Section 5 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Evaluation of alternative alignments

ALTERNATIVES	PREFERENCE RATING
Eastern Route	1
Eastern Route Deviation	a
Central Route	b
Western Route	2
Western Route Deviation 1 (Western Deviation)	a
Western Route Deviation 2 (Eastern Deviation)	c
Western Route Deviation 3 (Southern Deviation)	b

The Eastern Route is regarded as the most preferred alternative. Its location and position in the landscape is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the servitudes and the local roads. The impact of the Eastern Route on visual receptors varies between residents, tourists and motorists. The Eastern Route's great advantage lies in the less significant landscape and visual impact on motorists and residents as compared to the other alternatives.

Recommended Mitigation Measures

In most cases, the landscape and visual impacts occurring during the construction phase can be mitigated relatively effectively. Rehabilitation of the disturbed areas will prevent the exposure of soil, which may cause a reduction in the visual quality of the study area. Sensitive positioning of the construction camps and lay-down yards should take advantage of the natural screening capacity of the study area by locating the camps outside of the views of sensitive visual receptors. The proposed alignments traverse landscapes with a moderate VAC. Little or no screening will be provided by the landscape types through which the above mentioned alignment cross.

10.5 Socio-Economic Impact Assessment

Details of the nominated specialist:

Specialist	
Organisation:	Nemai Consulting
Name:	Sameera Munshi
Qualifications:	Nemai Consulting
No. of years experience:	2 years
Affiliation (if applicable):	N/A

This section provides a summary of the Socio-Economic Assessment for the Anderson-Dinaledi 400kV power line project, as undertaken by Sameera Munshi (2012), which is contained in ***Appendix D5***.

A socio-economic assessment was undertaken to determine the potential impacts that may occur as a result of the 400kV Anderson-Dinaledi Transmission lines.

The proposed power line will be approximately 40km in length and will run between the proposed Anderson Substation, which is located on Portions 82, 83 and 76 of Farms Schurveberg 488 JQ in the City of Tshwane Metropolitan Municipality to the existing Dinaledi Substation. The proposed power line will be constructed in the following two Municipal Areas: Madibeng Local Municipality, North West and City of Tshwane Metropolitan Municipality, Gauteng.

The Madibeng Local Municipality, which houses the Dinaledi MTS, is found in the North West Province. The total population number of the North West Province is estimated at 3.043 million. The North West Province is home to 9.5% of South Africa's total population. The North West Province has four district municipalities and twenty one local municipalities.

The City of Tshwane Metropolitan Municipality, which is to house the new proposed Anderson Substation is found in Gauteng Province. The Gauteng Province is bounded to the north by the Limpopo Province; to the south by the Vaal River, which separates it from the Free State Province; to the east by the Mpumalanga Province and to the west by the North West Province.

The Gauteng Province is the smallest province in South Africa, with only 1.4% of the land area. The Gauteng Province covers an area of 16 548 km2. The province is highly urbanised containing the cities of Johannesburg and Pretoria. Although it is South Africa’s smallest province, the Gauteng Province has the largest population, in 2007, of nearly 10.5 million, almost 20% of the total South African population. The Gauteng Province comprises of three metropolitan municipalities and three district municipalities which are further divided into nine local municipalities.

The Gauteng Province is considered the fastest growing province, experiencing a population growth of over 20% between the 1996 and 2001 Censuses. The Gauteng Province is highly urbanised with 97% of its population living in urban centres.

The study area is made up of the following land uses:

- Commercial activities;
- Tourism;
- Agriculture;
- Mining;
- Industrial; and
- Residential.

The land use for the area is for the most part dominated by agriculture. This is particularly evident in along the eastern route. Along the main roads there are commercial activity, thus the R511 Western Route South Alternative is mostly dominated by commercial activity.

Economic Impacts

There is likely to be a short term increase in economic activity as a result of the transmission line. Through the employment of local labour, skills and knowledge transfer is likely to take place which can increase the employability of these workers. Employment will also increase the income of households and capacity to be more productive.

Visual, Tourism and Leisure Impacts

The tourism and leisure attractions in the Hartbeespoort area are well established. The mountains and dam provides opportunity for tourism. A large proportion of the study area is used for conservation, nature reserves, and accommodation and tourism facilities. Thus there is a visual appeal to the land which has been used to generate income.

The impact of having a transmission line in such an environment could result in loss of income. The visual appeal of the land will be negatively impacted by having a transmission line.

Nature Reserves, when associated with tourism and leisure, derives their economic value from offering a glimpse of the natural wonders of the area, with a focus upon viewing game and the ecological habitat.

Transmission lines impact upon the value proposition by bringing modern development to this natural environment, thereby reducing the rural and undeveloped sense of place.

The construction phase can impact negatively through loss of income or reputation as the natural environment is disturbed. Impacts associated with construction crew actions, resulting in the loss of stock or equipment should also be considered.

Land, Value and Servitude Impacts

A servitude of 55m or 27.5m on either side of the centre of the power line will need to be purchased. The purpose of the servitude is to ensure public safety, safe construction, maintenance and operation of the line. Eskom will be entitled to unrestricted access. Negotiation with land owners on access control measures and security issues with regards to locking and unlocking of gates on private properties and damage to fences and gates will need to take place.

The land beneath the overhead lines and within the 55m wide servitude may continue to be used for some activities by the landowners, however, no crops or trees higher than 4m will be allowed along the route, and no structures may be developed underneath the line or within the servitude area.

The proposed power line can negatively impact the development and infrastructure plans for the area. Development within the 55m wide servitude will be restricted. Certain farming and current land use may need to be stopped completely or altered resulting in potential loss of income.

With regards to land values and compensation for the use of a servitude, impacts and mitigation should take into account the following categories of concern:

- the visual impacts on lines;
- maintenance issues during operation;
- multiple lines on a single property;
- larger relative impacts on small properties than on large farms;
- the public relations aspects of Eskom's business; and
- loss of business caused by the servitude.

Loss of Production

The project area is generally rural in nature, with urban and commercial activity increasingly occurring. Land used for agriculture is the most common on the project study area with citrus and maize being farmed. Current farming practices may be disturbed due to the development of the transmission lines. This will be through loss of land available for produce as well as a capital cost on the value of the land. The will be an expected decline in output as agricultural activity in the servitude area will be limited. Thus there is likely to be a loss of potential and existing income.

The biggest lost of productive land is expected to occur during the construction phase of this development. There may an expected removal of all crops within the servitude land for construction and road purposes. Furthermore there is an impact on the way in which agriculture can take place. Transmission lines place a restriction on the types of agriculture that can occur on the land. Thus there is a loss of production capacity.

Agriculture accounts for 36 percent of employment in the area which means that land use has a significant economic impact on production and income generation. Thus the impact on the loss of agricultural land and limitation on agricultural activity is likely to be very significant.

These communities are economically vulnerable and disruption to agricultural production will have disproportionately large impacts on those affected.

Impacts on the Social Environment

The study area has a high population growth rate and is developing rapidly. With the proposed project which is likely to attract workers, this population growth rate may increase and cause further strain on development needs.

When workers come into an area, there is a need to supply municipal services to these workers. The municipality may or may not have the capacity to support a larger number of people. Thus causing strain on social services.

As is common with migrant workers in an area, there may be some social disruption. The relations between locals and new job seekers may not be smooth and lead to conflict in the community.

Workers entering the area will also be competing with locals for employment which may cause tension in the community. Locals and new job seekers will be competing for the same jobs. Thus it is important to deter job seekers and stress on local employment.

Relations between migrant workers and locals can potential cause health problems by rising HIV and AIDS or other sexually transmitted diseases. This is a typically the case when a large number of males enter into an area. Hostel like structures will need to be prevented and awareness campaigns should be conducted.
During construction, the safety and security of labourers around may be at risk when working with transmission lines. Thus effective mitigation measures will need to be in place to avoid loss of life or injury. There safety of farming livestock will also need to be ensured.

Employment and Skills Transfer

There is likely to be a positive impact on employment especially during the construction phase. Construction of the power lines will require labour for building the power lines while the operation phase will require labour for maintenance. Potential secondary employment impacts can result as small business employs more persons to sell goods to labourers.

The project has the potential to positively impact upon household incomes during the construction phase. In the study area, most people are low income earners thus employment of locals will create a positive impact

on local communities who can derive some economic benefit from the project. The project also has the potential to positively impact upon the skills levels in local communities during the construction phase.

This conclusion is valid if the contractor implements skills-based training programmers at the site. Unskilled workers could be taught a skill and achieve a certificate to support the skill. This would provide a degree of assistance with the worker's future search for work and allow the project to leave a lasting legacy on the economic wellbeing of the affected community. Thus if all other aspects are ambivalent about which routing to follow, the employment and skills transfer aspect would dictate which of the routes would most benefit the affected communities. This conclusion is modified by the proviso that the employment and skills impacts are relatively small and short-term in nature and that the populations of all routes would benefit from the employment and skills transfer potential offered by the proposed project.

Comparative Analysis of Routes

	Advantages	Disadvantages	Priority* (1/2/3/4)
Eastern Route	✓ Lowest Cost Alternative ✓ Less economic activity than the western route; ✓ Less tourism and visual impacts; ✓ Impacts on agricultural production able to be mitigated.	• Passes through productive agricultural land; • Higher potential loss of income due to agricultural activities; • Traverse through the Eland Mine should be negotiated with mine owners, this traverse is easier when using the Eastern Route	2
Eastern Route Alt – Central Route Diversion away from Mothutlung	✓ Moves away from potential development near Mothutlung; ✓	• Same as eastern route alternative;	1
Western Route	✓ Easily accessible along the R511; ✓ Avoids large scale agriculturally productive land;	• Highest Cost Alternative • Passes through a more broadly based economy; • Will have a higher impact on residential development; • Difficult to pass through the Eland Mine; • This route has the highest potential impact on tourism and leisure activities.	3
Western Route Alt– Eastern Diversion through Eland Mine	✓ Same as western route alternative;	• Very difficult to pass through the centre of the Eland Mine;	4

Recommended Route

The impacts of the cost of servitude acquisition, the potential disruption to economic and social activity along the Western Route are estimated to be higher than that posed by the Eastern Route.

10.6 Heritage Impact Assessment

Details of the nominated specialists:

Specialists	
Organisation:	N/A
Name:	Leonie Marais-Botes
Qualifications:	BA (Cultural History and Archaeology) (UP), BA (Hons) Cultural History (UP), Post Grad Dip Museology (UP), Conservation of Traditional Buildings Cert. (University of Canberra), Post Grad Dip: Heritage (Wits)
No. of years experience:	17
Affiliation (if applicable):	N/A

Organisation:	Nemai Consulting cc
Name:	Khosi Mngomezulu
Qualifications:	BSc (Hons) Archeology
No. of years experience:	1 year
Affiliation (if applicable):	Member of ASAPA

This section provides a summary of the Heritage Impact Assessment for the Anderson-Dinaledi 400kV power line project, as undertaken by Ms Leonie Marais-Botes (2011), amended in November 2012 which is contained in ***Appendix D6***. An addendum was undertaken to assess the amended transmission line route) as undertaken by Khosi Mngomezulu (2012) (reviewed by Jean Beater) contained in ***Appendix D6***.

Eskom is proposing the construction of a new 400kV Transmission Line as part of their Tshwane Strengthening Scheme Project. The proposed powerline will be approximately 40km in length and will run between the proposed new Anderson Substation, and the existing Dinaledi Substation which is located approximately 8km North East of Brits.

The main town in the greater study area is Brits and the surrounds are well known for citrus, vegetable and grain production. The greater study area is in close proximity to Tshwane. In addition to being a centre for agriculture, the town is home to several heavy industries. The town also plays an important role in the South African mining industry: 94% of South Africa's platinum comes from the Rustenburg and Brits districts. Near to the Eastern Route Garankuwa is situated. The Township of Ga-Rankuwa was founded on communal land in the 1960's as part of the forced removal of the black community from the City of Tshwane. The establishment of this settlement and several others was coupled with the start of the "Border Industrial Area" that was created in the independent state of Bophuthatswana.

A survey was undertaken on 27 February and 1 March 2011. The entire study area was covered with a vehicle. At certain pre-determined points foot surveys were conducted to establish an overall understanding of the study area and the sensitivities associated with it in heritage context. 1:50 000 maps were studied to determine possible sensitive areas previously identified. The initial study took place in late summer, early

autumn. Due to good rainfall the vegetation was dense and visibility limited. In addition a literature and archival search were conducted to find additional and contextual information and in order to establish heritage significance the following method was followed:

- Investigation of primary resources (archival information);
- Investigation of secondary resources (literature and maps);
- Physical evidence (site investigation); and
- Determining Heritage Significance.

The following heritage resources were identified in the greater study area:

- Graves;
- Structures; and
- Historic Trees.

The following heritage sites that are protected by legislation were idenitifed along the Eastern and Western Routes:

Table 31: List of Heritage Sites along the Western and Eastern Routes

Western Route	Eastern Route
• Rietfontein Pinoeer Dwelling and Cemetry • Silkaatsnek Anglo-Boer War Sites • Military Cemetry and 4 Outlaying Graves (Ifafi) • Old Mine Schurveberg • Vredesboom (Peace Treaty Tree) • Skurweberg	• De Wildt Tree • Margaret Roberts Herb Centre • Jo Roos Studio

The specialist has recommended that the Eastern route be followed in terms of heritage significance, if the powerline is kept near existing infrastructure where mitigation is already in place, and then the potential impacts can be reduced. Any potential impact can be mitigated against provided that all recommendations made by the specialist are adhered to.

An addendum to the March 2011 Phase 1 Heritage Impact Assessment for the proposed Dinaledi-Substation to Anderson-Substation 400kV transmission power line was undertaken to update the heritage impact report that was conducted for the proposed transmission power line to the new.

Two site alternatives were originally investigated for the proposed construction of the Anderson Substation. These two site alternatives were located directly to the north of NECSA, in Broederstroom. Due to the sensitivity of the biodiversity the two sites have been changed to one new site for the Anderson substation

that is located in Flora Park. As indicated in figure below, the change made for the amended route is the removal of extended route towards the west that is indicated with the circle.

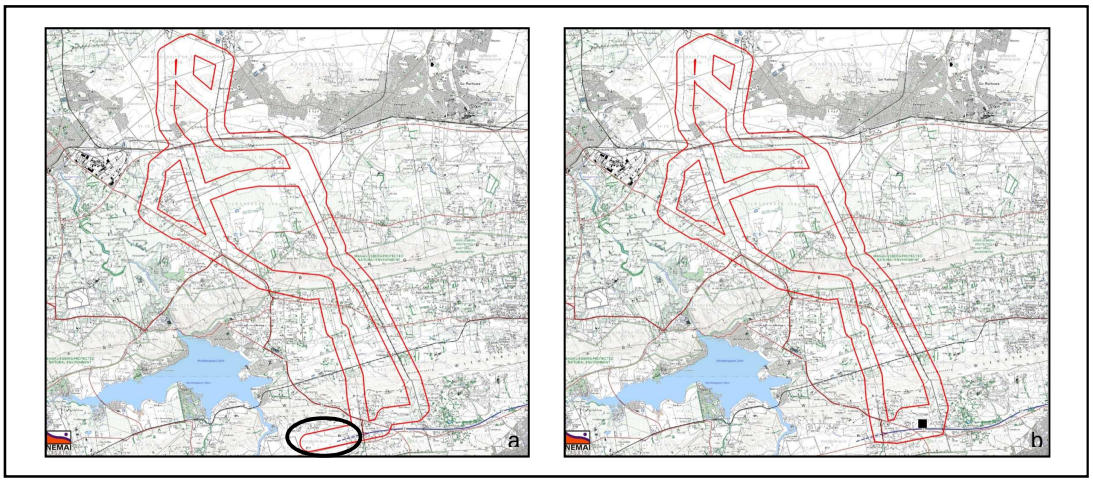

Figure 62: Maps showing the old transmission line (a) and the amended transmission line route (b)

Archaeological material, namely stone tools, as well as at least two graves were found in and around the new Anderson substation. Therefore, scatters of stone tools and graves were found in the southernmost portion of the Dinaledi-Anderson transmission powerline route. It should be noted that a separate HIA was undertaken for the new site for the Anderson substation.

10.7 Soil Survey and Agricultural Potential Study

Details of the nominated specialist:

Specialist	
Organisation:	INDEX
Name:	Dr A Gouws
Qualifications:	PHD – Integrated Agricultural Development
No. of years experience:	33 years
Affiliation (if applicable):	• Registered with the Counsel of Natural Sciences. No: 400036/93 (Agricultural sciences); and • Member of the Soil Science Society of South Africa

This section provides a summary of the Soil Survey and Agricultural Potential Study for the Anderson-Dinaledi 400kV power line project, as undertaken by INDEX (2012), which is contained in ***Appendix D7***.

Index was requested by Nemai Consulting to undertake a desk study to indicate the agricultural potential and land capability for the proposed Anderson - Dinaledi Transmission Line and for the new Anderson Substation.

The central western portion of the study area, just north of the Magaliesberg consists of deep, reddish and vertic soils that is high potential if they can be irrigated. The balance of the land is either too shallow or rocky to cultivate and only suitable as grazing. Approximately 400 hectares is under irrigation, of which 350 is from the Hartbeespoort Dam. All the irrigated land is within the western alignment. According to the guidelines of NDA all irrigated land is considered as high potential land.

Impact rating

- Loss of irrigated land

The impact on loss if irrigated land is difficult if not impossible to mitigate against. The impact therefore is high. The extent of impact is high on Western Route – Western Deviation and Western Route and moderate on C Western Route – Eastern Deviation. It is low in D Central Route and Eastern Route.

- Loss of grazing land:

All routed will equally be influenced. The impact is low.

Recommended Mitigation Measures

For irrigated crops, pivot irrigation may change in favour of less desirable movable pipes and can be costly. If the pylons, however, are placed next to the lands or on road reserves, then the impact will be very small.

The following mitigation measures must be adhered to:

- Keep the footprint during construction as small as possible;
- Maintain security of the sites by appointing guards and providing support to the local farmers;

- Spray water on roads to reduce dust, especially during harvest time.

Summary of impacts and preferred route

Central route and Eastern Route are preferred because of the lower impact that it will have on farming. It will lead to the lowest loss of high potential land and of income.

11 IMPACT ASSESSMENT

11.1 Overview

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed Anderson-Dinaledi 400kV transmission line during the pre-construction, construction and operation phases of the project.

The impacts to the environmental features are linked to the project activities, which in broad terms relate to the physical infrastructure (emphasis on construction and operation stages). Impacts were identified as follows:

- An appraisal of the project description and the receiving environment;
- Impacts associated with listed activities contained in GN No. R386 and R387;
- Issues highlighted by environmental authorities;
- Findings from specialist studies; and
- Comments received during public participation.

11.1.1 Impacts associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the EIA Regulations (2006), which serves as triggers for the environmental assessment process. The impacts associated with the key listed activities follows (note that list is not exhaustive – refer to complete list under **Section 3.1**).

The potential impacts linked to the listed activities are then addressed in the subsequent sections.

Table 32: Impacts associated with the key listed activities

GN No.	Activity	Description	Potential Impact Overview
R387	**1(l)**	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.	Ecological, social and economic impacts associated with the project life-cycle of the proposed transmission line.
R386	**1(m)**	The construction of facilities or infrastructure, including associated structures or infrastructure, for any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including - (vi) canals; (vii) channels; (viii) bridges; (ix) dams; and (x) weirs.	Effects to resource quality (i.e. flow, habitat, biota and water quality) associated with watercourse crossings / erecting the towers in close proximity to watercourses.
R386	**4**	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.	Effects to resource quality (i.e. flow, habitat, biota and water quality) associated with watercourse crossings / erecting the towers in close proximity to watercourses.
R386	**7**	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.	Pollution of bio-physical environment through poor practices associated with onsite storage of dangerous goods.
R386	**12**	The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Adverse impacts associated with the installation of the transmission line in sensitive, threatened or protected ecosystems.

GN No.	Activity	Description	Potential Impact Overview
R386	**14**	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding - (a) masts of 15 metres and lower exclusively used, (i) by radio amateurs; or (ii) for lighting purposes; (b) flag poles; and (c) lightning conductor poles.	Ecological, social and economic impacts associated with the project life-cycle of the proposed transmission line.
R386	**15**	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.	Access roads to the construction site, borrow pits and construction camps. In most cases, access is easily available from existing road network.
R386	**20**	The transformation of an area zoned for use as public open space or for a conservation purpose to another use.	Adverse impacts associated with the installation of the transmission line in sensitive, threatened or protected ecosystems.

11.1.2 Issues raised by Environmental Authorities and I & APs

The issues highlighted by authorities (both regulatory and commentary) during meetings and contained in correspondence received (refer to ***Appendix H)***.

11.1.3 Project Activities and Environmental Aspects

The main project components include the following:

- Installation of a new 400kV transmission line (including concrete foundations, towers, conductors and anchors);

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle, as shown below:

Table 33: Activities associated with the Anderson-Dinaledi 400kV Power Line Project Life-Cycle

Pre-construction
Project Activities
• Detailed engineering design
• Detailed geotechnical investigations
• Geophysical investigations
• Walk-down survey to identify most suitable sites to position towers

• Arrangements with individual landowners and/or land users
• Procurement process for Contractors
Construction
Project Activities
• *On-going consultation with affected parties*
• Vegetation clearance
• Pegging of central line and overall footprint
• Site establishment
• Establish construction camps (including material lay-down areas)
• *Construction employment*
• Delivery of construction material
• Storage and handling of material
• Transportation of equipment, materials and personnel
• Install access gates
• Upgrade existing access roads / build new access roads (where necessary)
• Grading of site (where necessary)
• Excavations for foundations and anchors of towers
• Position premade foundation structures into excavations
• Concrete filling of the foundation
• Erection of steel structures
• Stringing of transmission cables
• *Construction employment*
• *Refuelling*
• *Crossing* inaccessible sites
• *Crossing* sensitive areas
• *Managing construction sites*
• *Reinstatement and rehabilitation*
• Signing off by landowners
• Handing and taking over of the servitude
Operation
Project Activities
• Access arrangements and requirements
• Routine maintenance inspections
• Management of vegetation clearance
• Repair and maintenance works
• On-going consultation with directly affected parties

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment. The following environmental aspects have been identified for the proposed 400kV transmission line, substation upgrades and new turn-in lines, which are linked to the project activities (note that only high-level aspects are provided):

Table 34: Environmental Aspects associated with the Anderson-Dinaledi 400kV Power Line Project Life-Cycle

Pre-construction
Environmental Aspects
• Poor construction site planning and layout
• Inaccurate walk-down survey
Construction
Environmental Aspects
• *Lack of environmental awareness creation*
• *Poor consultation with affected parties*
• Indiscriminate site clearing
• Poor site establishment
• Poor management of access and use of access roads
• Poor transportation practices
• Poor fencing arrangements
• Erosion
• Disruptions to existing services
• *Disturbance of topsoil*
• Poor management of excavations
• Inadequate s*torage and handling of material*
• Inadequate s*torage and handling of hazardous material*
• Lack of *equipment maintenance*
• Poor management of labour force
• Pollution from *ablution facilities*
• Inadequate management of *construction camp*
• Poor waste management practices
• *Wastage of water*
• *Disturbance to landowners*
• Poor management of pollution generation potential
• *Damage to significant flora*
• *Damage to significant fauna*
• *Environmental damage at crossings of* inaccessible sites
• *Environmental damage at crossings of* sensitive areas
• *Disruption of* archaeological and cultural features
• Poor reinstatement and rehabilitation
Operation
Environmental Aspects
• Inadequate management of access, routine maintenance and maintenance works
• Inadequate management of vegetation

11.1.4 Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the project's environmental aspects, but rather to focus on the

potentially **significant** direct and indirect impacts identified during the Scoping phase and any additional issues uncovered during the EIA stage. The significant environmental impacts are listed in **Table 33**.

The EMPr strives to provide a comprehensive list of mitigation measures associated with the overall project-related aspects and impacts for the entire project life-cycle (i.e. pre-construction, construction, operation and decommissioning).

The cumulative impacts are discussed in **Sections 11.11**.

Table 35: Significant environmental impacts associated with the project

CONSTRUCTION PHASE	
Feature	**Impact**
Topography	• Visual impact on ridges • Erosion of affected areas on steep slopes
Surface Water	• Impacts where access roads and the transmission lines cross watercourses
Geology and Soil	• Erosion on steep slopes
Flora	• Removal of vegetation for stringing, building of new access roads, tower construction and construction camp(s) establishment
Fauna	• Impacts to animals • Impacts to livestock
Socio-economic	• Loss of income • Reduction in property value • Damage to property • Relocation of structures situated within servitude
Agricultural Potential	• Loss of agricultural land • Impacts to livestock
Archaeological and Cultural Features	• Damage to heritage resources
Transportation	• Damage to roads by heavy construction vehicles
Aesthetics	• Clearing of vegetation. • Construction-related operations.
Tourism	• Visual and noise impacts from construction operations. • Influence to ecotourism. • Reduction in tourism to areas affected by construction
OPERATIONAL PHASE	
Feature	**Impact**
Topography	• Visual impact on ridges from disturbed area and infrastructure. • Erosion along access roads on steep slopes.
Surface Water	• Inadequate stormwater management on access roads • Damage to towers from major flood events
Geology and Soil	• Erosion on steep slopes
Flora	• Encroachment by exotic species through inadequate eradication programme. • Clearing of vegetation along maintenance road.
Fauna	• Risk to birds from collision with infrastructure and from electrocution
Socio-economic	• Loss of land with extension of existing servitude • Reduction in property value • Threats to human and animal health from EMF
Agricultural Potential	• Loss of agricultural land
Transportation	• Use of maintenance roads
Aesthetics	• High visibility of transmission lines. • Inadequate reinstatement and rehabilitation of construction footprint.
Tourism	• High visibility of transmission lines • Loss of “sense of place”

The findings of the specialists are of particular importance in terms of understanding the impacts of the project and managing the adverse implications of the project life-cycle, as these studies focused on the significant environmental issues identified during the execution of the EIA. As can be seen from the various

impact assessments performed by the specialists, there are a host of cross-cutting impacts that are addressed in a number of these studies, with particular reference to the visual, social and economic effects of the proposed transmission line. The mitigation measures proposed by the specialists for these similar types of impacts are not regarded as contradictory, as they are aligned with best practices and principles.

11.1.5 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed on a qualitative level and thereafter quantitatively assessed by using the methodology provided below. Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

In the case of the specialist studies, most of the impact assessment methodologies deviated from the approach to follow. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of EIA.

For the methodology of the impact assessment, the analysis is conducted on a quantitative basis with regard to the nature, extent, magnitude, duration, probability and significance of the impacts. The following definitions and scoring system apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- Local - extend to the site and its immediate surroundings.
- Regional - impact on the region but within the province.
- National - impact on an interprovincial scale.
- International - impact outside of South Africa.

Magnitude
Degree to which impact may cause irreplaceable loss of resources.
- Low - natural and social functions and processes are not affected or minimally affected.
- Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration
- Short term - 0-5 years.
- Medium term - 5-11 years.
- Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability
- Almost certain - the event is expected to occur in most circumstances.
- Likely - the event will probably occur in most circumstances.
- Moderate - the event should occur at some time.

- Unlikely - the event could occur at some time.
- Rare/Remote - the event may occur only in exceptional circumstances.

Significance
Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-
0 - Impact will not affect the environment. No mitigation necessary.
1- No impact after mitigation.
2- Residual impact after mitigation / some loss of populations and habitats of non-threatened species.
3- Impact cannot be mitigated / exceeds legal or regulatory standard / increases level of risk to public health / extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat.

11.1.6 Impact Mitigation

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of doing things;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rehabilitate; and/or (4) compensate for the environmental impacts.

Figure 63: Mitigation Hiearchy

The proposed mitigation of the impacts includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The mitigation measures that follow in the subsequent sections are not intended to be exhaustive, but rather focus on the significant impacts identified.

The EMPr (refer to ***Appendix E***) provides a comprehensive list of mitigation measures for the entire project, which extends beyond the impacts evaluated in the body of the EIA Report.

	Overview of the EMPr
	The scope of the Anderson-Dinaledi 400kV power line EMPr is as follows: • Establish management objectives during the project life-cycle in order to enhance benefits and minimise adverse environmental impacts; • Provide targets for management objectives, in terms of desired performance; • Describe actions required to achieve management objectives; • Outline institutional structures and roles required to implement the EMPr; • Provide legislative framework; and • Description of requirements for record keeping, reporting, review, auditing and updating of the EMPr.

All liability for the implementation of the EMPr (as well as the EIA findings and environmental authorisation) lies with the project proponent (i.e. Eskom).

11.2 Watercourses

11.2.1 Impact Overview

For the discussion to follow watercourses are considered as rivers, streams, natural channels (perennial and seasonal), wetlands and dams. The alternative routes traverse various major rivers (Swartspruit, Crocodile and the Moganwe). The construction of the line and upgrading or building of new access roads could cause impacts to the "resource quality" of the affected watercourses, which is defined by the National Water Act (Act No. 36 of 1998) as the following:

- Quantity, pattern, timing, water level and assurance of instream **flow**;
- **Water quality**, including physical, chemical and biological characteristics of the water;
- Character and condition of the instream and riparian **habitat**; and
- Characteristics, condition and distribution of the **aquatic biota**.

Impacts to the resource quality of the affected watercourses could include:

- Damage to / loss or habitat (both instream and riparian zone) within the works area;
- Destabilisation of morphology (i.e. river structure);
- Reduction of water quality through sedimentation and poor construction practices;
- Alteration of the flow regime caused by temporary diversions; and
- Reduction in biodiversity of aquatic biota.

Should construction activities encroach upon the regulated area of a watercourse (i.e. 1:100 year floodline / delineated riparian or wetland habitats) water use authorisation will be required in terms of Section 21 of the National Water Act (Act No. 36 of 1998). In accordance with Section 27 of this Act, the following factors need to be taken into consideration by DWA before an authorisation may be issued:

- Existing lawful water uses;
- The need to redress the results of past racial and gender discrimination;
- Efficient and beneficial use of water in the public interest;
- The socio-economic impact of the water use or uses if authorised; or of the failure to authorise the water use or uses;
- Any catchment management strategy applicable to the relevant water resource;
- The likely effect of the water use to be authorised on the water resource and on other water users;
- The class and the resource quality objectives of the water resource;

- Investments already made and to be made by the water user in respect of the water use in question;
- The strategic importance of the water use to be authorised;
- The quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and
- The probable duration of any undertaking for which a water use is to be authorised.

Abstraction of water for construction purposes will not be permitted without the requisite authorisations.

11.2.2 *Impact Assessment*

Environmental Feature	1. Flow
Relevant Alternatives & Activities	All alternatives; watercourse crossings; construction camps; access roads
Project life-cycle	Construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
• Alteration of the flow regime caused by instream and riparian construction activities; • Wetlands may be susceptible to erosion during the clearing, grading and excavation activities.	1.1 No construction activities to encroach upon the regulated area of any watercourse (including buffer zones for wetlands). 1.2 Construction camps to be located not closer than 50m from the edge of riparian habitat / wetland buffer zone. 1.3 Special arrangements for stringing activities to avoid impacts to sensitive watercourse features (including sensitive riparian zones) 1.4 As far as possible, use existing bridge crossings as access roads. 1.5 Manage flow passing through works area for access roads to minimise disturbance to flow regime and to prevent erosion. 1.6 Prevent possible erosion caused by temporary instream diversion, associated with construction of access roads. 1.7 Remove diversion following construction of access roads and reinstate and rehabilitate affected works area.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium	short-term	likely	2
After Mitigation	–-	local	medium	short-term	unlikely	1

Environmental Feature	2. River Morphology
Relevant Alternatives & Activities	All alternatives; watercourse crossings; access roads; maintenance
Project life-cycle	Construction & operation phases

Potential Impact	Proposed Management Objectives / Mitigation Measures
• Destabilisation of morphology (i.e. river structure); • Erosion of watercourse structure; • Damage to / loss of habitat (both instream and in the riparian zone) within the works area.	2.1 Repeat mitigation measures 1.1 – 1.7. 2.2 Select most appropriate crossing point based on geotechnical conditions. 2.3 Select most appropriate crossing point based on sensitivity of riparian habitat (e.g. protected trees, large trees that afford bank stabilisation) and instream habitat, depending on technical feasibility. 2.4 For access roads, reinstate (shaping) and rehabilitate (indigenous riparian vegetation) affected areas. Install suitable buttressing to prevent future erosion, if required.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium	permanent	likely	2
After Mitigation	–-	local	low-medium	short-term	moderate	1

Environmental Feature	3. Water Quality
Relevant Alternatives & Activities	All alternatives; watercourse crossings; construction camps; access roads; maintenance
Project life-cycle	Construction phase & operation phases

Potential Impact	Proposed Management Objectives / Mitigation Measures
• Contamination of surface water through sedimentation from instream works, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water and disposal of solid waste).	3.1 Repeat mitigation measures 1.1 – 1.7 and 2.2 – 2.4. 3.2 Temporary diversion and other dewatering techniques (e.g. pumping) to maintain a dry works area. 3.3 Where necessary for access roads, install instream silt traps during construction within the watercourse channel and along the riparian habitat. Instream silt traps are to be maintained and serviced on a regular basis. 3.4 Implement suitable stormwater measures during construction to manage ingress of runoff into watercourses. 3.5 Ensure proper storage of material (including fuel, paint) that could cause water pollution. Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand. 3.6 Ensure proper waste management and housekeeping.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium	short-term	likely	2
After Mitigation	–-	local	low-medium	short-term	moderate	1

Environmental Feature	4. Aquatic Biota
Relevant Alternatives & Activities	All alternatives; watercourse crossings; access roads; maintenance
Project life-cycle	Construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
• Clogging of gills from increased silt loads; • Alteration of habitat; • Disturbance to migration patterns; • Poaching / illegal fishing.	4.1 Repeat mitigation measures 1.1 – 1.7, 2.2 – 2.4 and 3.2 – 3.6. 4.2 Temporary diversion for construction of access roads to allow for movement of aquatic fauna, as far as possible. 4.3 Environmental induction of all construction workers and implementation of disciplinary procedures for non-compliance.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium	short-term	likely	2
After Mitigation	–-	local	low-medium	short-term	moderate	1

Environmental Feature	5. Pans and Wetlands
Relevant Alternatives & Activities	All alternatives; watercourse crossings; access roads; maintenance
Project life-cycle	Construction & operation phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
Damage to drainage lines / wetlands from crossings, including erosion, loss of vegetation, adverse effects to biota, and disturbance of flow.	5.1 Repeat mitigation measures 1.1 – 1.7, 2.2 – 2.4, 3.2 – 3.6 and 4.2 – 4.3. 5.2 Identify wetlands during walk-down survey. Wetland systems and their buffer zones are regarded as no-go areas during the project life-cycle.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium-high	short-term	likely	3
After Mitigation	–-	local	medium	short-term	unlikely	1

11.3 Geology and Soil

11.3.1 Impact Overview

In areas of steep terrain soil erosion could occur following the clearing of vegetation, grading of tower sites, and use of access roads. Use of heavy equipment during the construction phase could lead to soil compaction.

11.3.2 Impact Assessment

Environmental Feature	6. Geology & Soil
Relevant Alternatives & Activities	All alternatives; access roads; construction camps
Project life-cycle	Construction & operation phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
• Soil erosion on steep slopes. • Erosion along access roads.	• No cutting and filling in areas of 4% sideslope and less. • Stabilisation of cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site specific conditions. • Drainage management should also be implemented to ensure the minimisation of potential erosion on access roads. • Acceptable reinstatement and rehabilitation to prevent erosion during operation phase. • A detailed geotechnical assessment must be undertaken for each tower site prior to commencement of construction activities.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	–-	local	medium-high	short-long	likely	3
After Mitigation	–-	local	low	short-term	unlikely	1

11.4 Flora

11.4.1 Impact Overview

The main reasons for managing the vegetation under power lines include the following:

- Ensuring safe clearances under and around power lines;
- Ensuring adequate access for inspection, maintenance and repair activities; and
- Reduction of fuels for fires under power lines that cause flashovers.

Potential impacts to vegetation resulting from the construction of the proposed transmission line include the clearance of an 8 m-wide strip down the centre of a transmission line servitude for stringing purposes.

During the operational phase, vegetation that could possibly interfere with the operation and/or reliability of the power line must be trimmed or completely cleared. In terms of the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all alien invasive species in the servitude is cleared and chemically treated for the total width of the servitude.

Refer to **Section 12.2.1** for an overview of the impacts to floral features associated with the alternative routes, as identified through the Fauna and Flora Survey (Nemai, 2012), which is contained in ***Appendix D1***. Based on the potential impact to RDL species, vegetation unit conservation and natural or protected areas, the specialist study preferred the following options:

- Western alternative – Eastern Deviation

The project is to be executed in accordance with Eskom's Transmission Vegetation Management Guideline (TGL41-334) (contained in EMP
- ***Appendix E***), which includes provision of the following:

1.1. Integrated Vegetation Management;
1.2. Biomes, Plant Species and Right of Way Management;
1.3. Atmospheric and Climatic Conditions and Vegetation Management;
1.4. Veld Management Practices;
1.5. Laws and Policies;
1.6. Suggested Vegetation Management Practices;
1.7. Commercial Forests;
1.8. Sugar Cane;
1.9. Karoo Biome;
1.10. Fynbos;
1.11. Indigenous Forests; and
1.12. Fire Protection and Fire Fighting Associations.

The walk-down survey team will include an ecological specialist who will identify sensitive floral species within the corridor. The necessary permits will be obtained under the National Forests Act (Act No. 84 of 1998) if avoidance of sensitive species is not possible during the siting of the towers and confirmation of the development footprint.

Note that the potential impacts to the riparian habitat and the associated mitigation measures are discussed under **Section 11.4.2**.

11.4.2 Impact Assessment

The following impacts assessment for floral features and associated attributes was extracted from the Faunal, Floral and Avifaunal Ecological Surveys (Nemai, 2011) (refer to ***Appendix D1*** for an overview of the rating system).

Environmental Feature	**Flora**
Relevant Alternatives & Activities	**All alternatives**
Project life-cycle	**Construction and Operational**
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Destruction of species of conservation importance and their natural habitats	• The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless unavoidable and essential for the purposes of construction. • Relocation of plants of conservation importance (such as Sclerocarya birrea and Boophane disticha) should be implemented by a qualified specialist, following issue of relevant permits. • The contractor for vegetation clearing must demonstrate competence and knowledge to be able to identify different species, declared weeds and alien species correctly. • Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species and make an effort to increase the natural areas around sensitive features such as ridges and rivers. Minimise the width of the servitude, particularly in sensitive areas.

Damage to sensitive important habitats	• Prior to the onset of the construction phase, a thorough search through the preferred site should be undertaken during the flowering season of known RDL floral species in order to remove and rescue potentially affected species. • The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless unavoidable and essential for the purposes of construction. • The contractor for vegetation clearing must demonstrate competence and knowledge to be able to identify different indigenous species, protected species, declared weeds and alien species correctly. • Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species and make an effort to increase the natural areas around sensitive features such as ridges and rivers. Minimise the width of the servitude, particularly in sensitive areas.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	3
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

Environmental Feature	**Flora**
Relevant Alternatives & Activities	**All Alternatives**
Project life-cycle	**Construction phase**
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Vegetation and soil disturbance around construction sites due to general construction activities	• Minimize topsoil disturbance as far as possible. • Level and landscape disturbed topsoil areas to facilitate plant succession. • Erosion control measures, such as stone packing, brush packing and reseeding, should be included on disturbed areas.
Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills.	• Employ on-site personnel responsible for preventing and controlling potential soil pollution through fuel and oil leaks and spills. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. • Containers containing potential contaminating substances must be kept on drip-trays or tarpaulins in case of spills. • Drip-trays must be placed under vehicles and equipment when not in use.
Loss of aesthetic value and sense of place of ridges	• Ensure that development designs compliment the natural surroundings in order to preserve a sense of place.

Damage to plant life outside of the proposed transmission line routes area	• Any plant accidentally removed outside the proposed routes should be replaced or rehabilitated at the expense of the contractor. • Measures must be taken to penalize construction workers who damage plants intentionally or remove plants accidentally without reporting the incident.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

Environmental Feature	**Flora**
Relevant Alternatives & Activities	**All Alternatives**
Project life-cycle	**Operational**

Potential Impact	Proposed Management Objectives / Mitigation Measures
The construction of the proposed transmission line may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalized species within the area.	• Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983). Rehabilitation measures must be employed until such a time as indigenous species are established. If herbicides are used then correct licenses and permits must be acquired prior to use.
Impacts on local and national conservation obligations & targets	• This impact affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. Impacts that could potentially affect the status of protected areas are regarded as unacceptable and should be avoided at all costs. Witwatersberg Pretoria Mountain Bushveld and Magaliesberg Pretoria Mountain Bushveld are listed as Critically Endangered (CR) Threatened Terrestrial Ecosystems and as such any further negative impacts on this ecosystem should be avoided.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	3
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

11.5 Fauna

11.5.1 Impact Overview

Mammals are sensitive to disturbances and habitat destruction and degradation and as such many more species would occur on or near the MPNE than near the residential areas. Thirteen mammals were recorded in the study area from a combination of observations during site-visits and anecdotal evidence provided by local landowners. No sensitive or endangered mammals were visually recorded during the site visits. During the construction of the pipeline it is anticipated that there would be a loss of ecologically sensitive and important habitat units; ecosystem function and faunal habitat. These effects should be temporary as any mammals residing on site would move probably to another area nearby and could move back after the pipeline construction has been completed and rehabilitated.

In terms of avifauna, the study area falls within the Magaliesberg and Witwatersberg Important Bird Area (IBA(ZA018)). IBAs form a network of sites, at a biogeographic scale, which are critical for the long-term viability of naturally occurring bird populations. MPNE provides a suitable habitat for Red data bird species that are known to occur in the area. Cape Vultures and eagles are known to occur on the MPNE. It is however recommended that for areas where the transmission line will run in close proximity to sensitive habitats, the disturbance factors must be limited as much as possible to avoid displacement of sensitive species. Route alternatives would be preferred that are located in close proximity to the existing main transmission system infrastructure as studies have shown that migratory birds become familiar with the powerline patterns within an area and therefore learn to avoid them (van Rooyen, 2009).

According to the specialist, the Eastern route is regarded as the route alternative that would pose the greatest threat to the overall biodiversity of the area during construction of the proposed transmission line as it traverses through the sensitive areas such as MPNE, and the number of Orange Listed plant species recorded on this route were higher than the other route alternatives. The preferred route in terms of flora and fauna sensitivity would be the Western Route-Western deviation, as most parts of the route are along the main road and existing powerline and are considered less sensitive than the alternative routes in terms of biodiversity. The use of existing degraded habitat is preferable and habitat units known to be highly productive in supporting breeding, foraging and roosting sites, such as wetlands and ridges should be avoided.

Various mitigation measures have been proposed to reduce the impacts of collisions of birds with power lines. It is well-known that collisions with the overhead shield (earth) wire far outnumber collisions with the phase (conductor) wires. This is because the earth wire is a single line suspended above the conductor lines, which are often bundled together in groups of four or five lines. These bundled lines are therefore far

more visible in comparison to the earth wire. Mitigation measures should therefore be aimed to making the earth wire more visible.

The most favourable mitigation measure to lessen the impacts of bird collisions is to plan the alignment in such a way that migratory routes are avoided. In a linear construction of this magnitude there are numerous factors to consider when choosing a preferred route, therefore making major alignment shifts are very often not feasible. Bird Flight Diverters (BFD's) were developed in Europe and are attached to the conductor wires. Studies, however, have indicated that their use has had limited success in averting collision impacts in South Africa. Another device, known as a Bird Flapper, has been used on a large scale in South Africa since 2001 and has proven to be more effective than the use of BFD's. A Bird Flapper is a reflective metallic disc-type device that is loosely attached to the earth wire. The loose-fitting attachment allows the disc to move freely in the wind. The resulting intermittent reflecting of the sun off the disc allows for a device that is highly visible from a greater distance. Fitment frequency of these Bird Flappers has been suggested at 10m intervals and staggered along parallel lines, resulting in a bird Flapper device being visible along every 5m of line. These devices should be fitted along all areas were migratory routes have been identified within the survey area along the chosen preferred route alternative. Some RDL species are known to migrate at night, when line visibility is at its lowest. Fluorescent tubes that derive power from the conductor fields of the lines have been shown to avert this impact in high impact areas.

Another mitigation measure that has been suggested is the removal of the earth shield wire from areas where migratory routes have been identified, as long as these areas do not fall within areas that are subjected to major electrical storms. This is considered non-feasible due to technical constraints and implications.

Habitat destruction and the associated displacement of various avifaunal species is thought to be a lesser potential impact on the general avifaunal conservation within the survey area. The general aridity of the survey area, especially within the western regions, means that clearing of vegetation within the servitude to an acceptable height to safeguard against fire hazards and therefore habitat loss could be minimised. River valleys harbour a greater density of taller vegetation. This is especially evident in the riparian forests within the eastern regions of the survey area. These tall trees support breeding of many avifaunal species that will be displaced if the vegetation is cleared to accommodate the servitude. The river valleys occur within lower-lying areas that could be spanned in a manner that would not necessitate vegetation clearing. It is recommended that minimal vegetation be removed from within servitude areas and only limited to a height class that could pose a fire risk to the overhead lines.

The project will adhere to Eskom's Transmission Bird Collision Prevention Guideline (TGL41-335).

As with the flora, the walk-down survey team will include an ecologist who will identify suitable habitat for sensitive faunal features. Where possible, these sites will be regarded as no-go for the location of towers.

11.5.2 Impact Assessment

Environmental Feature	Fauna
Relevant Alternatives & Activities	All Alternatives
Project life-cycle	Pre - Construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
Distrubance to fauna and avifauna	• During site preparation special care must be taken during the clearing of the works area to minimize damage or disturbance of roosting and nesting sites. • Barricading measures to be utilised should not restrict the movement of the fauna in the area. • As a pre-requisite to construction, it is strongly recommended that a rigorous monitoring programme is implemented to detail avian densities in the impact zone, better quantify flight paths and routes on site and in the immediate surrounding area. Careful installation of bird flappers on the conductors,at the Saartjies Nek will be required in order to mitigate collision risks at this vulnerable flight path area. Bird species, such as Bustards and cranes, which have slow, heavy flight pattern, are prone to collisions.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

Environmental Feature	Fauna
Relevant Alternatives & Activities	All Alternatives
Project life-cycle	Construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
Disturbance to animals and livestock	• Animals residing within the designated area shall not be unnecessarily disturbed. • Before construction starts, construction workers must be educated with regards to littering and poaching. • The Contractor and his/her employees shall not bring any domestic animals onto site. • Photographs of sensitive animals must be displayed in the construction camp to heighten awareness of the creatures. • Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.
Bird streamers causing electrical faults.	• Perch management through the use of perch deterrents (bird guards) can be used and fitted at least 1m directly above and on both sides of the phase conductor. Open perch areas should be allowed to remain after construction.

Potential impact on animal passage through and specifically out of the construction site.	• Construction areas must be fenced using palisades for the migration of small faunal species out of the construction zone. This excludes areas where animal activity could be hazardous, such as around excavations, where such areas should be appropriately blocked off. • Site camps should be placed in areas that do not impact on animal movement corridors.
Potential impact to habitats of sensitive species.	• Important sensitive habitats such as rivers and ridges need to be preserved in order to protect species that utilize these areas as their preferred habitats. A buffer-zone around sensitive areas must be demarcated with hazard tape or orange mesh netting to prevent accidental disturbance.

Potential impact on sensitive habitats related to invertebrates	• Building activities must be restricted and carefully monitored to keep disturbance to a minimum, and must be appropriately rehabilitated and managed. This entails the removal and proper disposal of all rubble and litter previously dumped along the proposed route illegally (considerable dumping was observed in Marikana Thornveld close to Damonsville), as well as all scrap materials, building rubble and rubbish dumped on the route during construction, at official municipal dumping grounds. • Dumping of any materials in undeveloped open areas is not allowed and this must be actively managed. • Construction must preferably take place during the dry season and no temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment or any other use of the buffer/flood zone whatsoever, may be permitted during the construction phase. • All construction-related impacts (including service roads) must be contained within the fenced-off development areas. • Adequate erosion preventative mechanisms must be implemented throughout the construction phase. Erosion resulting from the development must be appropriately rehabilitated preventing further habitat deterioration. • Stormwater runoff must be correctly managed during the development. Special care needs to be taken during the construction phase to prevent surface stormwater containing sediments and other pollutants from entering pans, drainage lines and wetlands. A surface runoff and stormwater management plan must be put in place prior to commencement of construction activities. The total sealing of walkways, pavements, drive ways and parking lots should not be permitted in the free space system. These should form part of and be contained within the areas earmarked for development. This would aid in the minimising of artificially generated surface stormwater runoff. • The use of insecticides, herbicides and other chemicals is not permitted within 200m of an open space system. • An integrated pest management programme, where the use of chemicals is considered as a last option, should be employed. However, if chemicals are used to clear invasive vegetation and weedy species or for the control of invertebrate pests, species-specific chemicals should be applied and in the recommended dosages. General spraying is prohibited and the application of chemicals as part of a control programme is not permitted to take place on windy days. • Outside lighting must be designed to minimize impacts, both directly on especially rare or endangered invertebrate species and indirectly by impacts on populations of prey species. All outside lighting must be directed away from sensitive areas. • All disturbed drainage lines that the proposed route will traverse must be rehabilitated and maintained as important biological corridors or migratory passages. The crossing of natural drainage systems must be minimized and should only be constructed along the shortest possible route, perpendicular to the natural drainage system. Transmission line crossings must span the entire stretch of the flood line or buffer zone (see *Sensitivity Mapping Rules for Biodiversity Assessments* for buffer zone and flood line requirements)".

• Potential impact to sensitive vegetation that houses reptiles and amphibians	• Minimal vegetation clearance and disturbances must occur along the proposed pipeline route. • Vegetation clearance to be restricted to the actual transmission line servitude (55m) and not into surrounding grassland or bushveld areas. • As certain sections of the proposed transmission line is situated on a sloping gradient; erosion/siltation preventative measures must be implemented throughout all phases of the project. • The object of vegetation clearing is to trim, cut or clear the minimum number of indigenous trees (*Sclerocarya birrea, Acacia caffra, Acacia nilotica*) and vegetation necessary for the safe mechanical construction and electrical operation of the transmission line. • Vegetation clearing on tower sites must be kept to a minimum and the alignment shifted away from open and closed *Acacia* woodland areas. • Large exotic trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. • Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. • Any vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower. Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. • The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications. All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. • Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer. • In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced. • Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc. • Contour banks shall be spaced according to the slope on tower sites. The type of soil shall also be taken into consideration. • No open fires are allowed on site. • Fire-fighting equipment must be available on all construction vehicles at all times.

• Potential impact to threatened amphibian species either directly or indirectly	• Construction activities of the Anderson-Dinaledi transmission line must be restricted to daylight hours reducing the potential impact on the nocturnal breeding activities of the majority of amphibian species. • Ideally the installation of the new towers/pylons must be undertaken during the dry winter months (May-September) when the majority of amphibian species are dormant. • All pylons must be positioned 32m from the edge of the riparian zone of the Crocodile River and Swartspruit. • Activities around the Crocodile River and Swartspruit must be strictly limited to the proposed servitude. • No Giant Bullfrogs must be collected for food or illegal pet trade. • No activities must be allowed within any adjacent wetland habitat. • As a precautionary mitigation measure it is recommended that the construction contractor as well as an independent environmental control officer (ECO) be made aware of the possible presence of certain threatened amphibian species (Giant Bullfrog) prior to the commencement of the construction of the new transmission line.

Potential impact to threatened reptile species either directly or indirectly	• Termite mounds also provide nesting site for numerous snakes, lizards (varanids) and frogs. If any termite mounds have to be destroyed a qualified herpetologist must be present in case any lizard, snake and blind snakes, or the red data Striped Harlequin Snake (Rare) are unearthed. • Wherever possible, large expanses of termite mounds should ideally be avoided wherever possible by the proposed transmission line servitude. • As a **precautionary measure**; prior to earth-clearing activities a suitably qualified environmental officer/herpetologist must carefully excavate larger termite mounds as well as around the termite mounds or burrow systems, logs, loosely embedded rocks and other surface material and remove affected animal species (reptiles, amphibians, small mammals). • Any termite mound which must be destroyed should be carefully excavated by hand and pick. • Any animals rescued or recovered must be relocated in suitable habitat away from the transmission tower and line. • Trees including stumps; bark and holes in trees are vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors). The removal of indigenous tree species as well as vegetation clearance must be kept to the minimum area required and be restricted to the servitude. • Indigenous cleared vegetation should form wood piles and logs and stumps. Dead or decaying wood piles should be created as these will provide valuable refuge areas especially due to the clearance of vegetation cover. • Any lizards, geckoes, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project. • Vegetation clearance on the Magaliesburg ridge crossing of the powerline servitude must be limited to the minimum requirements. Activities should be restricted to the current and proposed servitude especially in these sensitive environments. • Disturbance of topsoil on tower sites with severe slopes shall be minimised at all costs. • At any tower sites where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation of such tower sites. • During backfilling operations, the Contractor shall take care not to dump the topsoil in the bottom of the foundation and then place spoil on top of that. • In sensitive areas, foundations for tower constructions must be excavated by hand. • Should any threatened animal species (Striped Harlequin Snake, Blunt-tailed Worm Lizard) be exposed during excavation, the construction in the vicinity of the finding must be stopped. A suitably qualified herpetologist must be called to the site to inspect and determine the significance of the discovery. The relevant conservation authorities must be informed within 24hours of the discovery.

• Excessive habitat destruction during construction could reduce the amount of habitat available for reptiles and other herpetofauna.	• This impact is anticipated to be localised, of a long-term nature and of low significance, provided that appropriate mitigation measures are implemented (e.g. the limitation of vegetation clearance within sensitive areas). Prior to construction and vegetation clearance a suitably qualified zoologist (herpetologist) should undertake a walk-through of the preferred alignment and closely examine the proposed tower/pylon construction areas (concrete supports) for the presence of any animal burrows (including spiders and scorpions), rocky outcrops, logs, stumps and other debris and any affected animals to appropriate habitat away from the servitude or tower.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

Environmental Feature	**Fauna**
Relevant Alternatives & Activities	**All Alternatives**
Project life-cycle	**Operational**

Potential Impact	Proposed Management Objectives / Mitigation Measures
Maintenance of powerlines	• Use the existing road and look out for animals on the road. Speed limits must be maintained with the use of signs and speed bumps.
Collisions of birds with overhead lines	• People responsible for maintaining the area should monitor for collisions and report any incidents. • Ecologically sensitive areas should remain as prohibited areas. • Eskom employees and or subcontractors to remain inside construction footprint. All staff to be informed of disciplinary actions for the wilful damage to plants and animals. • Fitting bird flappers on the lines within migratory pathways and the major migratory routes pertaining to the project area to coincide with sensitive areas such as river valleys and prominent ridge systems. • Maintenance crews to monitor for bird collisions and to mitigate for this impact within areas identified as hotspot collision areas not previously identified during the pre-construction and construction and phase.
Bird streamers causing electrical faults	• Perch management through the use of perch deterrents (bird guards) can be used and fitted at least 1m directly above and on both sides of the phase conductor. Open perch areas should be allowed to remain.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

11.6 Heritage Resources

11.6.1 Impact Overview

A Phase 1 Heritage Impact Assessment, in accordance with Section 38 of the National Heritage Resources Act (Act No. 25 of 1999), was conducted as the project exceeds 300m in length. SAHRA was consulted during the execution of the EIA, and this authority requested a copy of the Heritage Impact Assessment for review.

The National Heritage Resources Act (Act No. 25 of 1999) identifies the following categories of significant heritage sites:

- 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 Heritage Impact Assessment (Leonie Marais-Botes, 2011) provides a matrix that incorporates the above criteria for each identified site (see **Section 11.6.2**).

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 application of mitigation measures would allow the development activities to continue.

The primary objective of the EMPr in terms of archaeology / historical resources is to ensure that no artefacts of historical or cultural value are negatively impacted, damaged or destroyed.

The project will endeavour to avoid heritage resources. To achieve this, a walk-down survey (which includes a heritage specialist) of the corridor will be undertaken prior to construction to document all heritage sites, features and objects. The siting of the towers will then be considered based on the findings of this survey. No heritage resources are to be affected without a valid permit from SAHRA.

11.6.2 Impact Assessment

Environmental Feature	**Heritage Resources**
Relevant Alternatives & Activities	**Eastern alternatives; access roads; construction camps**
Project life-cycle	**Construction phase**
Potential Impact	**Proposed Management Objectives / Mitigation Measures**