in order to detect any collision hot-spot areas, and evaluate the effectiveness of the mitigation measures. This monitoring should best be done by the Eskom-Endangered Wildlife Trust Strategic Partnership. Although this recommendation may appear stringent, in our opinion the fact that systematically collected data on the collision impact and effectiveness of mitigation measures of existing lines is not more widely available is unacceptable. There is no available data on collision rates of 765 kV lines in South Africa since no systematic monitoring has been conducted to date. This means we do not know how bad collisions might be on such a large structure and must estimate using collision rates from lower voltage lines. This situation can no longer be accepted when conducting EIAs for new lines.
- All construction, maintenance and decommissioning activities in any natural habitat along the route of the power line should be carried out in accordance with best environmental

practice principles so as to minimise disturbance of any natural habitat. Particularly sensitive areas will also be identified during the avifaunal walk through process.

- All nests on this line (and others) should be managed according to Eskom Transmission nest management guidelines and relevant provincial and national legislation.
- We have not been advised of the potential tower type, but recommend cross rope suspension to minimise issues for large eagles. This configuration does not provide much nesting area, and will also reduce risk of faulting.

9.4 WETLAND ASSESSMENT

9.4.1 Key Findings

The western part of the corridor is characterised by large amounts of drainage lines/riparian areas while the eastern part of the corridors have less drainage lines/riparian areas but does however have more wetlands, especially pans (Photograph 1). The high density of drainage lines in the west is associated with the Sakriver in close proximity to Corridor 1. The pans found throughout the studied area can stand dry for years between temporary flooding (Davies & Day, 1986 *in* Cowan, 1995). This is due to a high evaporation rate and a low precipitation rate.

The vast amount of dry pans found throughout the study site suggests that the water table is not close to the surface but that the pans rather fill up with water in seasons of heavy rain and subsequently dry out over time. Because of the dry nature of these pans it could be expected that impacts associated with infrastructure should be less extensive compared to permanently inundated pans.

The low vegetation densities is likely a contributing factor in the erosional features of some of the drainage lines as the lack of plants causes an increase in evapotranspiration from the soil and vegetation cover protects the topsoil from being washed away. Drainage lines are also linked to various rivers and wetlands and is thus an important source of water for wetlands and rivers in this dry region and any impacts within the drainage lines is likely to have an impact on the associated wetland or river system. This is especially true for pans in this area where the only water that it receives is rain water and if the drainage lines are not effective anymore, the pans will not receive enough water to be ecologically sustainable.

The riparian areas found on site have been affected by grazing and browsing animals. The rivers are usually linked to a large network of drainage lines which feeds the river with water during rainfall events. At the time of the field survey, the rivers were dry, while some pans held water after the preceding Easter weekend rainfall

The alternative routes studied were studied in a 2km wide corridor and the number of wetlands and riparian/drainage lines will thus be greatly higher than the line will actually cross. The number of wetlands and drainage lines/ riparian areas does however provide an overview into the densities of watercourses and thus provides a general idea which corridor would be ecologically the better option. The less number of watercourses in a corridor, the less impact the line will have. The watercourses are depicted within each corridor in Figure 26. It is important to note that within 500m of any watercourse a WUL (Water Use Licence) would likely be required (Figure 27).

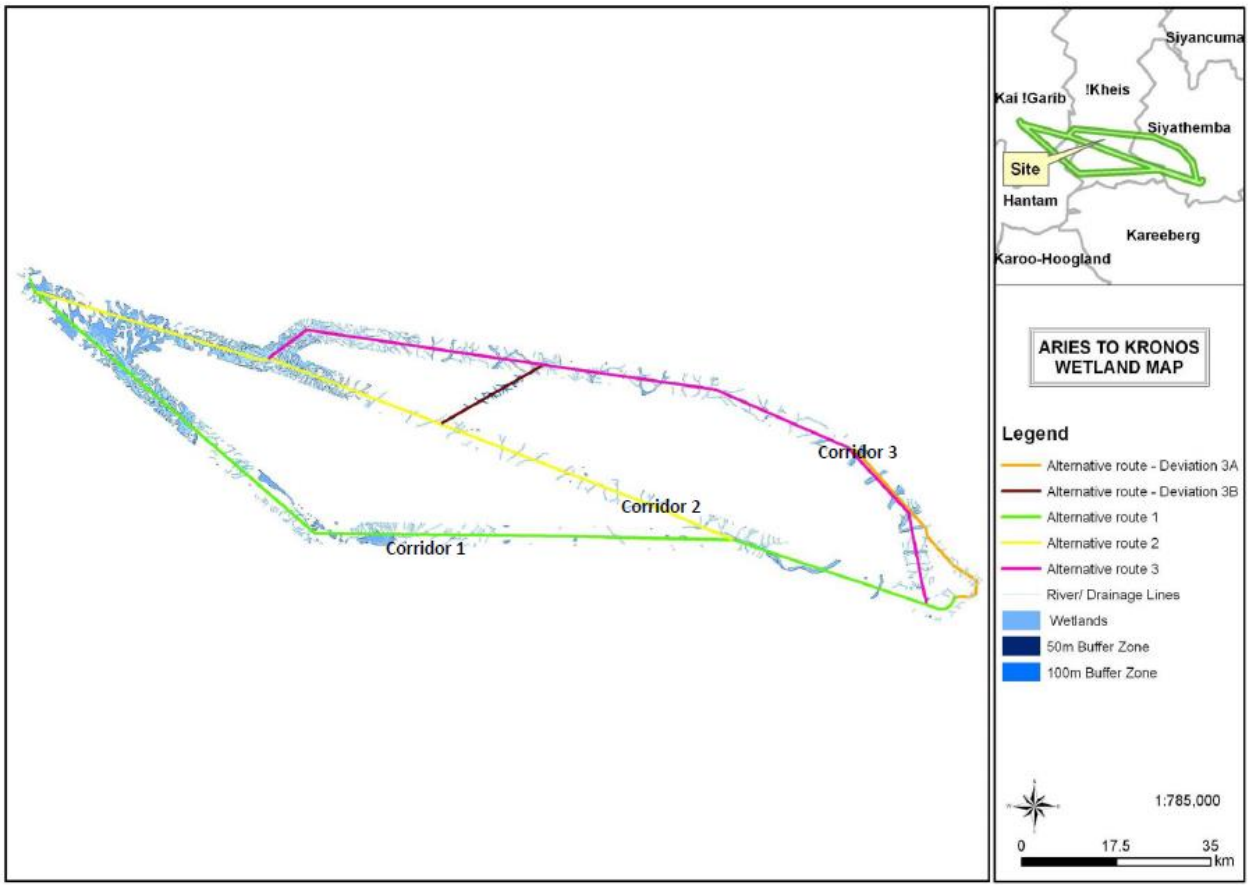


Figure 26: Wetlands, drainage lines and riparian areas along the power line corridors (Bootsma, 2013)

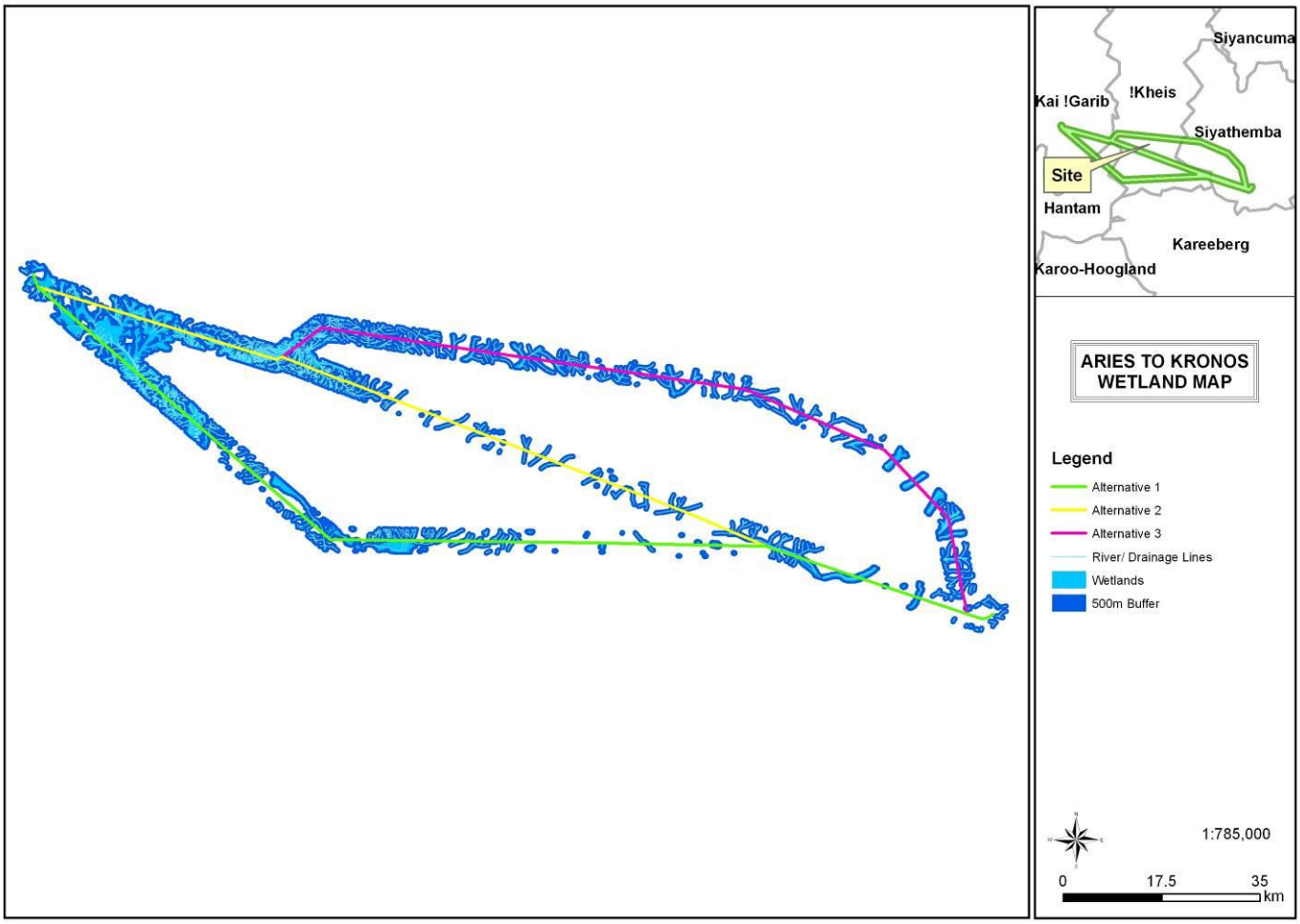


Figure 27: Wetlands, drainage lines and riparian areas along the power line corridors with a 500m buffer zone (Bootsma, 2013)

Preferred Corridors

Corridor 1

The total number of drainage lines/riparian areas within Corridor 1 is the least out of the three portions. However Corridor 1 has the highest number of wetlands out of the three corridors. The number of drainage lines/riparian areas within Corridor 1 is 272 with 59 wetlands. The majority of these wetlands are pans and some of these pans are very large. Corridor 1 is not a preferred option.

Corridor 2

Corridor 2 does have more drainage lines/riparian areas within but the corridor is straighter and thus likely shorter. In addition, Corridor 2 also has an existing power line and therefore associated infrastructure such as access roads. The total number of wetlands within Corridor 2 is 31 while the total number of drainage lines/riparian areas is 344. However the presence of the Alkantpan Testing Range in this corridor precludes this as a viable option.

Corridor 3
Corridor 3 has the second highest number of drainage lines/riparian areas with the total numbering 439 drainage lines/riparian areas. The total number of wetlands within Corridor 3 is 29. Corridor 3 also bends within the area where the highest density of drainage lines occurs. This corridor is the second preferred route.

Deviation 3A
Corridor 3A is a proposed deviation that avoids a proposed airstrip (Civil Aviation Authority obstacles and buffers) and proposed solar parks. This corridor has the highest number of drainage lines and riparian areas (450) and has 34 wetlands. This corridor is not a preferred route.

Deviation 3B
Corridor 3B is a deviation which links Corridor 3 to Corridor 2 which serves to avoid the "no power line zone" (Alkantpan Testing Range) located in Corridor 2. This corridor has the second lowest number of riparian areas and drainage lines at 408 and the least wetlands at 28. This corridor is the most preferred.

A summary of results and the preferred alternative is represented in Table 28 below.

Table 28: Kronos-Aries Transmission Line Wetland Summary

Alternative Corridor	Notes	Order of Preference
Corridor 1	• 272 Drainage Lines/ Riparian Areas • 59 Wetlands	Not Preferred
Corridor 2	• 344 Drainage lines/ Riparian areas • 31 Wetland	Not Preferred
Corridor 3	• 439 Drainage lines/ Riparian areas • 29 Wetlands	Second Preferred
Deviation 3A	• 450 Drainage lines/ Riparian areas • 34 Wetlands	Preferred
Deviation 3B	• 408 Drainage lines/ Riparian areas • 28 Wetlands	Most Preferred

9.4.2 Potential Wetland Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 29: Analysis of the Significance of Potential Wetland Impacts (Kronos-Aries – for all Corridors and Deviations) (Bootsma, 2015)

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
CONSTRUCTION PHASE	Changing the quantity and fluctuation properties of the watercourse	• Development within water resources e.g. tower footprint within wetland, pan or riparian area, thereby diverting or impeding flow; • Lack of adequate rehabilitation resulting in invasion by woody invasive plant species.	3 1	3 2	3 1	2 1	3 2	33 14	Moderate	Low
	Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount)	• Earthwork activities to construct towers; • Clearing of surface vegetation will expose the soils, which in rainy events would wash down into wetlands, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil; • Disturbance of soil surface; • Disturbance of slopes through creation of roads and tracks; • Changes in runoff characteristics; • Erosion (e.g. gully formation, bank collapse).	5 2	3 2	5 3	2 1	4 3	60 18	High	Moderate

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	Alteration of water quality – increasing the amounts of nutrients (phosphate, nitrite, nitrate)	• Disposal or discharge of human (including partially treated and untreated) sewage during the construction phase of the development	2 1	3 2	3 1	2 1	3 2	27 16	Moderate	Moderate
	Alteration of water quality – toxic contaminants (including toxic metal ions (e.g. copper, lead, zinc) and hydrocarbons	• Runoff from road surfaces; • Discharge of solvents, and other industrial chemicals.	2 1	2 2	3 1	2 1	3 2	27 10	Moderate	Low
	Changing the physical structure within a water resource (habitat)	• Encroachment to achieve maximum commercial returns; • Deposition of wind-blown sand; • Loss of fringing vegetation and erosion; • Alteration in natural fire regimes.	3 2	3 2	2 1	3 2	3 2	33 14	Moderate	Low
OPERATIONAL PHASE	Changing the quantity and fluctuation properties of the watercourse	• Vehicles driving in / through watercourses; • Damage to vegetated areas	3 1	3 2	3 1	2 1	3 2	33 14	Moderate	Low
	Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount)	• Vehicles impacting on surface vegetation.	5 2	3 2	5 3	2 1	4 3	60 18	High	Moderate
	Alteration of water quality – increasing the amounts of	• Disposal or discharge of human (including partially treated and untreated) sewage during the	2 1	3 2	3 1	2 1	3 2	27 16	Moderate	Moderate

	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	nutrients (phosphate, nitrite, nitrate)	operational phase (maintenance) of the development.								
	Alteration of water quality – toxic contaminants (including toxic metal ions (e.g. copper, lead, zinc) and hydrocarbons	• Runoff from road surfaces; • Discharge of solvents, and other industrial chemicals.	2 1	2 2	3 1	2 1	3 2	27 10	Moderate	Low
	Changing the physical structure within a water resource (habitat)	• Loss of vegetation.	3 2	3 2	2 1	3 2	3 2	33 14	Moderate	Low

Table 30: Mitigation Measures (Wetland)

Impact	Mitigation Measures
Changing the quantity and fluctuation properties of the watercourse	**Construction Phase** • 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 in and 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 environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the tower. • Prevent pedestrian and vehicular access into the wetland and buffer areas as well as riparian areas. • Consider the various methods of stringing and select whichever method(s) 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 wetlands areas to take place within the drier winter months and use equipment with the smallest possible footprint e.g. quad bikes.

Impact	Mitigation Measures
	• 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. • Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse • Management of point discharges. • 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/impacts that arise as a result of construction must be implemented immediately upon completion of construction. **Operational Phase** • Maintenance activities should not take place within watercourses or buffer zones. Where unavoidable, the footprint needed for maintenance must be kept to a minimum. This is subjected to authorization by means of a water use license. • Where possible, maintenance within watercourses must be restricted to the drier winter months. • Maintenance activities should not impact on rehabilitated areas. • Maintenance workers should respect and also maintain fences that are in place to prevent livestock from entering rehabilitated areas, until such time that monitoring found that rehabilitation s successful and the fences removed. • Maintenance should not impact on natural vegetation. • Maintenance vehicles must stay on dedicated roads/ servitudes.
Changing the amount of sediment entering	**Construction Phase**

Impact	Mitigation Measures
water resource and associated change in turbidity (increasing or decreasing the amount)	• Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent water runoff and erosion of the disturbed or heaped soils into wetland areas. • 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. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005). • 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 not allow any disturbance to the adjoining natural vegetation cover. • Rehabilitation plans must be submitted and approved for rehabilitation of damage during construction and that plan must be implemented immediately upon completion of construction. • 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. Ideally, the rehabilitated pylon footprints, especially on slopes and along riparian and wetland areas, must be fenced to prevent livestock grazing and trampling. Once rehabilitation was observed to be successful during monitoring, the fenced may be removed (at least two years). • Negotiate with landowners to delay the re-introduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of revegetation has been reached, especially against slopes. • During the construction phase measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation. • 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. • Runoff from roads must be managed to avoid erosion and pollution problems. • Implementation of best management practices.

Impact	Mitigation Measures
	• Source-directed controls. • Buffer zones to trap sediments. • Active rehabilitation. **Operational Phase** • Rehabilitated vegetation should not be impacted on by maintenance. • Maintenance vehicles must remain on dedicated roads and servitudes. • Maintenance activities should not take place within watercourses or buffer zones. Where unavoidable, the footprint needed for maintenance must be kept to a minimum. This is subjected to authorization by means of a water use license. • Where possible, maintenance within watercourses must be restricted to the drier winter months. • Maintenance activities should not impact on rehabilitated areas and where soil or vegetation disturbances took place, this should be rehabilitated immediately.
Alteration of water quality – increasing the amounts of nutrients (phosphate, nitrite, nitrate)	**Construction Phase** • Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone. • Establishment of buffer zones to reduce nutrient inputs in diffuse flow. • Implementation of appropriate stormwater management around the excavation to prevent the ingress of run off into the excavation. **Operational Phase** • Maintenance workers are not allowed to sue watercourse and associated buffers as ablution facilities. • Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone.
Alteration of water quality – toxic contaminants	**Construction Phase** • After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts

Impact	Mitigation Measures
(including toxic metal ions (e.g. copper, lead, zinc) and hydrocarbons	of the land shall be left in a condition as close as possible to that prior to use. • Maintenance of construction vehicles. • Control of waste discharges. • Guidelines for implementing Clean Technologies. • Maintenance of buffer zones to trap sediments with associated toxins. **Operational Phase** • Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other. • After maintenance, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Ensure maintenance vehicles are in proper order and well maintained. • Control of waste discharges. • Guidelines for implementing Clean Technologies. • Maintenance of buffer zones to trap sediments with associated toxins.
Changing the physical structure within a water resource (habitat)	**Construction Phase** • Other than approved and authorized structure, no other development or maintenance infrastructure is allowed within the delineated wetland and riparian areas or their associated buffer zones. • Demarcate the wetlands and riparian areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas. • Linear developments (e.g. roads) should span the watercourse. • Weed control in buffer zone. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance of the power line and take immediate corrective action where invasive species are observed to establish. **Operational Phase**

Impact	Mitigation Measures
	• Maintenance activities should not take place within watercourses or buffer zones. Where unavoidable, the footprint needed for maintenance must be kept to a minimum. This is subjected to authorization by means of a water use license. • Where possible, maintenance within watercourses must be restricted to the drier winter months. • Maintenance activities should not impact on rehabilitated or naturally vegetated areas.

9.4.3 Conclusions and Recommendations

Kronos-Aries proposed corridors intersect a vast number of watercourses. Although this number reflects the number of watercourses within a corridor and not the total number of watercourses that the proposed line is likely to cross it provides valuable information as to the densities of watercourses within each corridor and thus the corridor with the least amount of watercourses will be the preferred option.

From a wetland and riparian ecological perspective, Corridor 2 is the preferred option due to the presence of an existing powerline and associated infrastructure within the corridor as well as the small amount of wetlands. However the presence of the “no power line zone” (Alkantpan Testing Range) precludes this corridor as a viable option. Deviation 3B which avoids this obstacle is considered as the most preferred as it has the lowest number of wetlands potentially affected.

Corridor 1 has the least amount of drainage lines/riparian area but does however have the highest number of wetlands such as pans within the corridor and is therefore not a preferred option. Corridor 3 is the second preferred option since it has the second lowest number of wetlands. However, Corridor 3 also has various bends within the area of the highest density of drainage lines/riparian areas.

Linear developments such as the proposed transmission line are rarely able to avoid crossing any watercourses whatsoever. Where alternatives have been investigated and watercourse crossings have been shown to be necessary it is important that appropriate mitigation measures are put into place and carefully monitored to ensure minimal impact to regional hydrology.

In the case of the proposed power line mitigation should focus on:

- Rehabilitation / restoration of indigenous vegetative cover;
- Management of point discharges during construction activities;
- Alien plant control activities;
- Implementation of best management practices regarding stormwater and earthworks;
- Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone during construction activities;
- Implementation of appropriate stormwater management around the excavation to prevent the ingress of run-off into the excavation; and particularly; and
- Prevention of erosion and where necessary, rehabilitation of eroded areas.

9.5 AGRICULTURE ASSESSMENT

9.5.1 Key Findings

Soils

Due to the prevailing climatic restrictions (see section 2.2 in the Agricultural Report), the various land type mapping units occurring within the study area were grouped by their overall broad soil pattern. The general soil characteristics are given in table below (the colours correspond to the map units on the map in figure 28). The soils were classified according to MacVicar *et al.* (1977).

Table 31: Broad soil patterns occurring in the Kronos-Aries Study Area

Broad Soil Pattern	Description and main soil characteristics	Dominant soil forms	Dominant soil potential
Ae	Red, freely-drained, mostly structureless soils, not highly weathered, often calcareous. Depth will vary from shallow (<300 mm) to deep (>1200 mm). Some surface rock/calcreete may occur in places	Hutton, Mispah	Low to high (depth dependent)
Ag	Red, freely-drained, mostly structureless soils, not highly weathered, usually calcareous. Depth is diagnostic dominantly shallow (<300 mm). Some surface rock/calcrete/dorbank may occur in places, occasionally plentiful.	Hutton, Mispah	Low (shallow depth)
Ah	Red and yellow, freely-drained, mostly structureless soils, not highly weathered, often calcareous. Depth is usually at least moderately deep (>800 mm). Soil texture is diagnostic sandy (<15% clay).	Hutton, Clovelly	Moderate (sandy texture, very free drainage)
Ai	Yellow, freely-drained, mostly structureless soils, not highly weathered, often calcareous. Depth is usually at least moderately deep (>800 mm). Soil texture is diagnostic sandy (<15% clay).	Clovelly	Moderate (sandy texture, very free drainage)
Db	Non-red duplex soils (where a relatively sandy topsoil overlies (often abruptly) a subsoil clay layer). Soils are often saline and/or sodic, with extensive low-lying areas in the landscape. The soils are also susceptible to erosion if disturbed.	Estcourt, Sterkspruit, Valsrivier, Swartland	Low (erodible, saline)
Fc	Mixed soil pattern, usually shallow (<450 mm), with regular lime throughout the landscape. Surface stones and rock outcrops may occur extensively in places. Soil texture and colour will vary, usually reddish-brown, sandy/loamy soils.	Mispah, Glenrosa, Hutton	Low (shallow, often stony)
Ia	Deep alluvial deposits, usually in low-lying positions, including river floodplains. Soil textures and colours will vary (dependant on depositional mechanisms), but soils are often saline and/or sodic.	Oakleaf, Valsrivier, Swartland	Low to moderate (often saline)
Ib	Much surface rock outcrops (diagnostic >60% of the landscape). Terrain is often steeper than surrounding areas, with shallow (<300 mm) soils, usually reddish-brown, not highly weathered, sandy/loamy.	Mispah, Glenrosa, Hutton	Very low (rock with shallow soils)

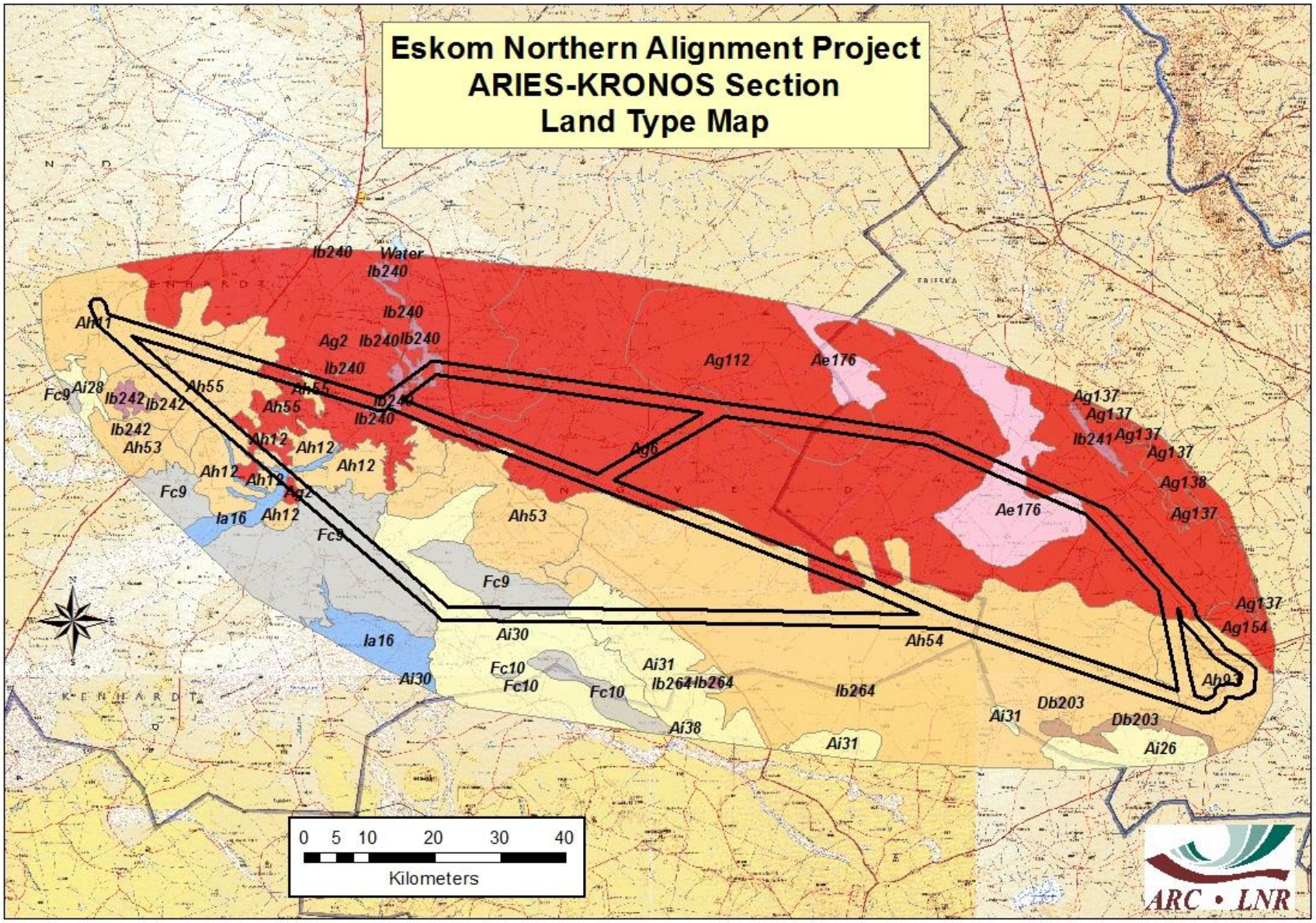


Figure 28: Kronos-Aries Land Types

Agricultural Potential

Most of the soils in the area are shallow, with only limited zones with deeper soils. However, despite potentially favourable soils for cultivation occurring in places, the over-riding restriction is the climatic limitation of the low rainfall and high evaporative loss from the soil surface. This means that the only potential means of cultivation is by irrigation, and the soils and potential irrigation water are likely to be somewhat saline.

Corridor 1

This alternative crosses mainly shallow soils. The only soil patterns where deeper soils might be expected would be the **Ae, Ah** and **Ih** zones, which occur as small areas at the southern (**Ae** and **Ai**) and northern (**Ah**) end. No significant areas of cultivation (especially irrigation) occur.

Corridor 2

This alternative also crosses mainly shallow soils. The only soil patterns where deeper soils might be expected would be the **Ae, Ah** and **Ai** zones, which occur as small areas at the southern (**Ae** and **Ai**) and northern (**Ah**) end. No significant areas of cultivation (especially irrigation) occur.

Corridor 3

This alternative also crosses mainly shallow soils. The only soil patterns where deeper soils might be expected would be the **Ae, Ah** and **Ia** zones, which occur as small areas at the southern (**Ae**) and northern (**Ah**) end. No significant areas of cultivation (especially irrigation) occur.

The dryland (rain-fed) agricultural potential of the whole study area is thus very low. The impact of a transmission line (with a comparatively small footprint) will be comparatively small.

Deviation 3A and 3B

At the scale of the available soil information (1:250 000), the relatively short deviation routes will not make a significant difference to the impacts of any of the alternative routes.

9.5.2 Potential Agricultural Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 32: Analysis of the Significance of Potential Agricultural Impacts (Aries to Kronos – for all Corridors and Deviations) (Paterson, 2013)

Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
Loss of Agricultural Soil	Due to the construction of the transmission line (mainly the tower sites), as well as a parallel adjacent access road.	3 2	3 3	1 1	4 4	3 2	33 20	Moderate	Moderate
Increased Soil Erosion	Due to the loss of surface vegetation and the exposure of bare soil at the surface, again caused by construction activities. This could take the form of removal by *wind erosion* (especially in areas where the topsoil texture is fine and sandy) or by *water erosion* (this will be limited to stream beds and watercourses, but such flash flooding events, though rare, may be severe).	3 2	3 2	1 1	4 3	3 2	33 16	Moderate	Moderate to Low

Table 33: Mitigation Measures (Agricultural)

Impact	Mitigation Measures
Loss of Agricultural Soil	• Avoid, wherever possible, any areas of cultivation, especially areas under irrigation, such as alongside streams/rivers.
Increased Soil Erosion	• minimum amount of vegetation should be removed; • great care should be taken where the transmission line crosses any stream or river course, so that damage to the river banks or adjacent areas is not caused; • all possible soil conservation measures (culverts, run-off channels, amongst others) should be implemented in the construction of access roads (especially in sloping areas); and • Regular monitoring of tower sites and access roads is done to ensure no worsening of soil erosion.

9.5.3 Conclusions and Recommendations

From the information contained in Table 31, as well as the Soil Map (Figure 28), it can be seen that for most of the corridor, the three alternative routes cross similar soil patterns. There is therefore little to choose between the three alternatives as far as soils and agricultural potential is concerned.

The conclusion is therefore: All Corridors and Deviations are equally acceptable.

9.6 VISUAL ASSESSMENT

9.6.1 Key Findings

Landscape Character Sensitivity

The sensitivity of the landscape character is an indication of "the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002).

The uncluttered openness of the landscape is greatly responsible for the simplistic and essentially secluded landscape character. Vast uninterrupted landscapes and vistas are dominated by low growing and low stunted vegetation. The unspoilt, panoramic landscape is an amenity that greatly contributes to the pristine and remote character of the landscape.

The majority of the study area is considered to have high landscape character sensitivity due to the relative undeveloped and pristine condition of the landscape, and the generally high visual quality and associated tourism value. Low terrain variability in the study area and thus a low Visual Absorption Capacity (VAC)[5] can be expected. Generally the vegetation cover is limited to low shrubs and groundcovers, which will provide little to no visual screening for the proposed transmission line.

Previous human induced activities and interventions have minimally impacted the original landscape character. In this case, mining and existing infrastructure, including power lines, roads, amongst others, can be classified as landscape disturbances and elements that cause a reduction in the condition of the affected landscape type and negatively affect the quality of the visual resource.

The following map and photographs are an illustration of the landscape character of the study area:

[5] Explanation of VAC is provided in Section 4.1.3.2 in the Visual Report provided in Appendix M of this Report

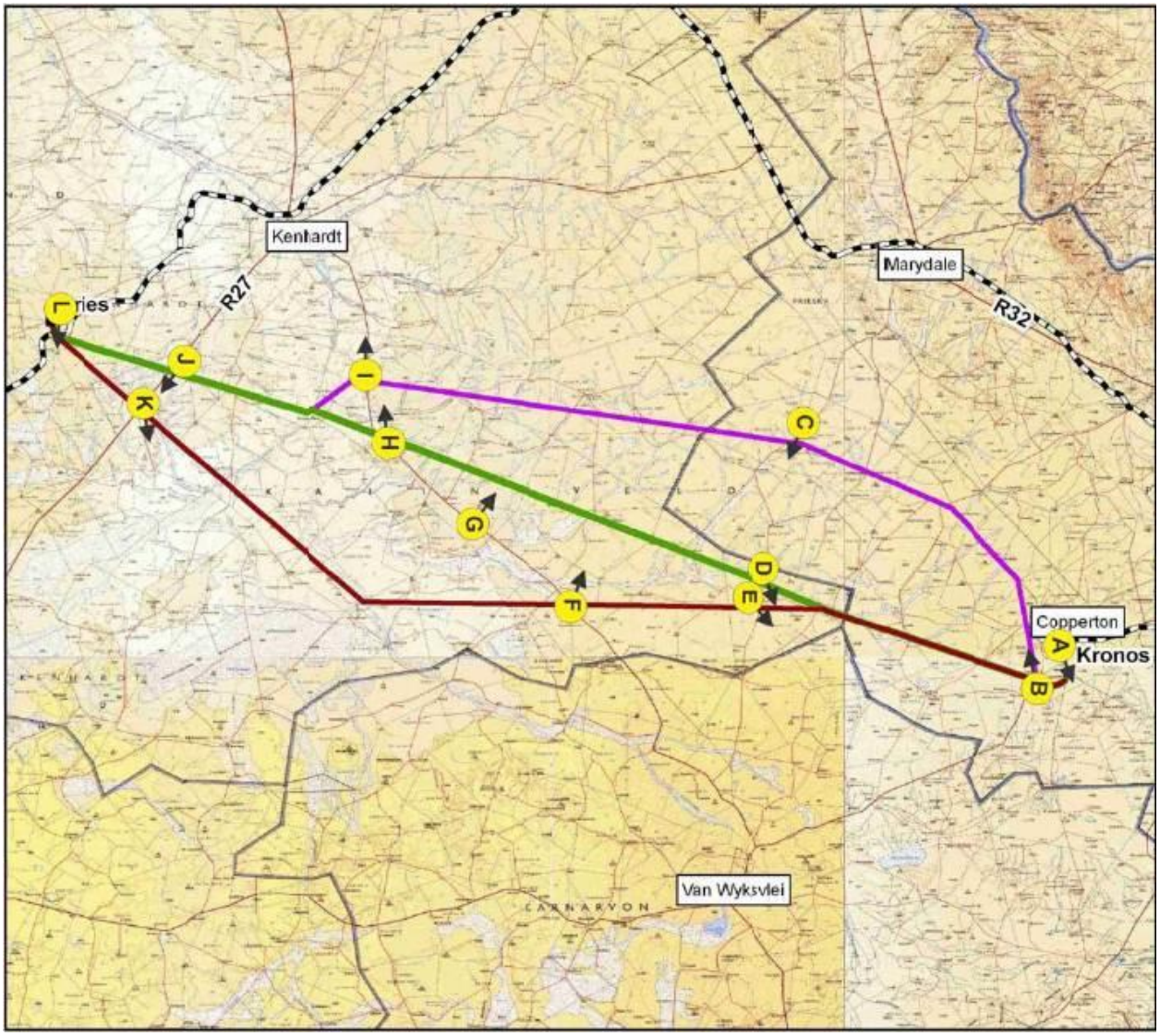


Figure 29: Photo Reference Map

Deviations 3A to 3B were not investigated during field work.

View **A**: View towards Kronos Substation from the R357

View **B**: View from R357

View **C**: View from local road towards Corridor 3

View **D**: View from local road towards Corridor 2

View **E**: View from local road towards Corridor 1

View **F**: View from R361 towards Corridor 1

View **G**: View from local road

View **H**: View from the R361 towards Corridor 2

View **I**: View from the R361 towards Corridor 3

View **J**: View from the R27 towards Corridor 2 and 3

View **J**: View from the R27 towards Corridor 1

View **K**: Aries Substation

9.6.2 Potential Visual Impacts and Mitigations

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types it traverses.

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are: *Residents; Tourists; and Motorists.*

To determine visual receptor sensitivity, a commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys[6].

Empirical research indicates that the visibility of a transmission tower, and hence the severity of visual impact, decreases as the distance between the observer and the tower increases. The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The following Impact Tables provide a summary of the anticipated landscape and visual impacts that may occur as a result of the construction of the transmission line.

[6] The sensitivity of the identified visual receptors is discussed in Section 5.2.1 in the Visual Report dated March 2014 in Appendix M of this report.

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 34: Landscape Impacts (Aries to Kronos) (Axis Landscape - for all three corridors and deviations Architects, 2015)

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	CONSTRUCTION PHASE									
1	Visual quality of the landscape	Due to the presence of foreign elements and a loss of vegetation cover.	3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
2			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	OPERATIONAL PHASE									
1	Visual quality of the landscape	Due to the presence of a power line	2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
2			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3			4 4	3 3	2 2	5 5	3 3	42 42	High	High
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

Construction phase

The activities that are expected to cause landscape impacts and associated with the construction phase, are the establishment of:

- Construction camps;
- Construction of access roads; and
- Clearance of the site.

These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The extent of the disturbances will generally affect a relative small footprint area. Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. During construction, the area around the individual towers will be disturbed.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the severity of the landscape impact. Due to a lack of technical information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in an undeveloped landscape will cause a temporary and localised alteration to the landscape character. A construction camp located in or adjacent to an existing town or settlement will easily be associated with the town and therefore the presence of the town mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is.

Considering the moderately low VAC throughout most of the study area, the undisturbed condition of parts of the landscape and the recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be *moderate for Corridor 1, 2, Deviations 3A and 3B and high for Corridor 3* The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it transects landscape types of varying VAC. Surface disturbances are also minimised through, for example, utilising existing roads.

The *severity of the landscape impact* can however be mitigated to a *low severity* for *Corridor 1, 2, Deviations 3A and 3B and moderate for Corridor 3*. Sensitive placement of the construction camp, limited surface disturbance and prompt rehabilitation are prerequisite conditions if the severity of impact is to be reduced.

Operational phase

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers of the lines, buildings and structures. The industrial character and the near monumental vertical scale of the towers will contrast with the diverse landscape character that prevails through most of the study area.

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 35: Visual Impacts on Residents (Kronos-Aries – for all three corridors and deviations) (Axis Landscape Architects, 2013)

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	CONSTRUCTION PHASE									
1	Construction camp and laydown yard	May cause unsightly views	3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
2			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	OPERATIONAL PHASE									
1	The presence of a power line	Intrudes on existing views and spoils the open panoramic views of the landscape.	2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
2			2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
3			2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

Generally, the study area is sparsely populated except around the human settlements, farms and towns. These communities are normally situated along main transportation routes, near agricultural areas or adjacent rivers or water resources

Residential areas and Farm residents will experience an intrusion on their views due to the presence of the proposed Transmission Line. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

Considering the distribution of residents across the study area, it can be concluded that the entire study area has a low density of residents with the exception of higher concentrations of residents in the towns and human settlements.

Construction phase

During the construction phase, unsightly views may be created by the presence of construction camps and the lay-down yards. The duration of the potential visual impact will be temporary which will result in an anticipated *moderately low* significance of visual impact for all the alternatives. The visual exposure to the construction activity will initially be limited and only local residents will experience views of the site preparation activity. As the structures increase in scale and height, the ZVI[7] increases, resulting in a greater number of affected viewers and a subsequent increase in visual exposure.

The cleared sites, construction camps and material lay-down yard will appear unsightly and out of character. Large scale construction elements such as cranes, will be highly visible and increase awareness of the construction activity over a considerable area. The visual intrusion caused during the construction stage will be moderate, but will be temporary in nature.

Operational phase

The residents of the residential areas and the farming communities next to the power lines may experience a moderate degree of visual intrusion due to their proximity to all the corridors.

The presence of a transmission line in the visual field of the residents in this part of the study area will spoil the uncluttered panoramic views they currently experience. The silhouette of a transmission line on the horizon will be visible from a great distance and thus increase the ZVI considerably, potentially impacting on more residents.

[7] Zone of Visual Influence is the visibility of the proposed power line.

Table 36: Visual Impacts on Tourists (Kronos-Aries – for all three corridors and deviations) (Axis Landscape Architects, 2013)

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	CONSTRUCTION PHASE									
1	Construction camp and laydown yard	May cause unsightly views and spoil the disturbed views over the landscape	3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
2			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3			4 4	3 3	2 2	5 5	3 3	42 42	High	High
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

Corridors	Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
									Without Mitigation	With Mitigation
	OPERATIONAL PHASE									
1	The presence of a power line	Intrudes on existing views of the landscape.	2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
2			2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
3			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low
3A & 3B			3 2	3 2	3 2	2 2	3 3	33 24	Moderate	Low

The study area is renowned for its Karoo and grassland landscapes. These characteristics provide the basis for the tourism industry which plays a major role in the economy of the Northern Cape Province. The entire study area is considered to have a moderately high tourism potential.

The type of tourist that visits this area is expected to travel considerably through the study area by vehicle. This implies that they will experience a large part of the study area in a relative short time span.

Construction phase

The temporary duration of the construction phase is expected to cause some visual impacts, especially Corridor 3. The location, number and size of the construction camps and lay-down yards will be crucial in regulating the impact. It's anticipated that the visual impact will occur localised and that a small number of tourists will be adversely affected by these project components during construction.

Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised.

The potential visual impact on tourists during the construction phase of the proposed project can be mitigated with relative ease except for Corridor 3. The greatest factor to consider is the location of the construction camp.

Operational phase

Considering the extent of the proposed alternatives, a number of tourists will be affected during their visit to the study area. Although it is difficult to pinpoint particular locations in the study area that is of specific tourist value, since the entire study area bears some value. For these tourists, Corridor 3 will create alterations to their views. The presence of a transmission line in this undeveloped landscape will spoil the views that are experiencing. It can be concluded that Corridor 3 will cause a high visual intrusion in the views expected by tourists travelling through the study area**.**

The study area generally has a moderately low VAC which will cause a greater ZVI.
The severity of the visual impact will *be moderate for Corridor 3* and *low for* Corridor 1, 2 and the deviations, causing a *moderate* significant visual impact.

Table 37: Visual Impacts on Motorists (Kronos-Aries – for all three corridors and deviations) (Axis Landscape Architects, 2013)

Impact	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
CONSTRUCTION PHASE									
Construction camp and laydown yard	May cause unsightly views	2 2	2 2	2 2	2 1	3 3	24 21	Low	Low
OPERATIONAL PHASE									
The presence of a power line	Intrudes on existing views and spoils the open panoramic views of the landscape.	2 2	2 2	2 2	2 1	3 3	24 21	Low	Low

The major routes in the study area are the R357, R361 and R27 connecting the towns and informal settlements. The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be low.

Construction phase

The potential visual impact that may be experienced by motorists during the construction phase is considered to be minimal. Limited information is available and the number, location and size of the construction camps and lay-down yard are essential for accurately assessing the visual impact.

The presence of the construction camp and lay-down yard may create unsightly views. Motorists' visual exposure to the impact will be brief and the severity of visual impact will be moderately *low*. The significance of potential visual impact is expected to be *low*.

Operational phase

All the alternative corridors will be visible from the main roads. The severity and significance of visual impact for the proposed alternatives on motorists will be low. The speed at which motorists travel also has a moderating effect on the severity of the visual impact and further reduces visual exposure.

Table 38: Mitigation Measures (Visual)

Impact	Mitigation Measures
GENERAL	• Proceed with construction of the substation during the off peak tourism season; • Where areas are going to be disturbed through the destruction of vegetation, for example the establishment of the construction camp, the vegetation occurring in the area to be disturbed must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation.
ACCESS ROUTES	• Make use of existing access roads where possible; • Where new access roads are required, the disturbance area should be kept as small as possible. A two-track dirt road will be the most preferred option; • Locate access routes so as to limit modification to the topography and to avoid the removal of established vegetation; • Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover; • Maintain no or minimum cleared road verges; • Access routes should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and • If it is necessary to clear vegetation for a road, avoid doing so in a continuous straight line. Alternatively, curve the road in order to reduce the visible extent of the cleared corridor.
TRANSMISSION TOWERS	• Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover; • The preferred type of tower is the compact cross-rope or the cross-rope suspension tower. These two tower types are the most visually permeable and create an extremely low degree of visual obstruction; • Avoid changing the alignment's direction too often in order to minimise the use of the self-supporting strain tower. This tower type is the most visually intrusive as the steel lattice structure is more dense than the other two tower types, hence creating more visual obstruction; • Where practically possible, provide a minimum of 1 km buffer area between the transmission line and sensitive visual receptors; and • Rehabilitate disturbed areas around towers as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil. • Align the route along the foot slopes of hills, mountains and ridges. This is to maximise the backdrop screening effect of the

Impact	Mitigation Measures
	topography that will reduce presenting the Transmission line in silhouette. • Plan the route so that the route crosses existing main routes as close to 90° as possible as this will reduce the time that the line is in the view shed of the passing motorist / viewer. • Align the route through areas of existing visual clutter and disturbance such as alongside railway lines, existing Transmission lines, roads and other visible infrastructure, rather than through pristine or undisturbed areas where possible. However, the cumulative effect of adding to the visual clutter prior to the final placement should be evaluated. • Avoid areas where the current land uses, such as game farm, lodges, etc. often rely on the absence of human visual intrusion. • The galvanising of the tower should be allowed to weather to a matt grey finish rather than be painted silver, as is often the case. This allows the structures to blend in with the existing environmental colours more readily than the silver that is highly reflective especially early morning and late afternoon. Should it be necessary to paint, it is recommended that a neutral matt finish be used.
CLEARED SERVITUDES	• Locate the alignment and the associated cleared servitude so as to avoid the removal of established vegetation; and • Avoid a continuous linear path of cleared vegetation that would strongly contrast with the surrounding landscape character. Feather the edges of the cleared corridor to avoid a clearly defined line through the landscape.
CONSTRUCTION CAMPS AND LAY DOWN YARDS	• If practically possible, locate construction camps in areas that are already disturbed or where it isn't necessary to remove established vegetation like for example, naturally bare areas; • Utilise existing screening features such as dense vegetation stands or topographical features to place the construction camps and lay-down yards out of the view of sensitivity visual receptors; • Keep the construction sites and camps neat, clean and organised in order to portray a tidy appearance; and • Screen the construction camp and lay-down yards by enclosing the entire area with a dark green or black shade cloth of no less than 2m height.

9.6.3 Conclusions

Corridor 2 is regarded as the most preferred alternative. Its alignment along the existing transmission line and transmission servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The impact of Corridor 2 on visual receptors varies between residents, tourists and motorists. Corridor 2's great advantage lies in the less significant visual impact on tourists and residents as compared to the other alternatives. The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable.

9.7 ECOTOURISM ASSESSMENT

9.7.1 Key Findings

Tourism Products and Services within Proposed Kronos-Aries Study Area

Verneukpan

Verneukpan is a widespread dry salt pan south of Kenhardt, between Swartkop and Diemansput in the Northern Cape, South Africa. Verneuk is Afrikaans for to trick, mislead or swindle. The pan is ideal for aerotowing operations as you can launch and land in any direction. During the seasons many birds flock to the pans, when they contain water. The surface is completely flat, claimed to be estimated 57 km long and 11 km wide.

The pan is undoubtedly the ultimate kiting destination in South Africa. The widespread open spaces offer ideal opportunities for parasailing. The pan is also used by kite-surfers, an extreme sport using wind buggies. These are bicycle-like vehicles with a sail attached to them. With wind buggies speeds of up to 70 kilometers per hour can be reached. There are also many viewpoints that are ideal for bird watching.

Figure 30: Activities on Verneukpan

Figure 31: Corridor Alternative 1 in context of Verneukpan

Copperton

Copperton was a mining town in the central Karoo region of South Africa. The area was well known for copper and zinc mining. Copperton was operating optimally between 1970 and 1991. The town housed approximately 3000 workers and their families. Amenities included a school and recreation facilities, including a golf course. Mining stopped in 1991 and the mine was closed. Denel now operate a missile testing facility in Copperton which brings people to the area. The 2011 census found that only 57 inhabitants live in the small town.

Attractions/Amenities/Locations	Photographic description
Open Landscapes/Hunting farms: - Pristine, natural environment in most the study area. - Ecotourists love wide open, pristine spaces. - A small number of game/hunting farms also occur in the area.	
Architecture - The Karoo Region is well known for its interesting architecture. - The numerous villages and homesteads in the area are a tourism attraction on their own.	

Other Tourism Attractions in Study Area

Olifantsvlei - Popular site for photographers. - Stunning views during rainy season.	
Good quality accommodation - Good quality accommodation is available in Copperton. - Visitors to the area may require overnight accommodation in the area.	
Camping at Verneukpan - Verneukpan provides the only formal camping grounds in the study area. - Facilities are very basic but the focus of visitors is more on the activities than on the accommodation.	

The below map provides special information on the location of the various well known tourism attractions in the study area and its surrounds:

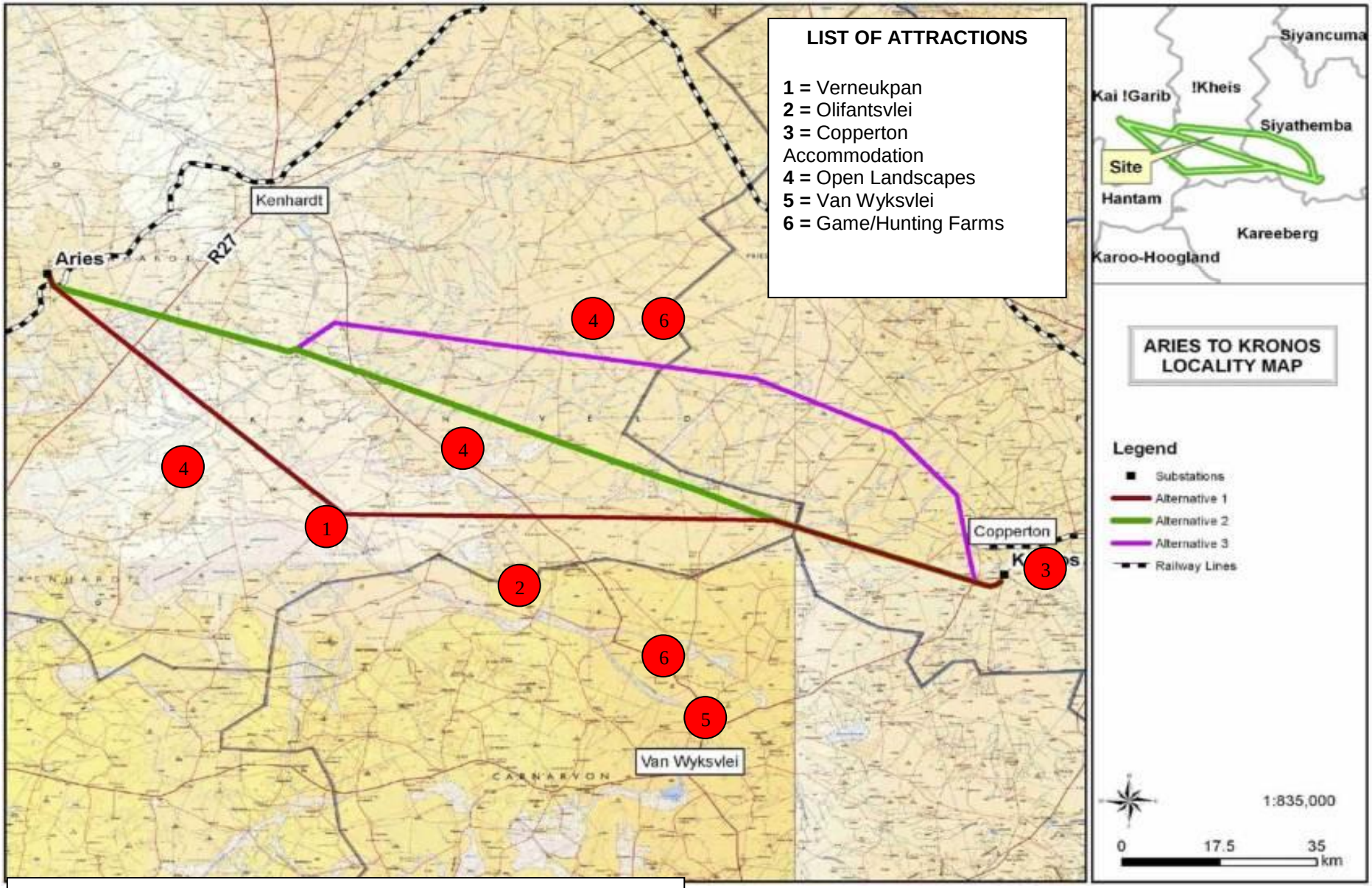


Figure 32: Tourism attractions in Kronos-Aries Study Area

9.7.2 Potential Ecotourism Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 39: Impacts on Existing Ecotourism Products/ Attractions (Milburn, 2013)

Activity	Nature of impact	Magnitude of impact	Duration of impact	Extent	Reversibility	Probability	Ranking	Significance without mitigation	Significance with mitigation
Construction Phase									
Alternative 1	Construction camp, lay down areas and activities may impact existing tourism products/ accommodation establishments in the study area.	3 1	2 2	2 2	3 3	5 4	50 32	High	Moderate
Alternative 2		2 1	2 2	2 2	3 3	3 1	27 8	Moderate	Low
Alternative 3		4 3	2 2	2 2	3 3	5 3	55 30	High	Moderate
Operational Phase									
Alternative 1	The presence of a power line has a negative impact on the value of tourism offerings in the study area and therefore a potential impact on income for product owners.	3 1	5 4	2 2	5 3	5 4	75 40	Very high	High
Alternative 2		2 1	4 3	2 2	3 3	3 1	33 9	Moderate	Low
Alternative 3		4 3	5 4	2 2	5 3	5 4	80 48	Very high	High

Table 40: Impacts on future expansion of protected areas (Milburn, 2013)

Activity	Nature of impact	Magnitude of impact	Duration of impact	Extent	Reversibility	Probability	Ranking	Significance without mitigation	Significance with mitigation
Construction Phase									
Alternative1	Construction camps, lay-down areas and construction activities would have an impact on existing Protected areas and the areas identified for the expansion of protected areas.	2 1	2 2	2 2	3 3	2 1	18 8	Moderate	Low
Alternative 2		2 1	2 2	2 2	3 3	1 1	9 8	Low	Low
Alternative 3		3 2	2 2	2 2	3 3	2 1	20 9	Moderate	Low
Operational Phase									
Alternative 1	The presence of a power line has a negative impact on the value of conservation worthy areas which are to be included in Protected Area Expansion.	3 2	5 4	2 2	5 5	2 2	30 26	High	Moderate
Alternative 2		2 1	5 4	2 2	5 5	1 1	14 12	Low	Low
Alternative 3		3 2	5 4	2 2	5 5	3 2	45 26	High	Moderate

Table 41: Mitigation Measures (Ecotourism)

Impact	Mitigation Measures
Impacts on Ecotourism Products	Establish an ecotourism/conservation forum for the project by engaging with all tourism associations (local and provincial) to ensure that ongoing communication is provided to all role players and to ensure that all ecotourism products are aware of the construction timeframes. This will enable ecotourism destinations to plan accordingly in terms of occupancies and potential down times. Conduct construction activities within the off-peak tourism seasons and outside of the hunting season which has been established for the Northern Cape Province. It should be noted that the hunting periods differ on a species specific basis but the main hunting periods are from April to September. Provide dedicated contact point for the purpose of providing an opportunity for product owners to obtain information on the project and to provide information on impacts or problems on an on-going basis. A response structure should also be setup to support this contact point. This will enable localized impacts to be mitigated more effectively and efficiently. All impacts on fauna or flora within high conservation/ecotourism value land should be rehabilitated immediately to a completely natural state. This should be done by managing removed vegetation in a manner which can be re-planted. Compile booklets which interpret the project and where the power is going and what value the project is adding to the local and provincial economy. Very often, when eco-tourists see the value in a development project, they are willing to accept the associated impact on the environment.
Impacts on Establishment and Expansion of Protected Areas	Engage with SANParks and Provincial conservation authorities to ensure development within proposed conservation areas is managed accordingly. Annual meetings with relevant stakeholders should be conducted to obtain updated management guidelines and expansion strategies (Preferably in GIS format) Implement management guidelines and action items in terms of the relevant management plan of the Protected Area in question.

9.7.3 Conclusions and Recommendations

Of the three alternatives, Corridor 2 is considered the most preferred alternative from an ecotourism perspective. Corridor 2 follows existing transmission line and transmission servitude and therefore will not create an additional visual impact during operation phase. All ecotourism products will be adapted to this impact already. Corridor 3 will have a visual impact on existing game farms and hunting farms in the region. It will also have an impact on the visual character of the area for tourists passing through the region.

The ecotourist specialist therefore recommends that the project proceed on condition that Corridor 2 is selected as the preferred alternative and developed accordingly. Should the mitigation measures be implemented as discussed, there is no reason why this project cannot proceed. No fatal flaws from an ecotourism point of view were identified.

9.8 HERITAGE ASSESSMENT

9.8.1 Key Findings

Below is a locality map of the proposed development indicating heritage sites within the study area:

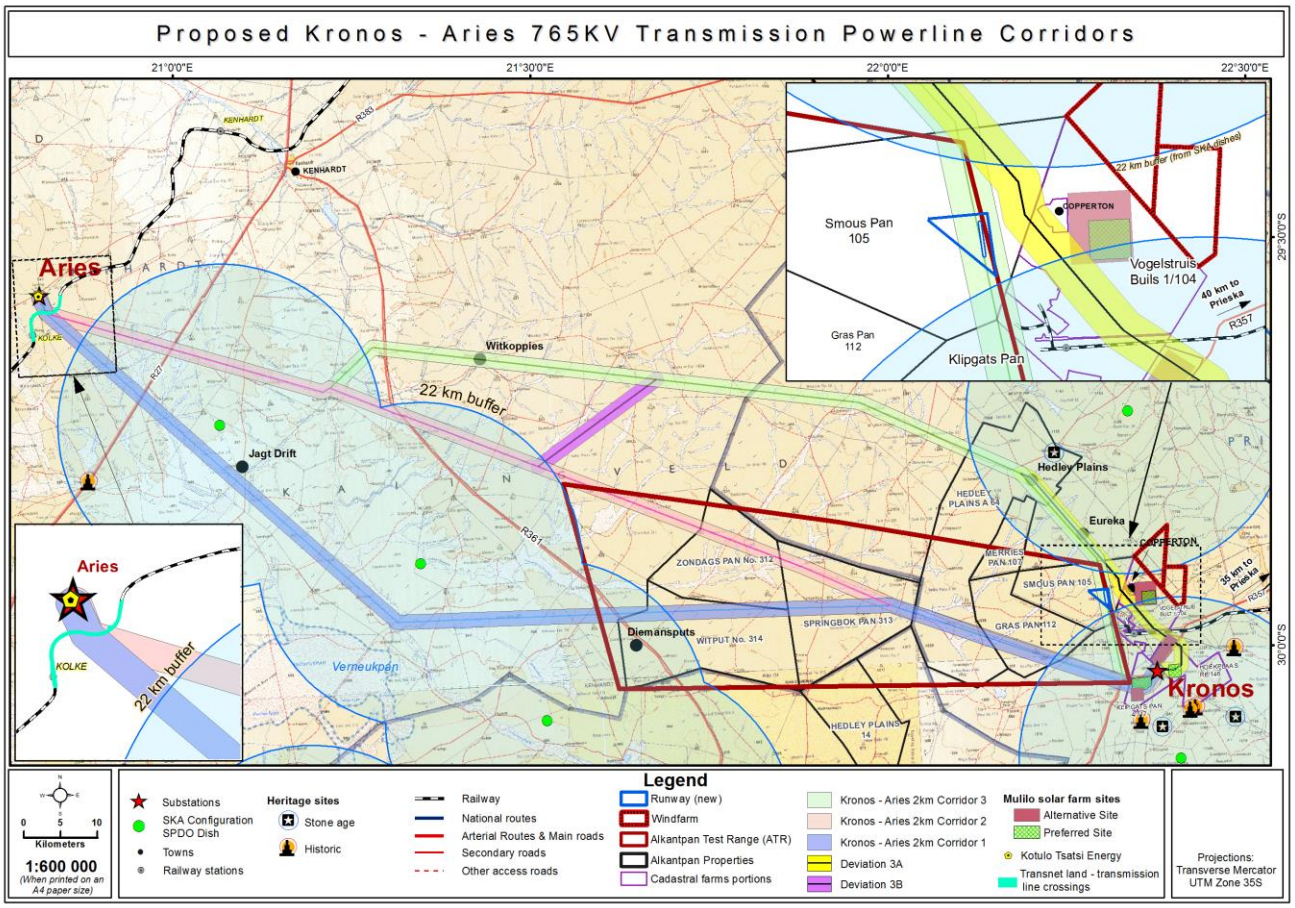


Figure 33: Map showing the location of identified heritage sites in the study area

Please note: Below is an excerpt of the "*Archaeological context for the Stone Age of the Northern Cape, Bushmanland and Namaqualand"* taken from the Heritage report. Only the relevant areas of the study area are included in this report. The detailed context of the whole region is provided in Section 5.2 in the Heritage report (Appendix M).

"The Northern Cape and Namaqualand, that includes the area known as Bushmanland, are arid regions with limited sources of surface water (Mitchell 2002). The territory occupied by Bushmanland broadly lies south of the Orange/Gariep River stretching to the west of Kenhardt and east of Springbok in Namaqualand. A widespread presence of hunting-gathering and herder groups within these regions has been documented by early travellers with the data often applied to identify historical territorial ranges (Burchell 1812; Campbell 1815, 1822; Stow 1872,

1910; Bleek & Lloyd 1911; Mossop 1935; Engelbrecht 1936; Arbousset & Daumas 1968; Lye 1975; Dunn 1978; Deacon 1996).

Earlier (ESA) and Middle Stone Age (MSA) lithics occur over most of the surface area with a more recent presence of Later Stone Age (LSA) occupations (Beaumont et al. 1995). The region in general contains very numerous small shallow pans, also known as dolines, of 100 to 200 m in diameter but also many larger pans. Areas around pan environments tend to display higher densities of lithics (Morris 2005b; van der Ryst & Küsel 2011, 2012).

Stone circles have also been recorded in this area. These features may represent residential structures being the bases of huts or windbreaks, storage structures, stock enclosures or hunting blinds (Kinahan 1986; Noli & Avery 1987; Parsons 2004; Jacobson 2005; Veldman 2008; Orton 2012a-c). These low structures are not well studied but some research has been undertaken further east along the Orange River (Sampson 1968), in the Seacow Valley in the eastern Karoo (Sampson 1986), at Bloubos northwest of Upington (Parsons 2004) and in Namibia (Veldman 2008). Stone circles have recently also been discovered at De Aar in the central Karoo (Orton 2011c).

Pastoralist communities that herded sheep, goat and cattle and speaking Khoe languages were well-established in these regions (Mitchell & Whitelaw 2005). Substantial herder encampments occur along the Orange River floodplain (Morris 2013a).

Beaumont et al. (1995) found differences in the geographical distribution of LSA hunter-gatherer localities and the herder sites of pastoral groups. Beaumont et al. (1995) were of the opinion that increasing pressure brought about by the presence of herders in the Orange/Gariep River Basin resulted in the displacement of hunters to marginal areas such as Bushmanland. This came about largely in the last millennium when the archaeological remains of hunting and gathering settlements are commonly found near water sources (Morris 2011c)."

1:50 000 Topocadastral Map Survey

- **2920BD GROOTRIET:** No data found.

- **2920DB SONDERHUIS**

According to Pelser (2011) the Olyvenkolk contains fairly large numbers of ESA and MSA tools over a large area with some concentrations of medium to high significance, e.g. GPS Location: S 29 29 38.1; E 20 47 20.6. Mitigation measures suggested in the 2011 report for sites that would be impacted upon by the development were undertaken during February 2012 during a Phase 2 (Lombard & Pelser 2012). Pelser (2012) subsequently assessed another part of the farm, Klein Zwart Bast 188. According to Pelser (2012: 17) *'[t]The assessment of the new expanded area for the Photo-Voltaic Solar Power Generation Plant on Klein Zwart Bast revealed that the whole area covered by the dwyka tillite material can be viewed as one Stone Age landscape, and that the area is generally homogenous in this sense. Individual sites cannot really be discerned, and it is clear that the area was utilized from the Early right through to Later Stone Age periods'*.

Halkett and Orton (2011a) found several weathered bifaces at Olyvenkolk whereas most of the other lithic occurrences were MSA. Morris noted in 2006 that the Dwyka tillites near Olyvenkolk and Klein Zwart Bast were sources of raw materials for ESA tools (Webley & Halkett 2012a). Whereas some weathered ESA tools on hornfels were recorded by Webley and Halkett (2012a), most of the lithics are from the MSA. Flaked products included flakes and blades (some with retouch), chunks and cores, were made on quartzite, banded ironstone and CCS. Morris (2013a) also mentions MSA sites from Olyvenkolk, southwest of Kenhardt and Maans Pannen, east of Gamoep. The ESA lithics at these localities are weathered Victoria West cores on dolerite, long blades and a very low numbers of handaxes and cleavers.

- **2921CA Kokerberg:** No data found.
- **2921CC Verneukpan (Noord):** No data found
- **2921CB Latrivier:** No data found.
- **2921CD Nooitgedact:** No data found.
- **2921DA AngelierspaN:** No data found.
- **2921DB Arcadia:** No data found.
- **2921DC Sondagspan:** No data found.
- **2921DD Springbokpan:** No data found.
- **2922CA Kraanvoëlpan:** No data found.
- **2922CC Kielder**

Kaplan & Wiltshire (2011) conducted an AIA on this locality and the adjoining map area. At 2922CC Kielder lithic knapping was recorded at the Smous Pan locality (Figure 33 landing strip, for the Smouspan sites that were impacted). Mainly MSA lithics, accompanied by evidence for *in situ* knapping, were recorded at Smouspan. On the SAHRIS website is a reference to SMOUS1 where 'a dark quartzite rock and associated flakes were found relatively *in situ* on top of a hard packed Aeolian surface. It was possible to refit some of these flakes onto the core'. According to the report (Kaplan & Wiltshire 2011:21) *'[a]lmost every single quartzite outcrop on both Smous Pan 105 and Struisbult had evidence of flake scarring. No engravings were found on any of these outcrops. These quarries have not been set aside from development as they are ubiquitous and sufficient quantities of similar examples will be retained where the turbines are not placed and on neighbouring properties. These sites have been rated as 3B: Local – medium significance*'. A permit for development is pending (SAHRIS 2013-04-30).

- **2922CD Copperton**

This is an important area where care should be taken in the positioning of future infrastructural development. Several AIAs recorded heritage resources (Kaplan 2010; Van Schalkwyk 2011a; Orton 2012a, 2012b).

Kaplan (2010) found mainly LSA lithics in low-density and some diffuse scatters. No workshops were identified. He was of the opinion that sufficient recordings were made during the AIA of the

lithics. These comprised mainly large flakes, cores, chunks, end scrapers, large utilized and retouched blade tools, and utilized and retouched flakes in fine grained quartzite, highly weathered hornfels and indurated shale. Several formal tool types such as adzes, scrapers, retouched and utilized flakes, bladelets were recorded.

Van Ryneveld (2006) found no heritage resources on portions of the 2922CD and 3022AB maps during her investigation for the reopening of the old Copperton Mine. Orton (2012a-c) observed good visibility for archaeological features during his surveys of the generally flat area with uphill slopes, pan sites and silty deflation hollows that fill with water after rains.

Kaplan and Wiltshire (2011) documented ESA with weathered handaxes and some MSA and LSA sites near pan environments. At Modderpan on Struisbult densities of up to 50 artefacts and more per square were documented. The site has been graded as 3A – local, high significance. The MSA includes large flakes, radial and bipolar cores, points, end scrapers, large utilized and retouched blade tools with utilized and retouched flakes on quartzite, hornfels, banded ironstone, haematite, gneiss and vein quartz. The LSA exhibits lower densities. Direct manufacturing activities for LSA lithics were recorded at exposures of quartzitic bedrock and on boulders of vein quartz (Kaplan & Wiltshire 2011). Similar findings were noted in the AIA report for Nelspoortje (Farm 103, Portions 4 and 5 and Hoekplaas 146) near Copperton where significant MSA and LSA lithic occurrences and also lithic quarries were identified during the survey for the Garob to Kronos line (Van der Walt 2013).

Van Schalkwyk (2011a) documented surface MSA and LSA lithics on or at the foot of small hills. He proposed the avoidance of such areas through buffer zones. In the event that the localities are impacted upon by proposed development, Phase 2 mitigation should be undertaken under a permit from SAHRA.

On Vogelstruis Bult 104 Orton (2012a) recorded discrete sites with LSA occupations and with a background noise of ESA and MSA lithics. Several dense scatters of lithics have also been recorded. The author assigns low significance to most occurrences but recommend that some of the LSA with high significance should be mitigated in the case of future impact (Orton 2012a). The LSA localities tend to focus on pan environments, for example Perdepan (Orton 2012a). An engraving site along the road between Copperton and Van Wyksvlei was recorded. The rock art comprises scraped engravings of eland and ostrich as well as very recent (historical) images of horses with riders, a chariot and some writing (Orton 2012a).

At Hoekplaas (Orton 2012b) notes background scatters of ESA and MSA artefacts that he rated of very low archaeological significance. There are three pans with several discrete LSA sites around the central pan. Gravel has been quarried at the pan, revealing a buried MSA deposit. In view of this observation Orton (2012b) points out the probability of other important subsurface material close to pan environments.

At Klipsgat Pan (Orton 2012c) again recorded scatters of ESA and MSA artefacts that he rated of very low archaeological significance. For the large number of discrete LSA sites recorded around ephemeral pans and the hill Orton (2012c) suggested mitigation measures in the event that they are impacted by future developments.

Kiberd (2006) excavated at Bundu Pan (29°45'05"S; 22°12'25"E) on the eastern edge of Bushmanland approximately 25 to 30 km northwest of Copperton and to the east of Prieska.

Stratified ESA, MSA and LSA deposits were found. A range of Pleistocene fauna include some extinct species such as a giant hartebeest (Kiberd 2006).

- **3022AA Halfweg:** No data found.
- **3022AB Springbokpoortje:** No data found.

ARCHAEOLOGICAL SITES

NHRA Category:	Archaeological and palaeontological sites
Protection status:	General Protection - Section 35: Archaeology, palaeontology and meteorites
Significance:	High on a regional level – Grade III

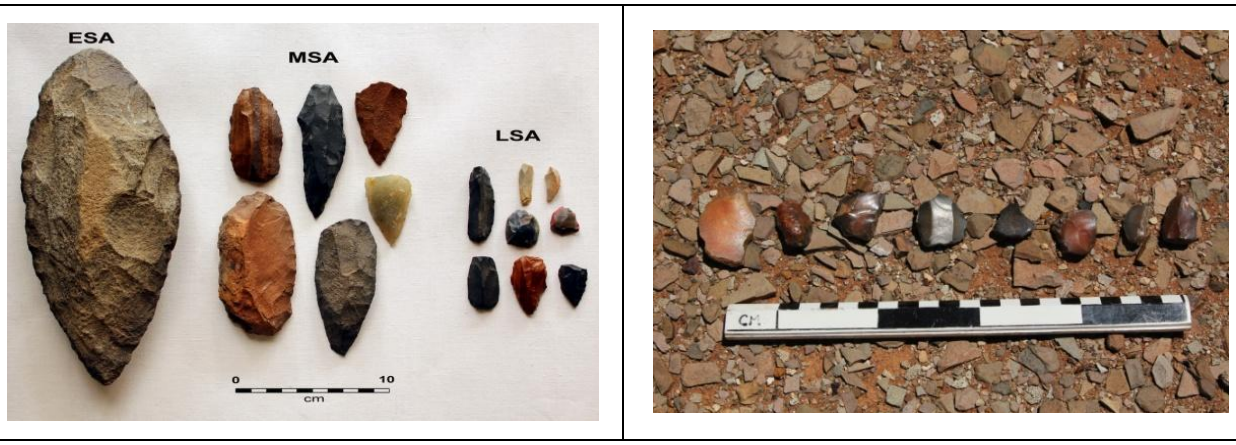


Figure 34: Stone tool typology and flake dating to the Middle Stone Age identified in the region

The stone tools (on the left) are not from the region and are only used to illustrate the difference between Early (left), Middle (middle) and Later Stone Age (right) technology.

BUILT ENVIRONMENT

These are complex features in the landscape, being made up of different yet interconnected elements. Fortunately transmission lines do not usually impact on towns. Most towns in the region have, according to various databases, about 20 buildings that are listed to be of provincial heritage significance.

NHRA Category:	Buildings, structures, places and equipment of cultural significance
Protection status:	General Protection - Section 34: Structures older than 60 years
Significance:	High on a regional level – Grade III

Figure 35: Buildings found in an Urban Area

FARMSTEADS

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

NHRA Category:	Buildings, structures, places and equipment of cultural significance
Protection status: General Protection - Section 34: Structures older than 60 years	
Significance:	High on a regional level – Grade III

Figure 36: Examples of farmsteads and farming related features identified in the region

CEMETERIES

Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important 'documents' linking people directly by name to the land.

NHRA Category :	Graves, cemeteries and burial grounds
Protection status :	General Protection - Section 36: Graves or burial grounds
Significance :	High on a local level – Grade III

Figure 37: Local cemeteries

PUBLIC MONUMENTS

Although most of these usually occur in urban areas, some also occur in rural areas where some event of significance took place.

NHRA Category:	Buildings, structures, places and equipment of cultural significance
Protection status: General Protection - Section 37: Public Monuments and Memorials	
Significance:	Medium on a regional level – Grade III

Figure 38: Monuments in Town and Rural Area

INFRASTRUCTURE AND INDUSTRIAL HERITAGE

In many cases this aspect of heritage is left out of surveys, largely due to the fact that it is taken for granted. However, the land and its resources could not be accessed and exploited without the development of features such as roads, bridges, railway lines, electricity lines and telephone lines, as well as industries that exploit locally available resources.

NHRA Category:	Buildings, structures, places and equipment of cultural significance
Protection status: General Protection - Section 34: Structures older than 60 years	
Significance:	High on a regional level – Grade III

Figure 39: Extensive salt works on Galputs (Photo: Google Earth)

HERITAGE ASSESSMENT CRITERIA AND GRADING

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

Grade I: Heritage resources with qualities so exceptional that they are of special national significance

Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and

Grade III: Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable of mitigation measures would allow the development activities to continue.

In terms of Section 7 of the NHRA, the sites currently known or which are expected to occur in the study area are evaluated to have the following significance:

Stone Age sites are viewed to have medium significance on a regional level and have Grade III significance.

Farmsteads are viewed to have medium significance on a regional level and have Grade III significance.

Graves and cemeteries are viewed to have high significance on a local level and have Grade III significance.

9.8.2 Potential Heritage Impacts and Mitigations

Scoring Without Mitigation = **(NM)** Scoring With Mitigation = **(WM)**

Table 42: Analysis of the Significance of Potential Heritage Impacts (Kronos-Aries – for all three route corridors and deviations) (Van Schalkwyk, 2013)

Environmental Parameter	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
Pre Colonial Stone Age Sites	Many sites are still unknown. Their potential and significance therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. tower positions or access/ inspection roads	3 2	3 3	2 2	5 5	3 3	39 36	High	High
Colonial Period - farmsteads	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole	3 3	3 3	2 2	3 3	2 2	22 22	Moderate	Moderate
Colonial Period - cemeteries	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole	2 2	3 3	3 3	3 3	2 2	22 22	Moderate	Moderate

Table 43: Mitigation Measures (Heritage)

Impact	Mitigation Measures
Stone age sites	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. Sites that cannot be avoided should be excavated in full by an archaeologist qualified in Stone Age archaeology.
Colonial Period - farmsteads	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.
Colonial Period - cemeteries	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

9.8.3 Conclusions and Recommendations

The following heritage sites were identified in the larger region:

Pre-colonial archaeological sites dating to the Stone Age have been identified to occur in the region of study area. In most known cases the impact of the development would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.

Colonial period heritage manifest in a wide variety – farmsteads, infrastructure and cemeteries. As the power line is to cross a rural landscape for the most part, the impact would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.

As an evaluation of the three route corridors and deviations, it can be concluded that the impact of the proposed development on sites, features or objects of cultural heritage would be low. The reason is that cultural heritage sites are distribute sparsely in the region. Secondly, power lines usually have less of an impact than for example mining developments.

From a heritage point of view there are no fatal flaws that would prevent the proposed development from taking place in any of the corridors and deviations. However, having said that, it must be remembered that heritage sites are not only fixed features in the environment, occurring within specific spatial confines, but they are also finite in number. Avoiding of impacts on sites is therefore the preferred form of mitigation. In areas where a high density of sites occurs, if at all possible, exclusion zones where no development is to take place, should be set aside. If that is not possible, mitigation can only be achieved through archaeological investigation.

As the exact coordinates for the power line and the individual tower structures are not yet available, it is difficult to determine what the final impact of the proposed development would be. Therefore, for the project to continue, the following is proposed:

- Mitigation should be based on avoiding of sites rather than anything else. To achieve this, a full “walk down” of the selected corridor must be done prior to construction taking place, to document all sites, features and objects, in order to propose adjustments to the routes and thereby to avoid as many impacts as possible.
- In addition, the management measures (included in the EMPr) should be implemented prior to construction taking place.
- No impact on heritage sites, features or objects can be allowed without a valid permit from SAHRA.

9.9 SOCIO-ECONOMIC ASSESSMENT

9.9.1 Key Findings

Project Regional Impacts
The impacts, (*which were also the findings of this assessment*) were determined based on the amount of land that would be taken out of production as a result of the project, and the resulting loss in agricultural output, value, employment, and income.

The impacts of these corridors on agricultural output, value, employment, and income are summarised below:

Agricultural Output & Value: A total of about 221 hectares of land would be taken out of production (from land used for construction of towers). This would translate to a loss 179 ha of cultivated land or loss of R8 million in agricultural output per annum.

Table 44: Socio-economic - Agricultural Impacts

AGRICULTURAL IMPACTS	
KRONOS-ARIES, 2014	
Item	**Impact Value**
Hectares (total)	221
Hectares (cultivated)	179
Rand Value 1/	R 8,064,652
Sources:	NDA, Statistics SA and ADEC.

Employment & Earnings: Up to one full-time agricultural job would be lost as a result of development in this section of the power line corridor. However, there would be an impact of R15,000 on employee earnings. Some of the unskilled workers would carry most of this nominal impact, with a loss of R3,500 in earnings per year. The greatest impact would be on casual & seasonal workers, at R10,000 per annum. Skilled workers would be the least impacted. Impacts on employment and earnings are summarised below.

Table 45: Socio-economic - Employment Impacts

AG. EMPLOYMENT IMPACTS,		
	KRONOS-PERSEUS, 2014	
Category	**Number**	**Earnings 1/**
Skilled	0.13	R 4,584
Unskilled	0.22	R 8,043
Casual & seasonal	0.32	R 11,688
TOTAL	**0.7**	**R 24,316**
Note:	1/, based on current monthly	
	earnings of R3,000 per month.	
Sources:	NDA, Statistics SA & ADEC.	

Limitations

There are a number of caveats relating to these impact estimates. First and foremost, it must be emphasized that these total regional impacts are based on *average* production and value data for the Impact Area and its component magisterial districts. Thus, *this regional data does **not** represent the specific impacts to any individual farmers, producers, or property owners*. No data or information was collected from individual farmers, producers or property owners for the purposes of this regional analysis, which lacked scope and budget for more detailed analysis of impacts on individual farms or land holdings. Second, because the impacts are based on averages, they draw from the existing mix of products, output and value assigned based on the survey data collected by Statistics South Africa in its latest Agricultural Census. Thus, the mix of products along the power lines corridor represented in these numbers is assumed to be equivalent to the mix of products in 2007 within each of the specific magisterial districts in the Impact Area. Obviously, there would be variation in the amount of land in production, the types of products, output generated, and value of products throughout the power line corridor that may not equate exactly to these factors in the magisterial districts' overall.

LOCAL AREA IMPACTS

The local area uses would be impacted to varying degree but would generally not be severely disrupted. The productivity and/or performance of livestock farming would be unscathed while crop and game farming would be impacted somehow. These local area impacts are elaborated below.

Livestock Farming: The only noted concern is disturbance and intrusion into stock farms during the construction phase of the proposed power lines. It is expected that Eskom and allied personnel would access and drive through farm properties leading to incidences of leaving farm gates open and resulting in animals escaping from secured areas. Of course, cases of animal theft cannot be ruled out, and are likely to manifest over time. It is important to note that stock farms can continue to operate under power lines, and this is already happening in the area.

Crop Farming: Crop farming under irrigation would be affected where the power lines disrupted centre pivots, irrigation infrastructure and aerial spraying programmes. In such cases, farms lying in the path of the power line corridor could be taken out of production leading to loss of output and employment. The area's high land values for irrigation farming and game farming would be reduced to grazing land values, while all investment and infrastructure installed on the farms would become less useful. It must be noted that crop and game farms are situated in localised areas and not across the entire stretch of Aries-Kronos Section.

Game Farming: Game farming is likely to be affected in relation to animal breeding and game hunting activities. The farm base is small in relation to the number of livestock farms, and these are situated in a few places. The impacts would be borne more by game hunting than game breeding.

TOURISM ECONOMIC IMPACTS

The construction and operation of power lines through the corridor will establish a visual presence for the power infrastructure in an area that otherwise lacks major visible utility infrastructure. That being said, the lack of nature-based tourism attractions and other forms of tourism activity or travel corridors through this section suggests that the imposition of new power lines would have limited effect on existing tourism activity.

Verneukpan

As illustrated below, Corridor 1 may come relatively close to the edge of the Verneukpan tourism site, located between Kenhardt and Zwartkop. An admittedly inexact and non-substantiated measure suggests that the "elbow" in Corridor 1 could skirt as close as two or three kilometers from the pan. Without direct field reconnaissance and/or computer simulation, it would be nearly impossible to determine whether there would be any visual disturbance at various view sheds of the pan, either from the edge of the pan or from within the pan itself. Given the extremely flat topography of this area, however, it is possible that there could be some moderate visual disturbance caused by the power line, at least at this "elbow" location, to the view shed on the north-eastern third of the pan.

Verneukpan attracts primarily extreme sports and adventure tourists, due to its extreme conditions and not specifically because of its scenic or natural beauty. Power lines and other visual disturbances do not necessarily ruin the visitor experience for sports enthusiasts. However, there is an important element to marketing Verneukpan that relates to its extreme isolation (or the perception of such), and its distance from settlements, urbanization, and human activities. Even passing under the power lines en route south from Kenhardt will remind visitors of the presence of human activity. Thus, the presence of power lines could distract from the overall marketing of this extreme isolation experience.

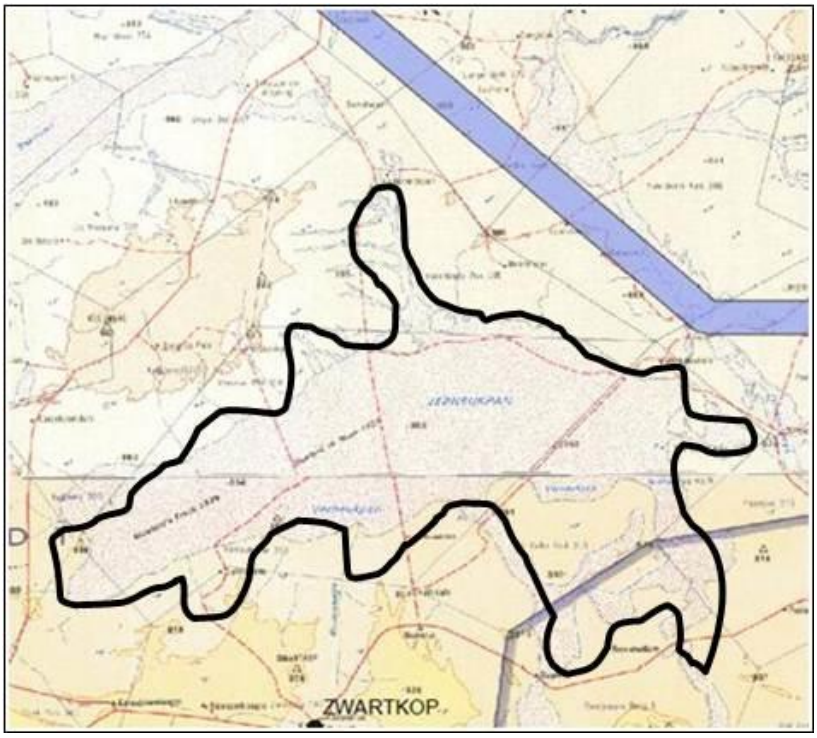


Figure 40: Corridor 1 in proximity to Verneukpan edge

The Kronos-Aries section has small settlements situated around farmsteads or along the rail line. None of these settlements has significant urban infrastructure, and they mainly serve as farmsteads. The several settlements near the power line corridor are described below.

URBAN SETTLEMENT ECONOMIC IMPACTS

Kenhardt

Located about 30km north of the proposed Aries substation and proposed power line . Thus, the town is situated outside of the primary impact area of the power line. Kenhardt is one of the most remote settlements in the Northern Cape and in all of South Africa. The town forms part of Kai !Garib Local Municipality, in Siyanda District.

Demographic base: Kenhardt population was 4,843 in 2011, based on the most recent Census. The town had 1,167 households, yielding an average household size of 4.1 (assuming there is no group housing in the town). According to the Census, a total of 829 people were employed versus 479 unemployed, yielding a relatively high unemployment rate of 36.6%.

Landuse and economic activity: Agriculture is the main economic activity in the surrounding area, with farming concentrated within a green belt along the Hartbees River, itself irrigated by Rooiberg Dam. The river system sustains sweet thorn trees, endemic to the area. Kenhardt lies at the heart of the Dorper sheep-farming region. Kenhardt offers air transport services though Kenhardt Aerodrome. There are tourist attractions in the area, including those identified earlier in this report, along with tourist services such as hotels and retail establishments. Seven local

lodging facilities can accommodate up to 113 visitors in hotels (e.g, Kenhardt Hotel, located in the town centre) and self-catering facilities.

Copperton

A mining town located about five kilometres east of Corridor 3, close to the proposed Kronos Sub-station. The town is situated in the central Karoo region and forms part of Siyathemba Local Municipality (in Pixley ka Seme District, Northern Cape).

Demographic base: The population of Copperton was only 59, occupying 37 households, according to the 2011 Census. The number of people employed in Copperton was reported to be 14, with only 3 unemployed, in 2011.

Landuse and economic activity: Copperton was formerly a copper and zinc mining centre which, at its peak between 1970 and 2000, hosted about 3,000 workers. Much of the mining activity has since disappeared. The former mine at Copperton is currently used by Denel as a missile test site. This activity utilizes the few mining buildings that remain. As a result of the closure of the mine, the Copperton area has lost most of its economic activity and population.

Other small settlements

Diemansputs and Ritchie are among the only notable settlements located between Corridor 2 and Corridor 3. These small settlements are located in Siyanda District Municipality and have a very small population base. There are only a handful of small farmsteads located within the power line corridors themselves. Such small farmsteads include Witkoppies, Hedley Plains, Eureka, Die Dam, Jagt Drift, and others. There is no significant urban development within these settlements, which are oriented primarily to agricultural activities.

The following map illustrates the locality of the towns and settlements discussed above:

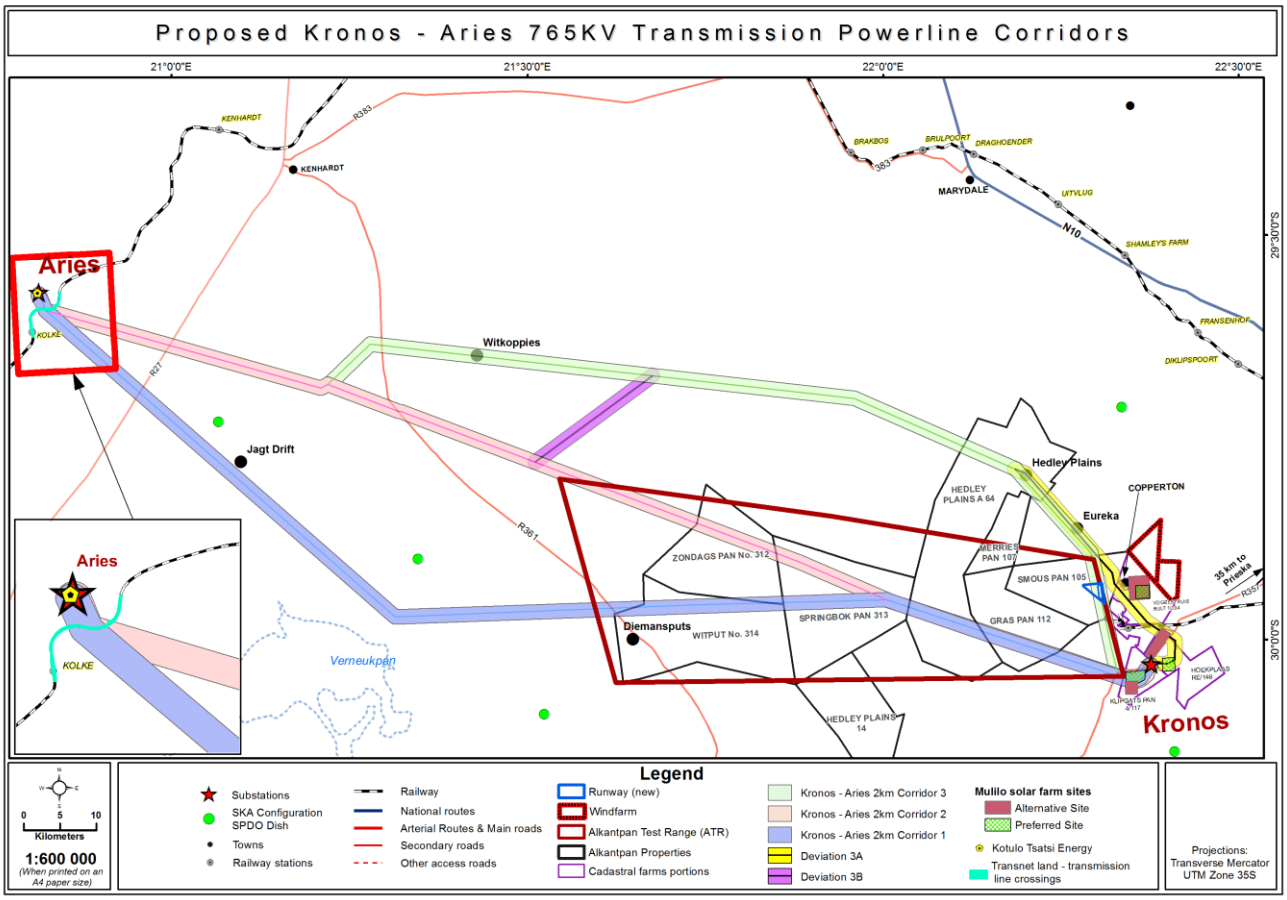


Figure 41: Towns and Settlements within Study Area

9.9.2 Potential Socio-economic Impacts and Mitigations

Scoring Without Mitigation = (NM) Scoring With Mitigation = (WM)

Table 46: Analysis of the Significance of Potential Socio-economic Impacts - Agriculture (Kronos-Aries – for all corridors) (ADEC, 2015)

Impact	Source	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without mitigation	With mitigation
1. Loss of productive agricultural land	• Land equivalent to the "footprint" of pylon towers taken out of production	Low (2) Minor (1)	Reversible with intervention (3) (1)	Local (studied area) (2) (2)	Long term (4) (4)	Almost Certain (4) Can occur (3)	44 24	Low	Low
2. Loss of agricultural production	• Productive capacity reduced by loos of cultivated land (significantly over and above land taken by construction of pylon towers)	Moderate (2) None (0)	Reversible with intervention (4) (1)	Local (4) (2)	Long Term (4) (4)	Can occur (3) Extremely remote (1)	40 7	High	Low
3. Loss of agricultural value/income	• Value and income reduced where productive capacity is reduced	Moderate (2) (1)	Reversible with Intervention (3) (1)	Local (2) (2)	Long term (varies) (4) (4)	Can occur (3) Extremely Remote (1)	36 8	High	Low
4. Loss of Employment	• Jobs lost where production and value lower (and	Minor (2) None	Reversible (1) (1)	Local (3) Local	Long term (varies) (4)	Almost certain (3)	20 7	Moderate)	Low

Impact	Source	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without mitigation	With mitigation
	returns insufficient)	(0)		(2)	(4)	(1)			
5. Loss of household income	• Income lost where jobs are lost	Moderate (2) None (0)	Reversible (1) (1)	Local (2) Local (2)	Long term (varies) (4) (4)	Extremely Remote (1) (1)	20 7	Moderate	Low

Table 47: Analysis of the Significance of Potential Socio-economic Impacts - Tourism & Development (Kronos-Aries – for all corridors) (ADEC, 2015)

Impact	Source	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without mitigation	With mitigation
6. Reduction in competitiveness or marketability of tourism attractions	• Visibility of power lines in areas otherwise marketable for physical isolation or environmental character	Low (2) Low (2)	Reversible with intervention (3) (0)	Site bound (1) (1)	Long term (4) (4)	Can occur (3) Can occur (3)	30 21	Low	Low
7. Loss of attendance and revenue for tourism attractions	• Reduced marketability or competitiveness of attractions	Low (2) Low (2)	Reversible with intervention (3) (0)	Site bound (1) (1)	Long Term (4) (4)	Can occur (3) Can occur (3)	30 21	Low	Low
8. Loss of revenue	• Reduced attendance at	Low (2)	Reversible	Local	Long term (4)	Can occur (3)	33 24	Low	Low

Impact	Source	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without mitigation	With mitigation
for tourism-related businesses (e.g., in towns)	visitor attractions in impact areas	(2)	with Intervention (3) (0)	(2) (2)	(4)	Can occur (3)			
9. Loss of tourism-related Employment	• Jobs lost at impacted tourism attractions or tourism-related businesses	None (0) None (0)	Reversible (1) (1)	Local (2) (2)	Long term (4) (4)	Extremely Remote (1) (1)	7 7	Low	Low
10. Loss of tourism-related HH income	• Household income lost where tourism jobs are lost	None (0) None (0)	Reversible (1) (1)	Local (2) (2)	Long term (4) (4)	Extremely Remote (1) (1)	7 7	Low	Low

Table 48: Mitigation Measures (Socio-Economic - Agriculture)

Impact	Mitigation Measures
Loss of Productive Agricultural Land: The construction of the power line route would require use of some land to accommodate the "footprint" of towers. Whilst the footprint is small on an individual basis, the total number of towers can result in an overall reduction in agricultural land in the broad area over which the corridors extend. All three corridors pass through agricultural land that would be removed from production to accommodate towers.	• The only way to avoid a reduction in productive agricultural land is to reduce the volume of towers and/or minimize pathways over productive farmland. In some cases, a few hundred metres in another direction can make a significant difference in the ability of a farmer to ensure efficiencies in production. • As a mitigation measure, farmers should be compensated at fair market value (FMV) for productive farmland used to accommodate towers and other infrastructure. The value of the farmland would be determined based on farm income generated on an average annual basis.
Loss of Productive Capacity When farmland is taken out of production, there is a reduction in production capacity and output. The reduction in output results not only from the loss of land but also from a reduction in efficiencies (e.g., farm equipment must manoeuver around pylon structures). For the purposes of this impact analysis, productive capacity is tied closely to a reduction in land available for agriculture.	• Loss in productive capacity is an indication of income and value. A reduction in farm income would result in a change in value. As such, mitigation measures are warranted as above (and below) based on farm income and value.
Loss of Agricultural Value: As noted above, the loss of productive capacity can result in a loss of farm income, which is used in turn to determine value.	• Farmers would be compensated for the loss in value, based on the income generated by their land. Fair compensation as a mitigation measure is noted above.
Loss of Employment: If a business (farm) loses revenue generated by land, there is the possibility that overall operations will become less profitable. Businesses will sometimes reduce their overhead charges or operating costs in order to stay afloat. Farms, however, are different from many businesses in that they tend to remain much more dependent on family and household members than on outside hiring of staff. A relatively small proportion of agricultural	• Compensation for land used to accommodate towers and other infrastructure does not ameliorate the fact that some farms will have less productive capacity and less need for workers. That being said, the employment impacts were still determined to be minimal. Mitigation in the form of a temporary subsidy is recommended where there is a direct layoff resulting from construction of power infrastructure. Such temporary compensation would be provided directly to claimants, equivalent to 3/5th annual salary and wages,

Impact	Mitigation Measures
employment is hired from outside the household. As a result, even a sharp downturn in farm revenue will not necessarily translate into a decrease in farm employment. Nevertheless, serious reductions in output and income can still result in tightening of workers' hours.	for a period of up to two years.
Loss of Household Income: As noted above, there is a very small possibility of a reduction in employment resulting from the loss of productive capacity. A reduction in employment can also include a loss of hours worked by those who remain employed. Clearly, either a reduction in hours or full-time job loss will result in reduced household income for the worker.	• As noted above, a subsidy could be provided for agricultural workers who are shown to have been laid off or had their hours reduced as a result of the construction of power lines through an agricultural area. This subsidy could help ameliorate the impact on household income generated by the loss of work hours and/or employment. That being said, compensation should only be provided where workers' claims are shown to be related directly to power infrastructure at a specific farm.

Table 49: Mitigation Measures (Socio-Economic – Tourism & Urban Development)

Impact	Mitigation Measures
Reduced Marketability for Tourism Attractions: While noting that the lack of nature-based tourist attractions, the construction of the power lines may impact on the "marketability" of region's few tourism attractions, notably extreme sport Verneukpan racing site and associated film and TV production. These attractions are oriented towards a market that values physical isolation and/or harsh but sport appealing environments. Adventure tourists and film crews are drawn to this area in part *because* of its *lack* of urban infrastructure. Visual pollution caused by power lines can interrupt or reduce the perception of isolation and tranquillity. Film and TV production crews and photographers are drawn to the region by the physical isolation character of eh environment. Power lines and tall pylons situated within the site can ruin the image generated for filming and TV production.	• The only way to mitigate for the impact of visual pollution on tourism sites is to ensure that power lines and pylons are situated as far away from high-quality view sheds as possible. This will require extensive research and mapping for routing of proposed power line corridor to avoid the view shed associated with extreme sport sites and surrounding environment. • In relation to Verneukpan site, an opportunity exists to reduce impacts by ensuring that power lines extend to within reasonable distance of the site. • Corridors 1 should be avoided as it would run closest to Verneukpan site.
Reduction in Game Farms & Game Hunting The construction of the power lines will bring visual pollution to the game hunting industry. The visual impact extends +/- 20 km on either side of the power lines or view shed of up to 40 km across. The plain and flat character of the area is attributed to this implied "exclusive zone" for the proposed power lines.	• Power lines must be constructed away from current game farms and game hunting areas. This would require changing the path of proposed power line corridor. • Two deviations are recommended: 1. Relocate power lines to existing power line corridors, if already in the area. 2. (Preferred) Construct power lines as far away as possible from existing and potential game faming/hunting areas. • Recommended principle mitigation measure is for Eskom to use existing "brownfield" corridors, with no new & incremental socio-economic and environmental impacts.
Loss of Game Farms & Wild Animal Stock	• Game farmers must be compensated for loss of investment

Impact	Mitigation Measures
The construction of power lines will lead to the collapse of the game farms and game hunting enterprises. Direct losses include investment capital in property, equipment, and wild animal (game) stock.	and game hunting enterprises as "going concerns", including future revenues streams for the projected lifetime of the businesses. • Compensation must take into account "knock on" effect on the viability of the other mixed-use business lines i.e. irrigation farming and livestock grazing, as appropriate.
Game (wild animal) Poaching The introduction of power lines will require Eskom service and repair personnel to access game farm properties and intrude secluded animal breeding programmes, leading to generation of interest and possible poaching activities (note: animal theft and poaching is non-existent at the moment).	• The path of the proposed power lines must be as far away as possible from existing game farms.
Reduced Attendance & Revenue for Tourism Attractions The impact area does not have a significant number of major commercial tourism attractions although it does have natural areas that generate tourism income for surrounding communities. The reduction in marketability associated with visual pollution could also result in a reduction in attendance to tourism sites.	• A loss in attendance and revenue at tourism sites could be avoided through appropriate positioning as noted above. The view sheds are ultimately very critical to tourism in this region, so ensuring that visual pollution and interruption is minimised in sensitive areas will help mitigate against a loss of attendance and site revenue.
Loss of Revenue for Tourism-Related Businesses: As noted above, the region does not offer nature-based tourist attraction, except for extreme sport Verneukpan racing site and associated film and TV production. These activities draw visitors to the region who generate revenues in lodging, restaurants, tour operations, transport, supplies and equipment, etc. Thus, a reduction in attendance at isolated attractions can result in a loss of revenue for businesses that may be located kilometres away in the region's towns.	• The primary mitigation approach would be to avoid sensitive view sheds, as noted above. • Where there is still visual pollution or interruption despite the aforementioned mitigation measures, then there may be a need to compensate business operators as claimants who can show a dependence on revenue generated by tourists visiting Verneukpan site film and TV crews. Compensation would best be assigned based on actual average revenue numbers tracked before and after project implementation.

Impact	Mitigation Measures
Loss of Tourist-Related Employment: If a business (i.e., tour operator) loses revenue generated by tourism, there is the possibility that overall operations will become less profitable. Businesses will sometimes reduce their overhead charges or operating costs in order to stay afloat. Tourism businesses are very labour intensive. Thus, a somewhat minor reduction in tourism revenues can still result in the loss of employment.	• Mitigation in the form of a temporary subsidy is recommended where there is a direct layoff of tourism-related workers resulting from construction of power infrastructure. Such temporary compensation would be provided directly to claimants, equivalent to 3/5th annual salary and wages, for a period of up to two years.
Loss of Household Income: As noted above, there is a possibility of a reduction in employment resulting from the loss of tourism. A reduction in employment can also include a loss of hours worked by those who remain employed. Clearly, either a reduction in hours or full-time job loss will result in reduced household income for the worker.	• As noted above, a subsidy could be provided for tourism workers who are shown to have been laid off or had their hours reduced as a result of the construction of power lines through a tourist area or site. This subsidy could help ameliorate the impact on household income generated by the loss of work hours and/or employment. That being said, compensation should only be provided where workers' claims are shown to be related directly to power infrastructure at a specific tourism-related site or business.
Reduction in Property Values: If power lines and infrastructure are developed proximate to residential property, there is a strong possibility of a negative impact on property values. Whist insufficient information is available on the exact interface between the proposed corridors and residential properties, the possibility still exists that there may be an impact on the value of a limited number of residential properties. Property values are impacted negatively primarily due to the visual pollution caused by the presence of the towers and lines. Proximity is a key factor, and where the pylons and lines are close to residential properties, the impacts are likely to be greatest.	• Mitigation can include compensation to residential property owners who can show that their property values have or will be impacted by the power infrastructure. Compensation would be made in the form of a negotiated (or economist-determined) percentage of fair market property value, representing the impact.

Impact	Mitigation Measures
Stoppage of Planned & Proposed Farm Expansion Projects The construction of power lines will stop immediate planned and proposed tourism/eco-tourism expansion projects spread in the area along and surrounding the path of the proposed power line corridor. The path of the proposed power lines transgresses identified potential land for earmarked for future development of game farms, including areas with existing water rights.	• Game farmers must be compensated for preparation costs already incurred in the form of investment in land and equipment, among others. • Land for future development must be marked as “hot spots” to be avoided by the proposed power lines. • Land with existing water rights must be also marked as “hot spots” to be avoided by the proposed power lines.

9.9.3 Conclusions and Recommendations

The impact of the power lines on livestock farming (i.e. section's primary use) would be negligible and would not disturb the performance and future of stock farm enterprises. However, the power lines would negatively impact on existing lucrative irrigation farming activities leading to loss of production and employment. The high land values for irrigation farming uses would be reduced to grazing land values, while all investment and infrastructure installed on the farms would become less useful. The immediate consequences are a reduction in existing farming activity, and disruption of any planned and proposed farming development in the area.

The power lines will impact negatively on existing lucrative game hunting activities along and surrounding the proposed path of the power lines. The impacts on game farming/hunting would be detrimental and would likely lead to permanent disruption and loss employment. The high land values for game hunting farms would be reduced to grazing land values, while current investment and infrastructure installed on the farms would become less useful. The immediate consequences are a reduction in existing game farming and game hunting activity and a likely stoppage of all planned and proposed tourism and eco-tourism development in the area. As an emerging industry, the game farming/hunting industry would not be given the chance to grow to its full potential. Game breeding programmes may continue but game hunting would be negatively impacted.

The principal mitigation measure is a detour of the path of the power lines to avoid existing /irrigation farming areas/game farming/hunting areas. Two deviations are recommended:

1. Eskom should construct the power lines in an existing corridor where Eskom already has other operational power lines. This is considered to be the best option as the power lines would run far away from existing and potential irrigation farming areas/game farming areas.
2. Eskom should construct the power lines as far away as possible to keep them out of visibility range of existing and potential irrigation farming areas/game farming areas. Game farming, and especially hunting activities can only strive in an environment that is not "polluted" by electric power line infrastructure.

9.10 RANKING OF THE ALTERNATIVE CORRIDORS

In order to rank the alternative corridors, a table was compiled and the corridors 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 50: Ranking for the proposed route corridors

Order Of Rank	Vegetation	Fauna	Avifauna	Wetland	Agriculture	Visual	Ecotourism	Heritage	Socio-Economic
1	Corridor 2	Corridor 1 Corridor 2 Corridor 3 Deviation 3A Deviation 3B	Upgrade / recycle existing 400kV line Or Corridor 2	Corridor 2	Corridor 1 Corridor 2 Corridor 3 Deviation 3A Deviation 3B	Corridor 2	Corridor 2	Corridor 1 Corridor 2 Corridor 3 Deviation 3A Deviation 3B	Deviate from existing irrigation farming areas / game farming / hunting areas.
2	Corridor 3 Deviations 3A Deviations 3B		Corridor 3 Deviation 3B	Corridor 3 Deviation 3B		Corridor 1	Corridor 1		
3	Corridor 1		Corridor 1 Deviation 3A	Corridor 1 Deviation 3A		Corridor 3 Deviation 3A Deviation 3B	Corridor 3 Deviation 3A Deviation 3B		

PREFERRED CORRIDORS –STAKEHOLDERS / I&APS

SKA:	Corridor 2 and Corridor 3 are likely to cause medium risk to the SKA sites and low risk should the power line be constructed outside the buffer zone. Corridor 1 is not preferred as it poses high risk.
Mulilo Renewal Energy:	Requests that Eskom avoids their sites near Kronos Substation
Plan 8:	Deviate Corridor 3 away from the proposed landing strip property.
Alkantpan Test Range:	Corridor 3 is preferred as it would avoid the restricted ballistic testing range areas. Most of Corridors 1 and 2 traverses through the testing range. This is a high safety risk.

9.11 SUMMARY OF ROUTE FINDINGS

Below is a summarised conclusion of the key findings regarding the preferred routes (Table 50) based on the nature and extent of impacts on the environmental and social aspects.

Vegetation

The four vegetation communities that could be impacted on by the power line corridors comprise the following sensitive areas: the riparian vegetation; vegetation in and around salt pans; vegetation of rocky outcrops; ridges and inselbergs. In addition, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) situated within the corridors, were also mapped as sensitive. Both substations are situated in vegetation groupings of medium sensitivity.

The route alternatives do not differ significantly as to their sensitivity towards the proposed power line development. However, an existing power line already exists along Corridor 2, while Corridor 3 is the only corridor that traverses significant areas of hills vegetation. Deviation 3B will ensure that these hilly areas are avoided. The preferred route was determined as Corridor 2, with Corridor 3 including deviation 3A and B or just 3B as the second options.

Fauna

The study area is generally of medium value for terrestrial vertebrate biodiversity, and terrestrial vertebrate fauna is unlikely to be substantially negatively affected by this development.

All alternative corridors including deviations are equally acceptable, given the low and similar sensitivity of terrestrial vertebrate fauna and anticipated impacts of the proposed development. Nonetheless, all attempts to minimise unnecessary disturbance and habitat loss during the construction phase should be employed.

Avifauna

The proposed corridors pass through an area of the country where large terrestrial bird species such as bustards are prevalent, and have proven to be extremely susceptible to collision with similar power lines at this location. Therefore, this new line represents a substantial addition to

an already high level of threat to these species. Very careful management of the collision risk will be needed if this is to be reduced to acceptable levels.

It is essential that the option of *upgrading or recycling the existing transmission*[8] line in the study area is fully evaluated, because this would have the great benefit of not adding more power line to this area. Failing this, it is concluded that the proposed power line be built directly adjacent to the existing transmission line, Corridor 2. The second most preferred route would be Corridor 3 with Deviation 3B.

Wetland

From a wetland and riparian ecological perspective, Corridor 2 is the preferred option due to the presence of an existing powerline and associated infrastructure within the corridor as well as the small amount of wetlands. However the presence of the "no power line zone" (Alkantpan Testing Range) precludes this corridor as a viable option. Deviation 3B which avoids this obstacle is considered as the most preferred as it has the lowest number of wetlands potentially affected.

Corridor 1 has the least amount of drainage lines/riparian area but does however have the highest number of wetlands such as pans within the corridor and is therefore not a preferred option. Corridor 3 is the second preferred option since it has the second lowest number of wetlands. However, Corridor 3 also has various bends within the area of the highest density of drainage lines/riparian areas.

Agriculture

From an agricultural perspective, the three route corridors cross similar soil patterns. There is little to choose between the three corridors as far as soils and agricultural potential is concerned. Therefore, all alternative corridors including deviations are equally acceptable.

Visual

Corridor 2 is regarded as the most preferred alternative. Its alignment along the existing transmission line and servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable. Hence, Corridor 2's great advantage lies in the less significant visual impact on motorists and residents as compared to the other corridors.

Ecotourism

Of the three alternatives, Corridor 2 is considered the most preferred alternative from an ecotourism perspective. Corridor 2 follows existing transmission line and transmission servitude and therefore will not create an additional visual impact during operation phase. All ecotourism products will be adapted to this impact already.

[8] **Please note:** This option is disregarded as a feasible alternative as it is not part of the Cape Corridor Strengthening Phase 5 Grid Plan (See Need and Desirability Section 1.1.1.).

Corridor 3 is the least preferred as it would have a visual impact on existing game farms and hunting farms in the region. It would also have an impact on the visual character of the area for tourists passing through the region

Heritage

As an initial evaluation of the three route corridors, the impact of the proposed development on sites, features or objects of cultural heritage would be low. The reason is that cultural heritage sites are distributed sparsely in the region. Furthermore, power lines usually have less of an impact than for example mining developments.

From a heritage point of view, there are no fatal flaws that would prevent the proposed development from taking place in any of the corridors and deviation routes. However, heritage sites are not only fixed features in the environment, occurring within specific spatial confines, but they are also finite in number. Avoiding of impacts on sites is therefore the preferred form of mitigation.

Socio-Economic

The impact of the power lines on livestock farming would be negligible and would not disturb the performance and future of stock farm enterprises. However, the power lines would negatively impact on existing lucrative irrigation farming activities leading to loss of production and employment. In addition, the power lines will impact negatively on existing lucrative game hunting activities along and surrounding the proposed path of the power lines. The impacts on game farming/hunting would be detrimental and would likely lead to permanent disruption and loss employment.

The principal mitigation measure is a detour of the path of the power lines to avoid existing /irrigation farming areas/game farming/hunting areas. Two deviations are recommended:

1. Eskom should construct the power lines in an existing corridor where Eskom already has other operational power lines. This is considered to be the best option as the power lines would run far away from existing and potential irrigation farming areas/game farming areas.
2. Eskom should construct the power lines as far away as possible to keep them out of visibility range of existing and potential irrigation farming areas/game farming areas. Game farming, and especially hunting activities can only strive in an environment that is not “polluted” by electric power line infrastructure.

10. ENVIRONMENTAL IMPACT STATEMENT

It is in the view of the Environmental Assessment Practitioner (EAP) that the construction and operation of the proposed Kronos-Aries 756kV transmission power line and the substations upgrades are biophysically acceptable, economically and socially beneficial, particularly in the long run where future electricity demands will increase as well as maximize the purpose and need of the proposed development.

The Do Nothing Alternative is considered to be undesirable as it does not meet the purpose and need of the applicant. It is not economically feasible because electricity users such as mining companies, farmers, and domestic users would be unable to avoid electricity interruptions in the long run.

Most of the specialists preferred Corridor 2 mainly due to the presence of an existing power line and associated infrastructure within the corridor. However, the majority portion of Corridor 2 traverses Alkantpan Testing Range (ATR) stated as a “no power line zone.” Moreover, SKA preferred Corridors 2 or 3 as they are further away from the SKA sites. Corridor 1 was not preferred from a biodiversity perspective mainly because it would impact on the largest extent of ESAs and traverses the highest number of pans.

Please note: The main reason for the amendment of this report was to include new deviations to Corridor 3, to accommodate the biodiversity, technical and safety feasibilities for the power line development. Purposes of the deviations are as follows:

- Deviation 3A was necessary to avoid the proposed airfield along Corridor 3 near Kronos substation. The deviation route was recommended by CAA.
- Deviation 3B was necessary to bypass Corridor 3 and link to Corridor 2 along the existing line to Aries substation. Moreover, Corridor 3 is the only corridor that traverses significant areas of hills vegetation towards its western extent. Therefore, the proposed Deviation 3B will ensure that these hilly areas are avoided.

It is therefore in the opinion of the EAP that the recommended route from Kronos to Aries substations should be; Corridor 3 with Deviation 3A and 3B linking to Corridor 2. The corridors and deviations would accommodate the biodiversity, technical and safety feasibilities for the proposed power line as mentioned above.

Nonetheless, localised sensitivities are to be expected along all the route corridors such as: e.g. occurrence of threatened plant species; occurrence of irrigated areas; tourism areas; and traversing through wetland and riparian areas. This study was broadly scaled and the preferred Corridor should be ground-truthed and be allowed to deviate to accommodate the conservation of such local environmental sensitive areas.

10.1 RECOMMENDATIONS

It is recommended that the proposed transmission power line from Kronos to Aries substation be constructed along **Corridor 3 with Deviation 3A and 3B linking to Corridor 2,** partly due to

presence of an existing power line and avoidance of the ATR areas. Corridor 3 must avoid hills as well as the proposed airfield near Kronos and be further away from SKA sites.

In this regard it is fundamental that the Environmental Management Programme (EMPr) and all other mitigatory 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:

- Walk down of the line was called for by all specialists, especially veg & avi-faunal, recommend this done before servitude negotiations are started
- Erect Construction camps and towers some distance from the boundary of ecologically sensitive areas, such as mountainous areas, koppies, wetlands; drainage lines; and agricultural irrigation areas.

- Power lines should be marked with anti-collision marking devices according to Eskom Transmission guidelines and particularly at the section emphasized by the Avifauna Specialist. Essential that nocturnal markings are included as per avifaunal specialist recommendation

- 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 power line 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 Environmental Management Programme (EMPr) provided in **Appendix L** should be approved as part of the Environmental Authorisation and be strictly adhered to during the

construction and operational phase of the proposed 765kV transmission power line 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 power line (including contractors, engineers, and administrators) are, in terms of NEMA's "Duty of Care" and "Remediation of Damage" principles (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 for the proposed construction of the Kronos-Aries 765kV transmission power line and substations upgrades. The new power line will ensure a more reliable electricity supply to users in the country. In addition, more reliable electricity supply is highly likely to confer operating and economic benefits to a variety of industries in the regions.

In the Scoping and EIA phases, three alternative routes were considered. The preferred route was weighed to be Corridor 3 with Deviation 3A and 3B linking to Corridor 2 (From Kronos to Aries substation). In July 2015 after the Environmental Impact Report was drafted, Deviations 3A and 3B were proposed. Deviation 3A was necessary to avoid the proposed airfield, as recommended by CAA. Deviation 3B was necessary to avoid hilly areas as well as to provide a link between Corridor 3 to Corridor 2 to avoid the Alkantpan Testing Range (ATR).

Hence in this amended draft Environmental Impact report (EIR) phase, Corridor 3 with Deviation 3A and 3B linking to Corridor 2, have been determined after considering technical and safety feasibilities as well as the lowest environmental sensitivities and social costs.

I&APs were continuously identified and would be contacted and notified of the project through site notices and written notices (posted and e-mailed). Notice of the project was published on the relevant regional and local newspapers. The Amended Draft EIR will be circulated to stakeholders and registered interested and affected landowners. The Amended Draft EIR would be on Mokgope website. Notification of the availability of the report would be published in local newspapers.

All comments and issues raised by I&APs and stakeholders have been recorded and considered by the EAP when recommending a final decision during the EIA phase. The final built decision by Eskom on the proposed transmission power line and substations upgrade will be made after the Department of Environmental Affairs has granted authorisation and any appeals lodged have been successfully dealt with.

In general, specialist assessments that have been undertaken in the EIA phase have not found any significant detrimental environmental issues that can be caused by the proposed development.

Negotiations will need to take place between Eskom and landowners whose properties would be traversed by the proposed transmission power line.

12. REFERENCE

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APPENDIX A

APPLICATION FORM AND

DECLARATION OF INDEPENDENCE FROM CONSULTANT

APPENDIX B

EAPS, SPECIALISTS CVS AND OR COMPANY PROFILES

APPENDIX C

LOCALITY MAP

APPENDIX D

BACKGROUND INFORMATION DOCUMENT (BID)

APPENDIX E

SITE INSPECTION PHOTOGRAPHS

APPENDIX F

INTERESTED AND AFFECTED PARTY REGISTER

APPENDIX G

SITE NOTICE PHOTOGRAPHS

APPENDIX H

NEWSPAPER ADVERTISEMENTS

APPENDIX I

MINUTES AND ATTENDANCE REGISTERS

APPENDIX J

COMMENTS AND RESPONSE REPORTS

APPENDIX K

TRANSMISSION VEGETATION MANAGEMENT GUIDELINE

APPENDIX L

ENVIRONMNENTAL MANAGEMENT PROGRAMME (EMPr)

APPENDIX M

SPECIALISTS REPORTS

1. **VEGETATION REPORT**
2. **FAUNA REPORT**
3. **AVIFAUNA REPORT**
4. **WETLAND REPORT**
5. **AGRICULTURE REPORT**
6. **VISUAL REPORT**
7. **ECOTOURISM REPORT**
8. **HERITAGE REPORT**
9. **SOCIO-ECONOMIC REPORTS**