Turn-in

BRAAMHOEK TRANSMISSION INTEGRATION EIA

BRAAMHOEK TURN-IN

SCOPING REPORT

DRAFT FOR PUBLIC COMMENT

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1. INTRODUCTION

In December 2002, the Department of Environment Affairs and Tourism (DEAT) awarded Eskom environmental authorisation for the construction of the Braamhoek Pumped Storage Scheme in the Drakensberg on the provincial border between the Free State and Kwa-Zulu Natal. A condition (no. 6.2.37) of the authorisation is that Eskom undertakes "a comprehensive Environmental Impact Assessment for all access roads and power lines that connects the scheme to the national transmission grid".

Eskom Transmission is tasked with connecting the scheme to the National Grid, and has assumed responsibility for the EIA for the power lines. The extent of the development to effect this connection includes:

- The construction of a 400kV Transmission Substation, to be called the Braamhoek Substation, near the scheme,
- Provide an initial connection to the National Grid via a 'turn-in' from the nearby Majuba-Venus #2 400kV Transmission line,
- Ensure the reliability of the network by linking Braamhoek Substation directly to the Venus Substation near Estcourt with a new 400kV Transmission line.

Location information and co-ordinates for all the main locations in this report are given in Appendix 1.

Following a Pre-feasibility Study completed in October 2004, applications for permission to undertake Environmental Impact Assessments (EIAs) were submitted to the Department of Environment Affairs and Tourism (DEAT) in November 2004. DEAT approval was granted for detailed Scoping Studies for each of the projects, and this report presents the findings of the Scoping Study for the Braamhoek 400kV Turn-ins. Separate reports are published for each of the three projects, but these need to be read in conjunction with the Public Participation Process report that covers all three projects.

A suite of reports are published in support of the Braamhoek Transmission Integration EIA:

- Braamhoek-Venus 400kV Line – Draft Scoping Report
- Braamhoek Turn-in – Draft Scoping Report *(This report)*
- Braamhoek Substation – Draft Scoping Report
- Appendix A – Public Participation Process *(to be read in conjunction with all of the above)*

2. STUDY BACKGROUND

2.1. BRAAMHOEK PUMPED STORAGE SCHEME

Towards meeting predicted future electricity demand, Eskom is implementing its Integrated Electricity Plan (IEP) that considers combination of initiatives including:

- Demand side management – implementing energy saving measures and encouraging non-peak load use where possible in domestic, commercial and industrial sectors.
- Increasing base-load capacity - bringing previously mothballed power stations back into operation and the development of new base-load (= continuous load) power stations (hydro-power, coal and gas fired, nuclear power).
- Increasing peaking capacity – provision of generation capacity that can be 'turned-on and switched-off' at short notice to meet daily peak loads. These include combined-cycle gas turbines and pumped storage hydro schemes, such as the Braamhoek Pumped Storage Scheme (PSS).

It is understood that over the last two decades Eskom has investigated close to 90 possible pumped storage scheme sites across the country, including over 20 in Kwa-Zulu Natal. Between 1989 and 1995 a shortlist of sites was drawn up, including the Braamhoek PSS site. It was subsequently selected for implementation and an EIA was undertaken. Depending on peak demand capacity requirements, other sites may also be identified for development in the future. As mentioned above, environmental authorisation and Record of Decision (RoD) for the Braamhoek PSS was issued in December 2002.

It is clearly necessary for the Braamhoek PSS to be connected to the National Grid, and as such the 'need and desirability' of the three Transmission projects associated with the Braamhoek PSS is not questioned further. It has been noted during the public consultation process on this study that there has been considerable debate surrounding the Braamhoek PSS. **It is important to note here, therefore, that it is not within the focus of this EIA to question the need for the Braamhoek PSS nor its environmental authorisation**.

Instead, it is necessary to review the manner in which the Braamhoek will be connected to the National Grid, and the following sections set out the Transmission project proposals, and a Pre-feasibility study that was undertaken.

2.2. TIMEFRAMES

Based on the latest growth predictions, it is expected that power from Braamhoek PSS will be required by 2012. It is expected that the first unit of the scheme will be commissioned in 2011. The next three units will be commissioned every three months thereafter, with the last unit being commissioned in 2012. In order to meet this commissioning date, the design of the scheme commenced in 2004 and construction must begin in 2007.

The given timeframe for starting the construction of the Transmission infrastructure is 2007.

2.3. TRANSMISSION PROJECT PROPOSALS

The new power station will require two connections to the National Grid to provide the necessary reliability of supply. The three main elements required to achieve this are:

a) A new substation at the power station site = the Braamhoek Substation
b) Two independent links to the Transmission network (=National Grid). These could either be achieved by 'turn-ins' from existing lines, or by new lines connecting to nearby Transmission substations.

Appendix 3 of the *Braamhoek-Venus 400kV Line – Draft Scoping Report* presents an Eskom statement on the need for the 400kV Transmission lines to the National Grid. Two options for connecting to the grid are proposed, and these became the focus of a pre-feasibility study prior to the start of this EIA (see next section). It is understood that Eskom considered some 20 different options before arriving at the two preferred options. These included different combinations of turn-ins and new lines within the existing Transmission Grid shown below.

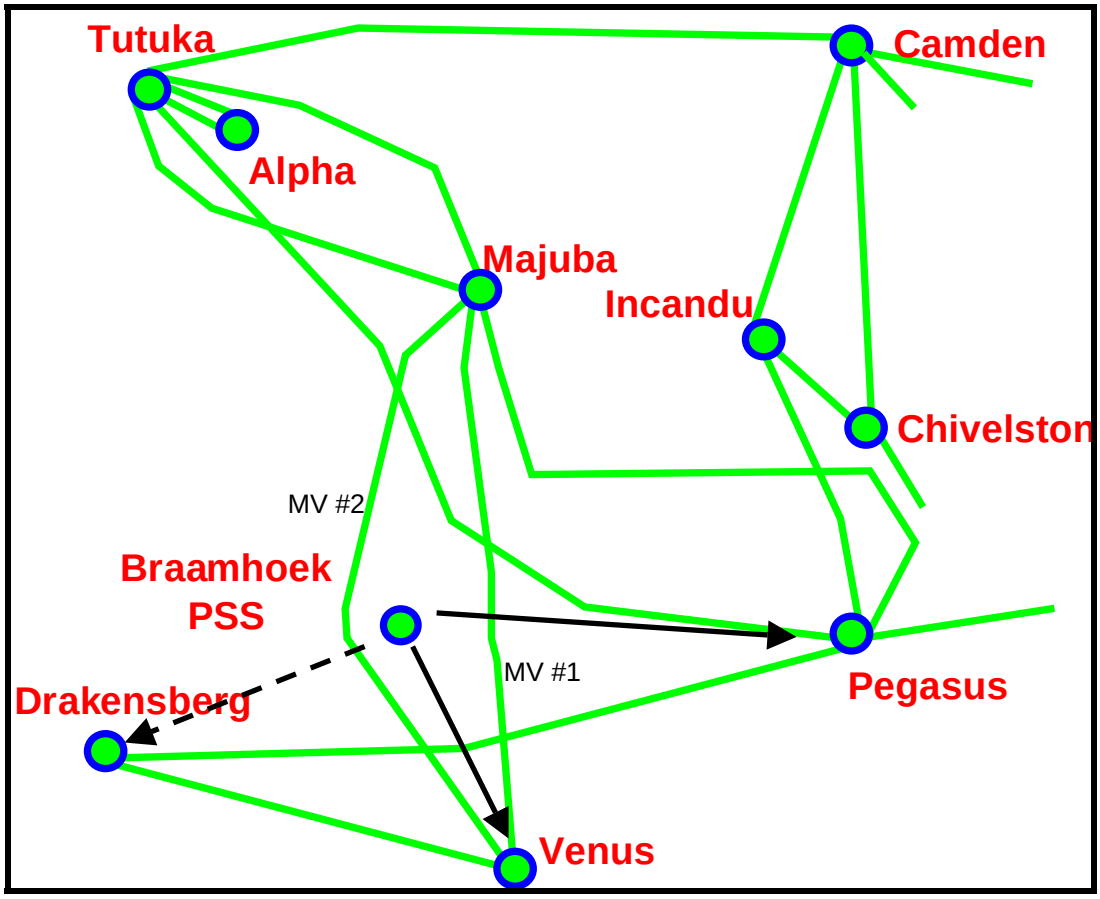


Figure 1: Location of Braamhoek PSS within the Transmission Grid

The two nearest 400kV Transmission lines that may be turned in to the Braamhoek substation are the Majuba-Venus #1 and Majuba-Venus #2 lines (MV #1 and MV #2 lines in Figure 1). The nearest point to the MV #1 line is 25km, while MV#2 is some 10km from Braamhoek. For

reasons of network stability only one of these may be considered for turning in to Braamhoek, and the shorter of the two has clear preference in this instance.

There are also three Transmission substations to connect to; Drakensberg, Venus and Pegasus, and are each a similar distance from Braamhoek at around 80km. However, Drakensberg Substation will require a substantial upgrade, making it considerably more expensive than the other two. Technical analysis of Venus and Pegasus showed both to have very similar electrical performance, and it was left to environmental considerations to determine which would be the preferred option. As a result, Eskom commissioned a pre-feasibility study on these two options prior to the start of the EIA, the outcome of which is summarised in the *Draft Scoping Report: Braamhoek-Venus 400kV Transmission Line*.

3. TECHNICAL DETAILS OF THE PROPOSED INFRASTRUCTURE

3.1. 400kV Transmission Lines and Turn-ins

The proposed line, pylon type and servitude details are as follows:

- 400kV overhead Transmission line
- Pylon construction will typically be cross-rope suspension design, 35 – 40m high (Figure 2a), or a compact cross-rope suspension design (see Figure 2c below) of similar dimensions.
- Strain towers may be required on difficult terrain and on bends greater than 3° (Figure 2b),
- Single-pole lattice structures with anchor guys may also be used on bends as appropriate. These are much less visually intrusive and are cheaper than conventional strain towers (Figure 3).
- Conductor ground clearance between towers is 8.1m
- Maximum operational height under conductors of 4.0m
- Servitude width 55m (27.5m either side of centre line). It is to be noted that the anchor cables for cross rope towers usually fall outside the 55m servitude width.

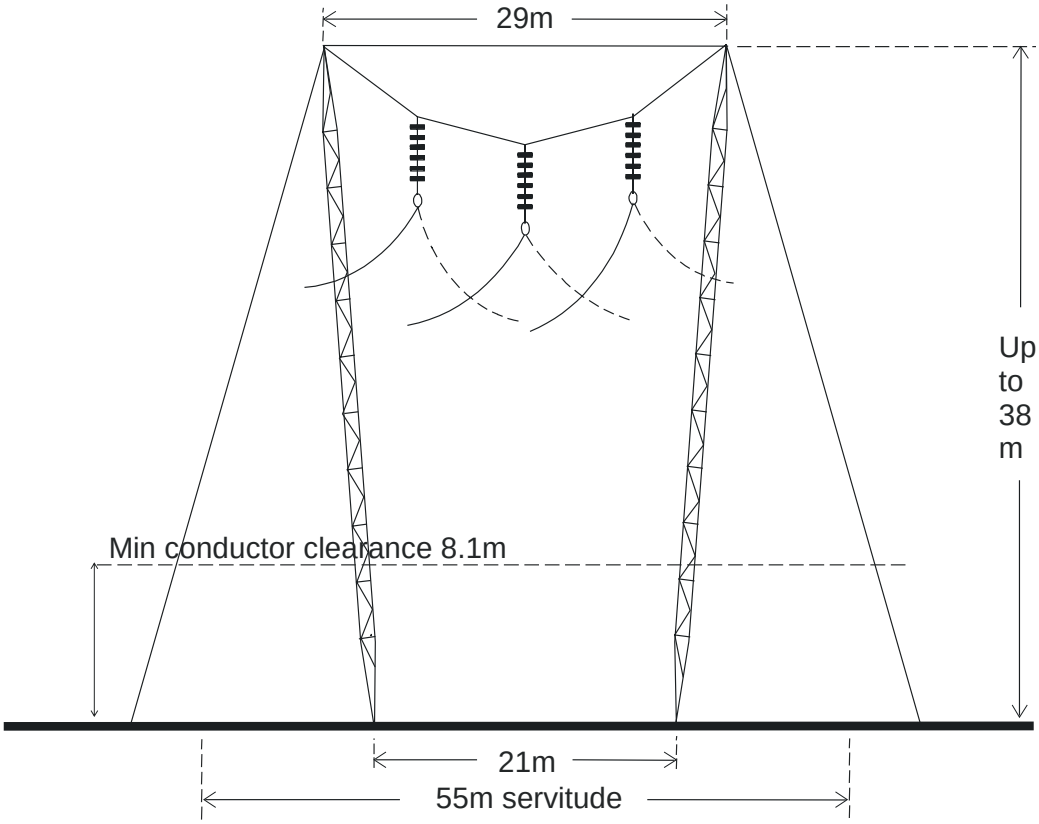


Figure 2a: Typical form of a Cross-rope Suspension Tower.

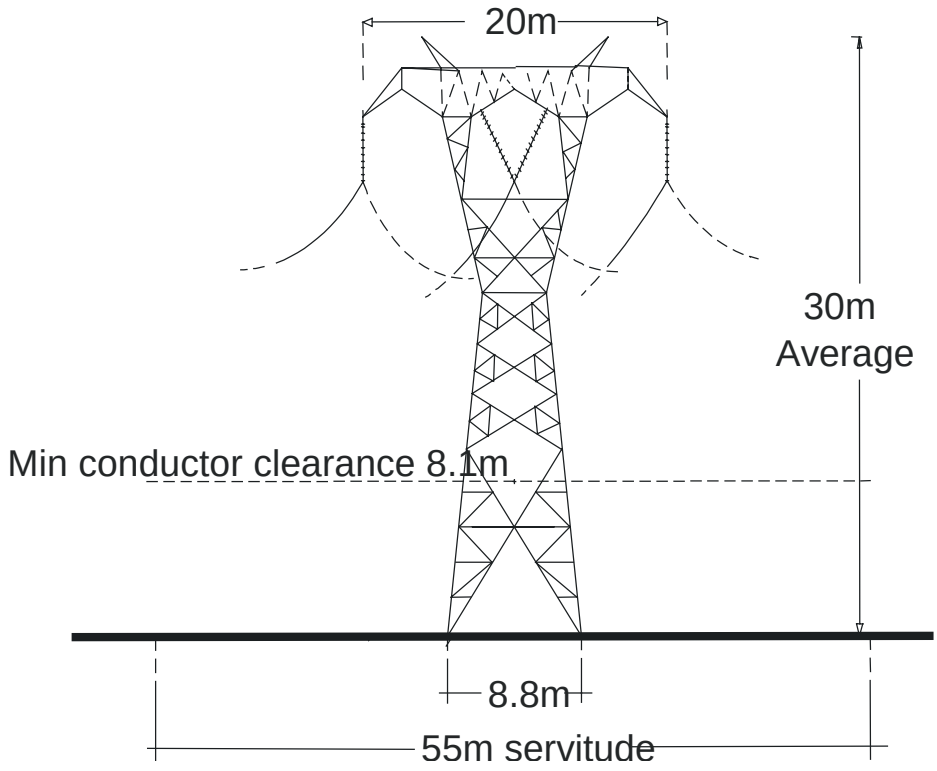


Figure 2b: Typical form of a Strain Tower

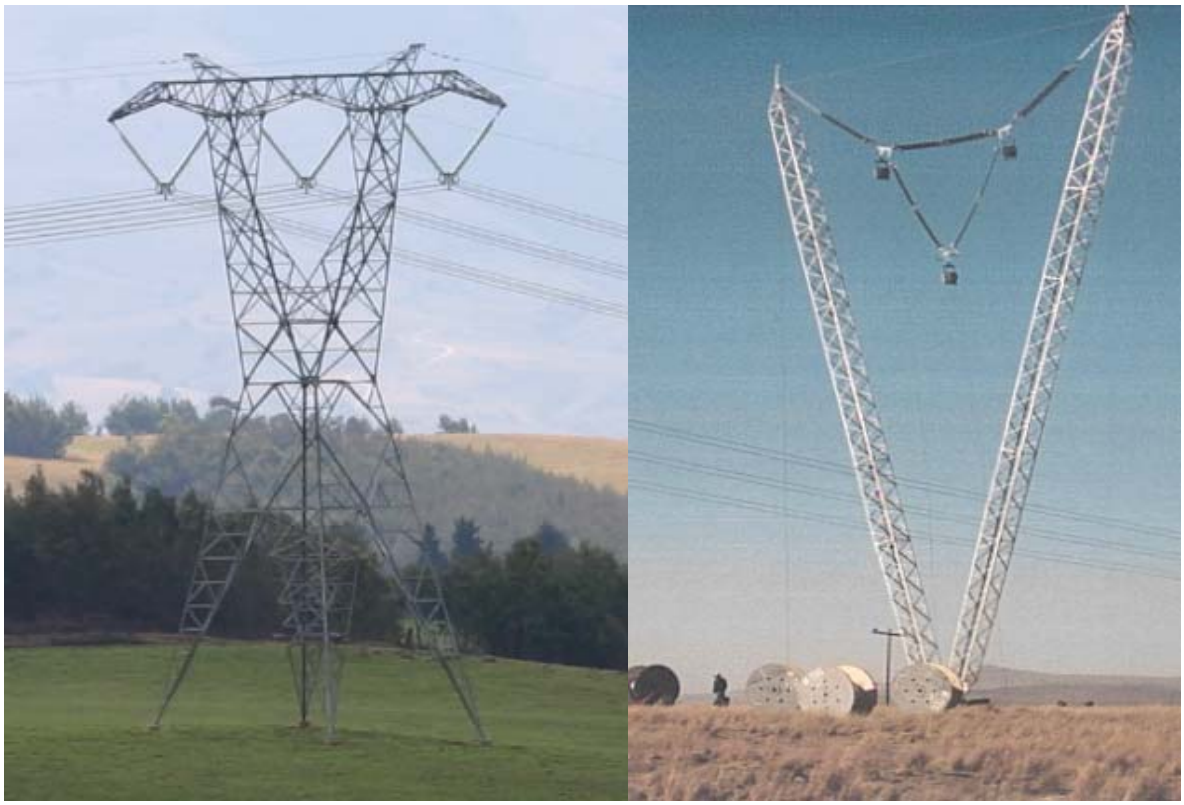


Figure 2c: Examples of both strain tower and compact cross rope suspension tower types

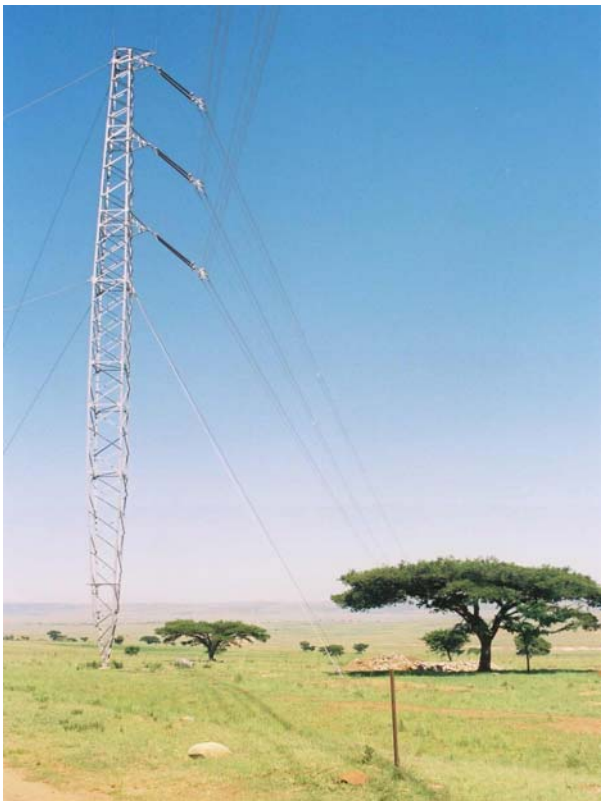


Figure 3: Example of a single pole steel lattice pylon

4. PROPOSED STUDY APPROACH

Due to the unusual circumstances pertaining to these projects, in particular the existing servitudes along the Majuba-Venus #1 and #2 400kV Transmission lines, and the location of the Braamhoek substation on ground that will have already been disturbed and used during the construction of the power station, it was considered reasonable to undertake a detailed Scoping Study for each of the three projects in the study. The Pre-feasibility Study Report was submitted to DEAT and the DAEA-KZN at the Pre-application Meeting and it was agreed to proceed on this basis. The application forms and Plan of Study were therefore prepared and submitted describing this approach, and these were approved by DEAT and the DAEA-KZN.

4.1. TURN-INS FROM THE MAJUBA-VENUS #2 TRANSMISSION LINE

Initial investigations for route options for Turn-ins from the Majuba-Venus #2 line and Braamhoek Substation are similarly limited. Largely determined by the terrain, a route along the foothills of the Drakensberg escarpment stands out as the clearly preferred option. The environment in this area is fairly uniform and comprises a combination of open grasslands and wetlands. These are sensitive environments and will need to be carefully managed during construction, but the impacts and mitigation requirements will be similar wherever the line passes through the area.

Another option was considered; a route along the top of the escarpment, utilising access roads already planned for the Braamhoek PSS, but then dropping down the steep escarpment at a location between the Upper and Lower reservoirs of the PSS. However, concerns relating to visual and avifauna impacts and likely construction problems in dropping the lines down the escarpment were raised.

The Scoping Study addresses both options, but gives focus to the route along the foothills of the escarpment as the preferred route.

4.2. PUBLIC PARTICIPATION

A comprehensive public participation programme has been undertaken in this study. It has been structured to encompass all four projects (including the access roads EIA) that are related to the Braamhoek P.S.S. this was thought to be a better process from the public's perspective in that they would not have to participate in two or more consultation programmes and that all issues raised could be collated into one report. Thus a separate report on the public participation process is published in support of this Scoping Report on the Braamhoek Substation. This is entitled *Appendix A – Public Participation Process*.

5. DESCRIPTION OF THE STUDY AREA

The location and general data relating to the Turn-in are given in the map and data sheet in Appendix 1. *Additional environmental sensitivity maps are also presented in Appendix 1 (Maps 2-1 to 2-5) of the Braamhoek-Venus 400kV Line – Draft Scoping Report.*

The Turn-in will link the proposed Braamhoek Substation with the existing Majuba-Venus #2 400kV Transmission line that runs to the west of the substation site. The study primarily focussed on the foothills of the Drakensberg Mountain escarpment though consideration was also given to the top of the escarpment as a potential option. Photos in Appendix 3 depict the nature of the area.

Given the lack of human intrusion and very diverse topography the visual quality of this area is seen to be high (see specialist report in Appendix 5). Views of the Turn-in lines will be intermittent given the undulating nature of the terrain. Critical views will typically be from the De Beers Pass and the surrounding mountain slopes (though the latter have limited access). The planned future De Beers Pass National Road will pass through the middle of the study area.

The land cover is characterised by Highland Sourveld, large sections of which remain little affected by landuse practices and are in good condition, though some areas of transitional tall grassveld occur where disturbances (eg over grazing) have occurred. Upland wetlands occur in many of the valleys in the area, ranging in size from small hillslope wetlands to wetland areas of many hectares (see map in Appendix 1). Some of these wetlands have been disturbed by past impacts (eg road and track crossing, erosion, excavation), but many are in a healthy condition.

The wetlands and high altitude grasslands attract a number of bird species that are sensitive to power lines mainly through collision with earth wires, but also electrocution. These birds include Crowned and Blue Cranes, the Korhaan, Denims Bustard and Secretary Bird. In total there are estimated to be some 14 power line sensitive Red Data bird species in the study area for the Turn-ins (see specialist study in Appendix 7 of the *Braamhoek-Venus 400kV Line – Draft Scoping Report*). The map in Appendix 1 shows an important area of crane habitat, though in general the wetlands below the escarpment are seen to be less sensitive than those at the top of the escarpment. Critically endangered Wattled Crane and White-winged Flufftail are potential visitors to the lower areas (base of the escarpment), but are important species found at the top of the escarpment. It is important to note that the crane populations will migrate between the grasslands and wetlands at the top (summer) and the bottom (winter) of the escarpment.

The ecology of the area is generally seen to be fairly robust given the nature of power line developments. The study area for the Turn-ins is on the edge of the distribution of a number of Red Data plants but apart from *Kniphofia flammula* they are considered unlikely inhabitants along the Turn-in route. The *Knophofia* is transplantable and can be protected from construction damage. The grasslands are robust provided there is no scraping away of the topsoil, and wetland vegetation is usually quickly rehabilitated provided soil water flows are not disrupted or drained.

Apart from impacts on birds, other fauna in the area is mobile and should move away from the areas during construction. However, there are a number of protected species that will need to be avoided and will require care in the construction phase:

- The Dobson's rough haired golden mole is a Red Data specie that is likely to occur in the undisturbed grassland areas of the study area,
- The Natal leaf folding frog and the long-toed tree frog are possible habitants of some of the wetland areas. Though mobile, care will need to be taken during construction so as not to disturb these species and their habitats.
- Two reptiles need to be avoided; the Natal midlands dwarf chameleon and the Black headed dwarf chameleon. Habitat destruction during construction is likely without due care.
- A number of possible Red data butterfly species may also exist in the area of the Turn-ins; *Metisela meninx, Capsys penningtoni, Chrysoritis lyncurnium, Lepidochrysops pephredo* and *Lepidochrysops hypopolia* (the latter is thought to be extinct).

Landuse is primarily extensive grazing, though there are areas on the flatter slopes that have moderate arable potential. The main areas are closer to the proposed lower reservoir site and are shown on the map in Appendix 1. The area is also sparsely populated with isolated clusters of homesteads scattered throughout the area.

6. DISCUSSION ON ALTERNATIVES

6.1. STRATEGIC ALTERNATIVES

To meet the required standard of reliability of supply from Braamhoek P.S.S., the Braamhoek substation will require two connections to the National Grid. As discussed in Section 2.3 in this report, Eskom investigated some 20 different options and identified their best technical and cost options to be a combination of Turn-ins from either the Majuba-Venus #1 or #2 lines, and a new line linking Braamhoek directly to a Transmission substation. The Turn-in links to the Majuba-Venus #1 or #2 lines will be approximately 25km and 10km respectively, and both will be through terrain of similar environmental sensitivity. Hence, preference was given to developing a Turn-in link to the Majuba-Venus #2 line running to the west of Braamhoek. The possible Turn-in link to Majuba-Venus #1 was not considered in this EIA Study.

6.2. TECHNICAL ALTERNATIVES:

The main technical alternative to the overhead power lines is the possible 'undergrounding' of the power lines. There are both environmental and cost implications of this option that are described in more detail in the Section 6.1 of the *Braamhoek-Venus 400kV Lines – Draft Scoping Report.* For reasons given in that report this alternative has not been considered further in this study of the Turn-ins.

6.3. LOCAL ALTERNATIVES

Two principle alternatives were considered here; along the top of the escarpment and along the base of the escarpment. Depending on alignment in these areas, it is possible that these options will be of similar length (approximately 12km).

6.3.1. Route along the top of the escarpment.

The best route along the top of the escarpment is expected to follow the access roads proposed for the upper reservoir for the P.S.S. (see map in Appendix 1). The access road shown is the subject of an EIA being undertaken at the time of writing of this report, and therefore can only be considered a possible access route at this stage. However, there is already a vehicle track along much of this route that would be sufficient for the construction of the Turn-in lines. This route closely follows the provincial border between Kwa-Zulu Natal and the Free State, which approaches the crest of the escarpment at many locations along the way. Moving the Turn-in route option away from the crest of the escarpment would lose the benefits of following the access road/existing track, but more importantly it would move it into the wetland areas in the valley to the north. These wetlands are highly sensitive bird habitats for cranes and the White-winged flufftail.

During site inspection with environmental specialists two major concerns were raised:

- The route would be highly visible and with the visual quality of the Drakensberg mountain escarpment deemed to be high, the resulting visual impact would be highly significant and negative.
- Though the route is not in the wetlands on the top of the escarpment, it will cut across critical flight paths for the crane species that migrate across the escarpment between the upper and lower grasslands and wetlands. Crane mortalities have been recorded on the existing Majuba-Venus #2 400kV line that passes along the top of the escarpment. The potential impact of this option on birds is seen to be highly significant and negative.

Under the circumstances this option of routing the Turn-ins along the top of the escarpment is seen to be fatally flawed and therefore a 'no go' alternative.

Questions were raised regarding the technical feasibility of dropping the Turn-in down the face of the escarpment to the proposed substation site. There are various examples in South Africa where Transmission lines have been constructed across steep mountain ridges of similar slope and height. It is expected that it is technically possible for the Turn-in to climb the escarpment at the proposed substation site, and two provisional routes were mapped as possible options here. However, given the concerns above, the technical and environmental issues of this were not explored further.

6.3.2. Route along the base of the escarpment

The terrain and environment below the escarpment is relatively homogeneous. As such, environmental impacts will be similar within an estimated 3 to 4km corridor from the base of the escarpment. Constraints are seen to include (see map in Appendix 1):

- The steeper slopes at the base of the escarpment
- Crane breeding areas to the south
- Potential arable areas
- The infrastructure and lower reservoir associated with the Braamhoek P.S.S.

With specialist environmental input, a preferred route has been identified within this corridor. The main issues that affect the route are:

- To minimise bird impacts by avoiding wetlands or, where this is not possible, finding the shortest route across the wetland.
- Avoiding ridges and high points where possible so as to minimise the visual impact.
- Avoid crossing potential arable areas as identified by landowners
- Avoid crossing the lower reservoir water body.
- Confine the Turn-ins and the proposed Braamhoek-Venus 400kV line to the same corridor.

It is seen to be beneficial to run the proposed Braamhoek-Venus line parallel to the Turn-ins. This will minimise bird and ecological impacts, though it will increase the visual impact of the route.

The route shown in Appendix 1 is considered to achieve a reasonable compromise between the different issues, and this has been considered in more detail for potential environmental impacts.

7. IMPACT ASSESSMENT

The detail of the impact assessment is given in the Impact Tables in Appendix 2. This section presents a summary of the Impact Tables and address certain key aspects that may have arisen during the public consultation process.

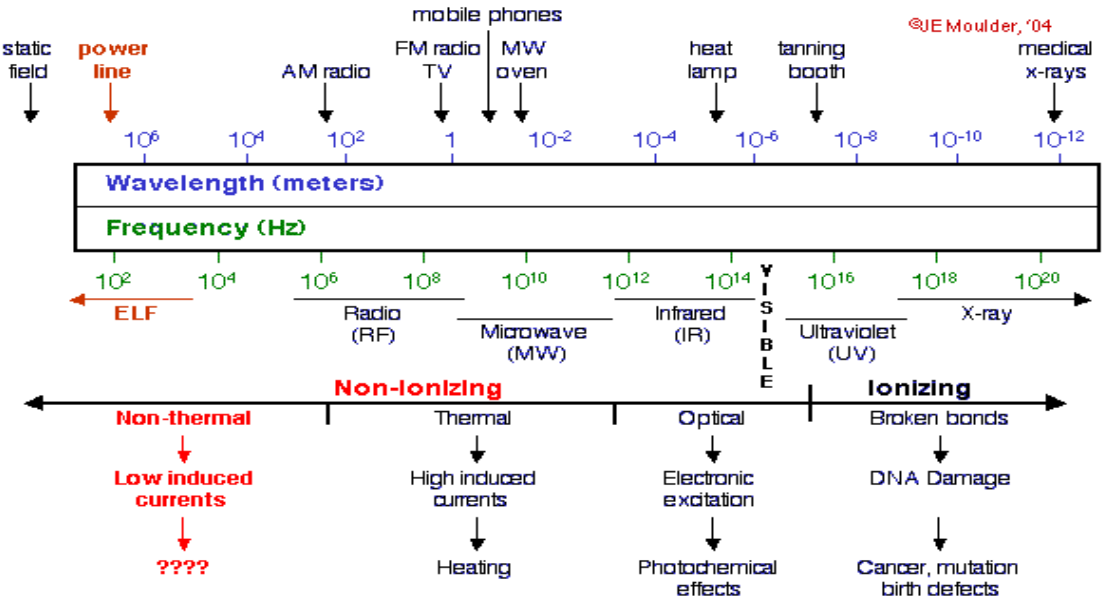
7.1. ELECTROMAGNETIC FIELDS AND HEALTH HAZARDS

The recurrence of the debate in the media on electromagnetic fields and human health almost has a frequency of its own. Relatively recent reports (Sky News, October 2004) stated that a study showed an increased risk of childhood leukaemia from powerlines, and a subsequent BBC website report was headlined “Pylons double child cancer risk”. However, the quality of the reporting has been questioned and this section attempts to review the current understanding on the effects of EMFs on human and animal health, and sets out the Eskom policy in this regard.

Electric fields are generated by the voltage applied to a conductor and is measured in volts/metre (V/m). Electric fields are easily shielded by conducting objects, trees, buildings, etc. Electric fields reduce with increased distance from the source. Natural background electric fields near the earth may be around 200V/m on a calm day, but may be as much as 50,000V/m (50kV/m) during a thunderstorm.

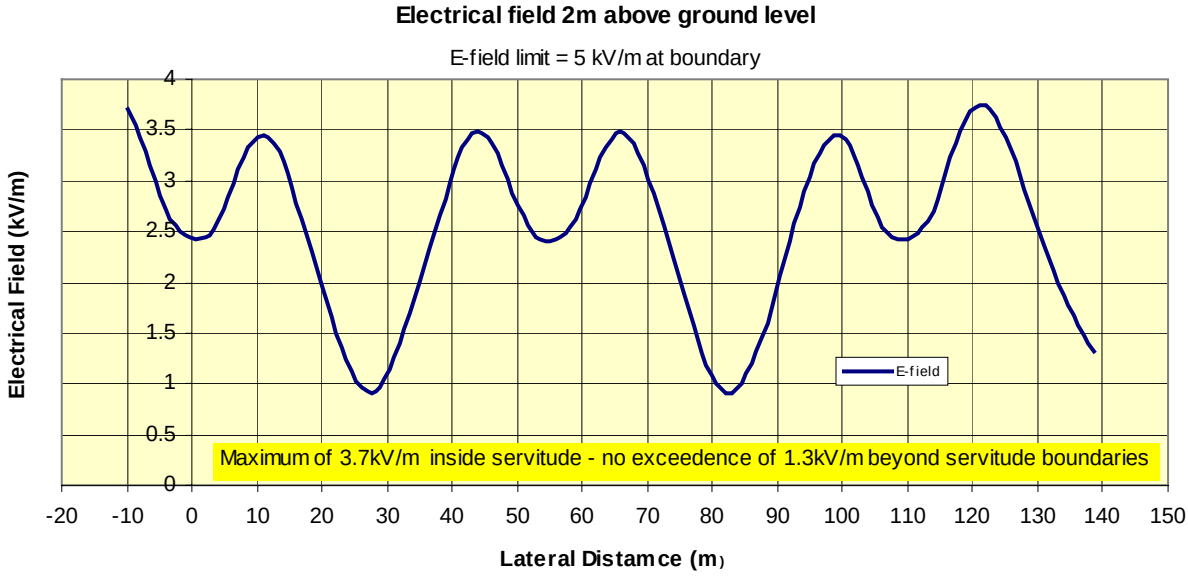
Magnetic fields are generated by the current in the conductor, and internationally is measured in Tesla (T) (in the US it is measured in Gauss, G. 1µT=10mG). Magnetic fields are not easily shielded, but do decrease in strength with increase in distance from source. Natural background levels of the earths magnetic field is around 30µT in Johannesburg, for example, and up to 70µT near the poles.

The electromagnetic spectrum is depicted in the diagram below.

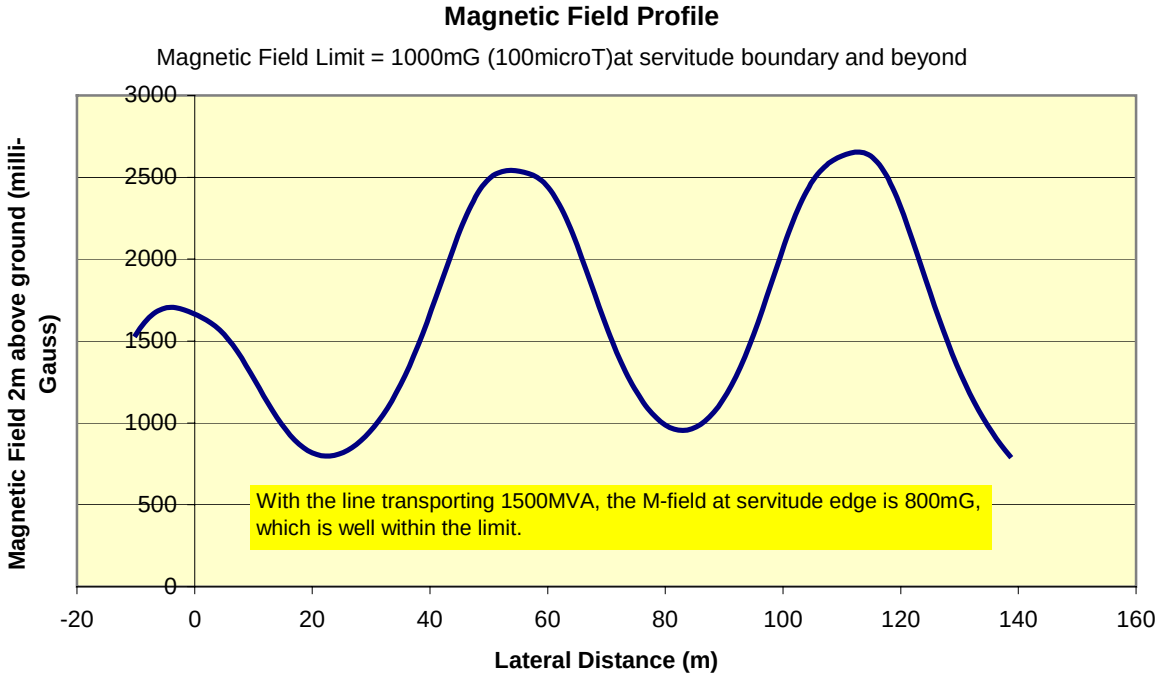


(Source: JE Moulder, October 2004)

Electric fields generated by overhead power lines are dependent on the voltage of the line. Ground level measurements under 400kV lines reach a maximum of 3.7kV/m under the line, while at the edges of the servitude (27.5m from the centre line) the electric field drops to below 1.3kV/m. The latter is deemed an acceptable background level given an international guideline of 5kV/m. The calculated electric field under the 400kV line, assuming the worse case condition of three parallel lines (= Braamhoek-Venus plus two turn-in lines), is shown below.



The calculated magnetic field under the same 400kV line configuration is shown below.



Eskom's stated approach to minimising any possible risk associated with exposure to EMFs from power lines is to adopt a precautionary approach. The servitude widths are set such that both electric and magnetic fields reduce to more commonly experienced 'everyday' levels. These are shown in each of the graphs above. Examples of such 'everyday' levels are shown in the table below[1].

Residences	0.02µT & 2V/m up to 150µT (1500mG) & 200V/m near some appliances (eg microwave ovens)
Some occupations (eg welders)	100µT (1000mG) & 5000V/m
Electric trains (passenger seat level)	60µT (600mG)
Electric blankets	10µT (100mG) & 1000V/m
400kV line servitude boundary	80µT (800mG) & 1300V/m (dependent on current – these values are calculated for the Turn-ins, a worst case condition in this study. See graph above)

Electric fields from power lines are not elevated in buildings as they are shielded by the building structure. However, magnetic fields are not affected by building structures and will persist in buildings under power lines.

Research into EMF and cancer links

Some studies have reported that children living near certain types of power lines (high-current distribution lines and high-voltage transmission lines) have higher than average rates of

[1] Source: John E Moulder, October 2004. Electromagnetis fields and human health. Medical College of Wisconsin.

leukaemia, brain cancers and/or overall cancer. The correlations were not strong, and the studies generally did not show dose-response relationships. When power-frequency fields were measured, the initial correlations generally vanished. Many other studies have shown no correlations between residence near power lines and risks of childhood leukaemia, or overall childhood cancer.[5]

Studies continue, but most still show no significant associations. A Canadian study has, however, reported an association between the incidence of childhood leukaemia and some measures of exposure.

With two exceptions all studies of correlations between adult cancer and residence near power lines have been negative. The one exception reported an excess of total cancer and brain cancer, but no excess of leukaemia; and the other reported the opposite result. The first of these studies was the Wertheimer and Leeper study in 1979 that is widely reported as one of the first studies to raise fears of possible associations between cancer and power line EMFs. However, when tested, this study proved to have flaws, and other possible influences are also seen as potentially significant, for example socio-economic status.[2]

Considerable focus has been given to possible correlations between power lines and increased incidence of childhood leukaemia. This is used as an indicator as radiation raises rates of leukaemia before it produces other forms of cancer. Using this indicator, there have been so many studies done in the last 25 years or so, that many scientists believe that if any significant association existed it would have been found by now. There are a number of reasons why these scientists believe no link will be found[6]:

- The fields produced by power lines is too small. Background levels 'everyday' exposures are usually greater than that arising from powerlines.
- No plausible mechanism for adverse health effects has been postulated. Frequencies produced by power lines are too low to have adverse biological effects.
- The initial study was flawed. This is the Wertheimer and Leeper study referred to above.
- The incidences of leukaemia are decreasing. Americans are exposed to increasing sources of magnetic and electric fields as technology and appliances become more widely used, yet it is reported that leukaemia rates are slowly decreasing.
- Furthermore, one would expect power line maintenance personnel to be exposed to unusually high, long-term doses of electric and magnetic fields, and would therefore show higher incidences of cancer. Yet neither international press, nor Eskom (personal communication) report any such trends.

Allegations of vested interests and bias are not uncommon in references on the subject, but yet seemingly there has been no scientific institution that has said anything other than that the data and statistics are inconclusive.

Yet, as far as is known, none have said that EMFs from power lines are safe either. Therefore, the precautionary approach adopted by Eskom would appear to be a sound approach.

[2] John Farley, July 2003. Power lines and cancer: Nothing to fear. University of Nevada, US

7.2. POWER LINE MAINTENANCE: FIRES & FIRE MANAGEMENT

A number of stakeholders have raised concerns about the management of servitudes, fire management and fire fighting (lightning issues also raised are discussed in the next section). Additionally, there appears to be different understanding between Eskom and landowners regarding maintenance responsibilities and a lack of awareness that fighting fires under power lines is dangerous. This section looks into the different aspects in more detail and the potential environmental impacts are reviewed.

7.2.1. Maintenance

Eskom undertakes ongoing research into vegetation management. International best practice is regularly reviewed and adapted where appropriate for the South African environment. Eskom Transmission has a "Transmission Vegetation Management Guideline" (ref TRMAGAAZ7, last update May 2003) that is distributed and accepted by all the Regional Line and Servitude Managers.

The definition of a servitude is given as "the right to use someone else's land for a specified purpose". In the case of an overhead power line this right includes the erection, operation and maintenance of the power line, and the right of access to carry out these activities. The servitude also allows Eskom the right to prevent or limit activities that may affect the operation of the line (eg no buildings or tall trees within the servitude). It is also relevant that the Ownership of the land in the servitude is not transferred to Eskom, but remains with the original landowner. **This implies that the landowner retains overall responsibility for the land.** This is significant in terms of the National Veld and Forest Fire Act of 1998, where it is stated that a landowner is presumed negligent if a fire starts or spreads from his/her land.

The primary objective for the establishment of the servitude is the protection of the electricity supply. However, the "Transmission Vegetation Management Guideline" clearly sets out to integrate the maintenance and operational functions of the line and servitude with the local environment, including the landowners activities. Initiatives include:

- Preparation and operation of an Environmental Management Plan (EMP) for the servitude,
- Identification of the appropriate degree of vegetation management depending on botanical content and landuse (Note: it is not automatic that all trees are cleared),
- Vegetation management for fire control. While, the maintenance emphasis is on protecting power supply, the guideline promotes integration with landowner fire management practices where possible. This would include using the servitude as a firebreak where mutually agreed. The guideline states "the landowner should at all times be consulted and be made part of the process".

The guideline promotes minimal removal of vegetation from the servitude unless it is either alien or presents a fire hazard to the line. Vegetation removal includes chemical, manual, mechanical and fire methods, though the latter is recommended only at appropriate locations and under strictly controlled conditions. It is understood that vegetation management by fire is now seldom undertaken.

Disposal of cut material is also noted to be a potential problem (including added fire risk to the line) and various disposal methods are put forward for consideration. However again, this should be done in conjunction with the landowner.

Lack of landowner liaison appears to be the main cause of the dissatisfaction raised on this project. Communication with the landowners would seem to have been very limited in the past, resulting in differing expectations including a) Eskom owns the land and therefore b) Eskom is responsible for undertaking fire break and fire fighting responsibilities as a result.

Eskom does not have veld fire fighting capabilities. The guideline makes reference to working with local Fire Fighting Associations in this respect. It would appear that Eskom should initiate such a relationship with the Ladysmith and Besters Farmers Associations who, it is understood, both operate co-ordinated fire management plans. (*This approach should apply to all other aspects of servitude maintenance.*)

7.2.2. Responsibility for fires generated within the servitude

Potential causes for fires generated by electrical infrastructure in the servitude include (lightning issues are discussed below):

- Flashovers between the conductor and vegetation (or mechanical harvestors) that grow too close.
- Falling trees
- Poor line maintenance and the pylon falls over (such a case has been reported in this study, and involved a gum-pole distribution line).

Other sources of fire originating from the servitude may include cooking fires made by the maintenance contractors or cigarette butts. However, these are normally prohibited on site.

Flashovers with the ground due to excessive heat from veld fires may also occur and apart from being a threat to the power supply, they are also particularly dangerous to fire fighters.

It is understood that in circumstances where any of the above may have occurred, Eskom will assume responsibility for damages arising. Landowners will have the right to claim for damages. However, Eskom will investigate such claims to ascertain proof of negligence. It is understood the landowner should be given a copy of the investigation report.

Concerns have also been raised by landowners regarding the dumping of cut material in the servitude as this may also constitute a fire hazard. Eskom does not have the right to remove cut material from within the servitude as this belongs to the landowner. However, Eskom should liaise with the landowner and agree on what to do with the material. It is understood that cut material should not be left in the servitude without the landowner's agreement.

Eskom will not accept responsibility for veld fires passing underneath a line. Eskom's vegetation management in the servitude does not consider this unless there is specific agreement with the landowner. Therefore it is seen to be the landowner's responsibility to manage veld fire on his/her farm where there are overhead electricity lines.

Eskom will not accept responsibility for 'Acts of God' – for example pylon collapse in a hurricane.

7.2.3. Eskom's early warning system

Veld, forest and bush fires have a severe effect on the operation of power lines and the quality of supply. In recent years Eskom has acquired the use of two satellites to identify and track fires near their lines. An early warning system alerts managers to fires within 5km of power lines. The facility also has a fire weather forecasting system. It is understood this information is available to municipalities and Fire Protection Agencies/Fire Fighting Associations, and interested parties are given access to the website.

It is suggested that, as much of the study area is seen to be a high fire risk area, the early warning system information be made available to the local fire fighting units operated by the Besters and Ladysmith Farmers Association. Indeed, it is Eskom Transmission's policy, according to their 'Fire Protection Association Guideline' (TRMAGABD9, dated March 2004), that Eskom Transmission seeks to participate in the activities of local Fire Protection Associations (FPAs) where possible.

7.2.4. Fire impacts arising from poor servitude management

It can be simply stated that poor servitude vegetation management could result in high environmental impacts arising from veld fires. These environmental impacts include damage to property, crops, livestock and even injury to people. However, it is apparent that there are dual responsibilities in the maintenance of the servitude; Eskom's and the landowners.

Incidents of fire damage apparently related to power lines, and reported during this study are now the subject of separate discussions between the landowners and the relevant sections of Eskom (local offices). However, it is clear from the public consultation process that there is a difference in understanding of responsibilities relating to land management in and around servitudes, and that this can lead to a lack of appropriate maintenance and therefore possible fire related damages. It is recommended therefore that Eskom undertakes to liaise with landowners directly to inform them of the respective responsibilities, and to refine the EMPs accordingly.

It is believed that the level of environmental impact significance associated with this issue can be reduces to an acceptable level (low) given that fires are a natural part of the environment and landuse in this area. To achieve this, however, Eskom's relationship with landowners in the study area needs to improve, and the efforts reported by Eskom Transmission and Distribution at the time of writing are encouraging and should be continued.

The addition of a parallel 400kV line next to the Majuba-Venus #2 line should therefore have a low impact on the fire management environment, and should even improve the current situation.

7.3. LIGHTNING

It is a common concern that the presence of power lines and pylons increase the risk of lightening strikes where they occur. This section seeks to report on the risks associated with Transmission lines (i.e. above 132kV).

There are three main conductors plus an earth wire to each power line. Transmission line configurations usually place the earth wire above the main conductors, essentially to protect the main conductors from lightning strikes. These earth wires therefore effectively act as lightning shields for animals and people below them.

The condition around the pylons is the same provided the pylon is properly earthed. Any lightning strike on the pylon tower is transmitted to the earth unless there is high electrical resistance in the foundations of the tower. Soil samples are taken at each tower location during construction and the resistivity of the soil is tested. The tower is then earthed according to the soil conditions.

If the pylon is not properly earthed, or the earth wire on the tower structure has become faulty, it is possible that animals or people in close vicinity to a tower during a lightning strike may be injured. In these instances the landowner has a right to claim damages from Eskom. As with reported incidences of fire, Eskom will investigate the claim and should provide a written report on the findings.

It is important to note that Eskom is able to monitor all lightning strikes on the Transmission network. Therefore, as part of any such investigation, checks will be done on the location of recorded strikes in conjunction with the location of the claim.

This impact assessment must assume that the towers will be properly earthed. Based on work done by the CSIR in 1994, the study area lies on the edge of one of the highest ground-flash densities in the country; the eastern area of Lesotho and the Drakensberg Mountain Range where an average of 12 to 14 ground-flashes/km^2/annum have been recorded. In the study area the range is seen to be between 8 and 10 ground-flashes/km^2/annum, and though the western areas are likely to have the higher risk of ground-flashes, the risk is seen to be similar across the study area as a whole. Therefore, the likelihood of injury to people and animals is seen to be the same everywhere in the study area and, assuming properly earthed towers, the level of environmental significance should be low.

7.4. SUMMARY OF IMPACTS

The summary below is derived from the Impact Tables in Appendix 2.

ISSUE	DETAILS	PHASE OF CONCERN	POTENTIAL SIGNIFICANCE OF IMPACT	
			Before Mitigation	After Mitigation
1. ECONOMIC				
1.1 National and Provincial Impact	National and provincial importance of project in terms of promoting economic growth in the region and South Africa	Operation	High (positive)	High (positive)
1.2 Local Benefits	Economic benefits that the Transmission line will bring to local communities	Construction & operation	Low to Moderate (positive)	Moderate (positive)

ISSUE	DETAILS	PHASE OF CONCERN	POTENTIAL SIGNIFICANCE OF IMPACT	
			Before Mitigation	After Mitigation
1.3 Job Creation	Employment of local labour (South African citizens and people local to the area) and preference given to a local contractor	Construction & operation	Low to Moderate (positive)	Moderate (positive)
1.4 Tourism	The line will detract from the aesthetic appeal of the natural environment, and will therefore negatively impact on tourism activities	Operation	Low to moderate	Low to moderate
2. WELL BEING:				
2.1 Electro-magnetic fields	Impact of electromagnetic fields (EMFs) on animals, people and vegetation	Operation	Low	Low
2.2 Dust & Noise (within plant area)	Dust & noise control during construction	Construction	negligible	negligible
2.3 Corona noise	The effect of the corona (low "buzzing" noise) may be noticeable in properties immediately adjacent to the servitude.	Operation	negligible	negligible
2.4 Use of creosote poles	Creosote poles may be used during the project and may have a negative health implications and an ecological impact	Construction	Low	Low
2.5 Fire hazard	The construction and operation of the line may alter the occurrence and management of fires in the area. The change in the nature of fire hazards and events can have safety, economic and ecological implications.	Operation & Construction	Potentially High	Moderate to Low
3. AESTHETICS:				
3.1 Visual impact	Visual impacts will be significant in the local area	Operation	Moderate to high	Moderate to high
3.2 Sense of Place	Negative impact on the spiritual, aesthetic and therapeutic qualities associated with the area in the vicinity of the line	Operation	Moderate to high	Moderate to high
4. SOCIAL:				
4.1 Relocation of people	Will there be a need to relocate people, and their property/houses? What are the likely impacts? Will they be compensated?	Construction	Low	Low
4.2 Disruption of social networks and daily movement patterns	The social routine and social networks may be disrupted during the construction process.	Construction	Moderate to low	Low
4.3 Location of construction camps	The siting of construction camps	Construction	Potentially High	Potentially low (positive)
4.4 Gravesites	Protection of gravesites, disinternment of graves	Construction	Low	Low
4.5 Traffic Safety	Road traffic safety, particularly relating to construction traffic.	Construction	Low	Low
5. LAND ISSUES				
5.1 Property value reduction	Negative impact on property values	Operation	Moderate (perceived)	Low (positive)
6.FARMING RELATED ISSUES				

ISSUE	DETAILS	PHASE OF CONCERN	POTENTIAL SIGNIFICANCE OF IMPACT	
			Before Mitigation	After Mitigation
6.1 Access to properties	The creation of new or improved access to properties, for access to the line, brings potential associated issues that need to be considered.	Construction & Operation	Moderate to High	Low
6.2 Access roads	The physical creation and use of new roads, or increased use of existing roads will also have associated impacts	Construction & Operation	Potentially High	Moderate to Low
6.3 Loss of agricultural potential	Restrictions on landuse and activities will impact on the agricultural potential of the land.	Construction & Operation	Low to Moderate	Low
6.4 Season for construction activities	Certain activities (construction and operation) may have greater impacts on the environment and agricultural activities at certain times of the year.	Construction	Moderate to High	Moderate to Low
7. NATURAL ENVIRONMENT:				
7.1 Erosion	Erosion on access roads may become a problem.	Construction & Operation	Moderate to low	Low
7.2 Impact on fauna	Impacts on the natural fauna in the area	Construction & Operation	Moderate to high	Low
7.3 Impacts on Avifauna (birds)	Impacts on birds.	Operation	Potentially high	Moderate
7.4 Impact on flora	General impacts on flora.	Construction & Operation	Moderate	Moderate to Low
7.5 Impact on wetlands	Potential damage to wetlands in during construction and maintenance	Construction & Operation	Potentially high	Moderate
7.6 Importation of alien vegetation	Importation of alien vegetation through building materials	Construction	Moderate to High	Low
7.7 Impact of herbicides	Herbicides will be used during the construction and operation phases of the project to clear and potentially manage the line.	Operation	Moderate	Low
7.8 Impact of construction camps	The construction camps may have an impact on the natural environment	Construction	Potentially High	Moderate to low
8. CULTURAL AND ARCHAEOLOGICAL SITES				
8.1 Palae-ontological Sites	Impact on fossils.	Construction	negligible	Negligible
8.2 Archaeology	Impact on late stone age and possible iron age sites.	Construction	Moderate to Low	Low
8.3 Cultural, Historical and National Heritage Sites	De Beers Pass	Construction	Potentially high	Moderate
9. CONSTRUCTION CAMP ISSUES				
9.1 Inmigration of construction workers	Inmigration of construction workers may lead to social disruption, increased crime, sexually transmitted diseases.	Construction	Potentially moderate to high	Moderate to low

8. RECOMMENDATIONS

A number of recommendations are set out in this report, particularly in the Impact Tables in Appendix 2, and these are considered relevant to the future implementation of the project. However, a number of general recommendations are made here.

- It is recommended that Eskom clarify issues relating to servitude access, maintenance and fire management in the servitude and associated responsibilities. It is suggested these responsibilities are clearly set out in the servitude agreements. A greater level of integration with local fire fighting associations is also recommended.
- It is recommended that the Braamhoek-Venus 400kV line and the Turn-in from the Majuba-Venus #2 line be run in parallel, and that the construction of the two should be done simultaneously.
- Construction camps for the two projects should also be combined, and as far as possible this should be integrated with the construction camps for the Braamhoek P.S.S. and Braamhoek Substation.
- Relocation of dwellings and homesteads are expected to be few, if any, but if so a formal relocation programme should be drafted and implemented. Clear documentation of agreements with owners and relocation activities should be available.
- The construction programme should set out anticipated rehabilitation activities and timing. Emergency rehabilitation measures should also be identified (eg for spillage containment, erosion, plant damage, etc.).
- It is important that Eskom appoints a full time Environmental Control Officer (ECO) for the construction planning and construction phase. This ECO will be able to initiate specialist surveys in the design phase (archaeology and ecology) and will ba responsible for drafting a detailed Environmental Management Plan.
- In support of this, it is recommended that the Department of Agriculture and Environmental Affairs – Kwa-Zulu Natal monitor the construction planning and the construction programme.

9. CONCLUDING REMARKS

These remarks are made pending any comments from the public on this Draft Scoping Report.

The route goes through an area of high visual quality, and every effort should be made to minimise any disturbances. However, given that other significant linear development is planned for the area (De Beers Pass tunnel and highway), and that other route alternatives will result in similar or even greater impacts, it is expected to recommend the route identified in Appendix 1 along the base of the escarpment as the preferred route for the new Braamhoek Turn-in from the Majuba-Venus #2 line. This option, in combination with the Braamhoek-Venus 400kV Transmission line, is seen to offer the least impact on the environment.

However, given the relative homogeneity of the area, local deviations are unlikely to affect the overall impact of the Turn-in. It is recommended, however, that specialist visual, avifaunal and

ecological input be sought for any such deviations. and that rehabilitation should be implemented as soon as possible in the construction programme.

Furthermore, it is again stressed that current servitude management responsibilities must be clarified with landowners.

APPENDIX 1: MAPS AND LOCATION DATA

BRAAMHOEK P.S.S. - Transmission Integration

General Data Sheet

	Lat.	Long.	
Braamhoek P.S.S.	28° 19'S	29° 35'E.	Farms Braamhoek 1220, Bedford 1845
Braamhoek Sub.1	28° 16.69'S	29° 35.35'E.	Farm Zaaifontein 1070
Braamhoek Sub.2	28° 16.85'S	29° 34.52'E.	Farm Braamhoek 1220
Braamhoek Sub.3	28° 16.60'S	29° 34.18'E.	Farm Braamhoek 1220
Venus Substation	28° 56.28'S	29° 50.74'E.	

The direct distance between Braamhoek and Venus is 79km.

Month	Monthly rain (mm)		Daily Mean Temp (deg C)		Relative Humidity (%)	
	Nr Braamhoek	Nr Venus	Nr Braamhoek	Nr Venus	Nr Braamhoek	Nr Venus
Jan	158	121	20	22	64	68
Feb	141	101	20	22	66	68
Mar	109	95	18	20	66	68
Apr	47	41	16	18	62	66
May	22	20	12	14	58	62
Jun	12	11	10	12	56	60
Jul	12	11	10	12	54	58
Aug	21	21	12	14	54	58
Sep	45	43	14	16	58	62
Oct	84	68	16	18	60	64
Nov	118	102	18	20	64	66
Dec	131	116	20	22	64	68
MAP	900	750				

Frost:	Duration of frost risk period	120 days	mid May-mid August
	Days below zero degrees Centigrade	30 - 40	(average)
Hail risk:	(Average)	5 - 7 days/an	
	High risk area = Spionkop / Winterton	+ 7 days/an	

Snow: The northern sections of the study area regularly (annually) experience snow, and snow loading on the lines will need to be considered in the design. Snow does occur in other areas (particularly western parts of the study area), but the snow is seldom as heavy and is less frequent (estimated once every three to five years on average).

Fire risk: The grassland areas are high-risk fire areas, particularly in the northern and western parts of the study area. Fire management of the veld is a common practice, and co-ordinated burning programmes are in operation within the different Farmers Associations.

Lightning: Lightning ground-flash density is among the highest in the country in this area. Average ground-flash densities of 8 - 9 flashes/km^2/annum are reported for much of the area, though in the western areas these go up to an estimated 10 - 12 flashes/km^2/annum.

Soils:	Western & northern areas	moderate to deep clays (moderate erodability)
	Eastern & southern areas	moderate to deep clay loams (moderate to high erodability)

Slopes: In general, the terrain is described as undulating, though with particularly steep areas in the middle of the study area, along the main river valleys (Tugela, Klip & Bloukrans) and in the northern sections.

Erosion: Erosion is more evident in the eastern areas, but areas of erosion occur in places in much of the study area

APPENDIX 2: IMPACT TABLES

APPENDIX 3: PHOTOGRAPHS OF THE STUDY AREA

APPENDIX 4: SOCIO-ECONOMIC ASSESSMENT REPORT

APPENDIX 5: VISUAL IMPACT ASSESSMENT REPORT